2022 Design and Prototype Finalists

Solid Magnetic Boots

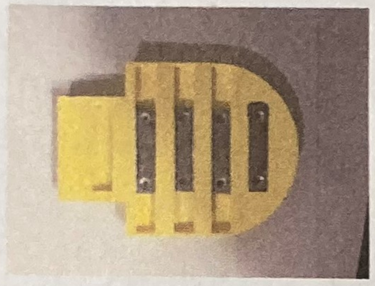
Students: Whitney Reinkoester, Samuel Vazquez
Teacher: Steven Marcus
School: Cypress Springs, Texas

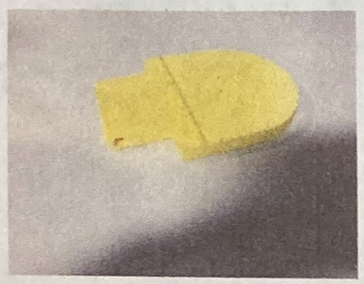
Students: Noah Sisk, Richard Meghan
Teacher: Ashley Pederson
School: Lakewood, Colorado

Students: Nolen Jaramillo, Ricardo Guerrero, Joey Rodriguez
Teacher: Cuaron
School: Sanger, California


SHOE MAGNET
Cypress Springs High School
Industrial Technology
Engineering design II
Cypress Fairbanks ISD
Cypress, Texas
NASA JSNCH PROGRAM
Magnet Shoe
Team members:
Samuel Vazquez
Whitney Reinkoester
Instructor:
Steven Marcus
JSC NASA Advisor/ Mentor:
Glen Johnson
General Information:
The goal of our project is to create a magnetic boot that will allow an astronaut to freely walk on the outside of a spacecraft
Tri-Fold Display Board
Tri-Fold

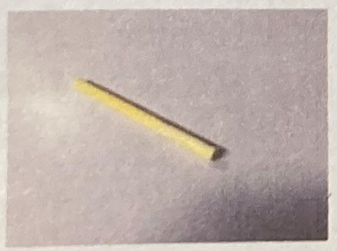
Platform 1 (Heel)



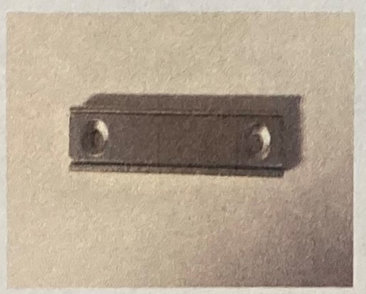


Platform 2 (Toe)

Top Shoe + Straps

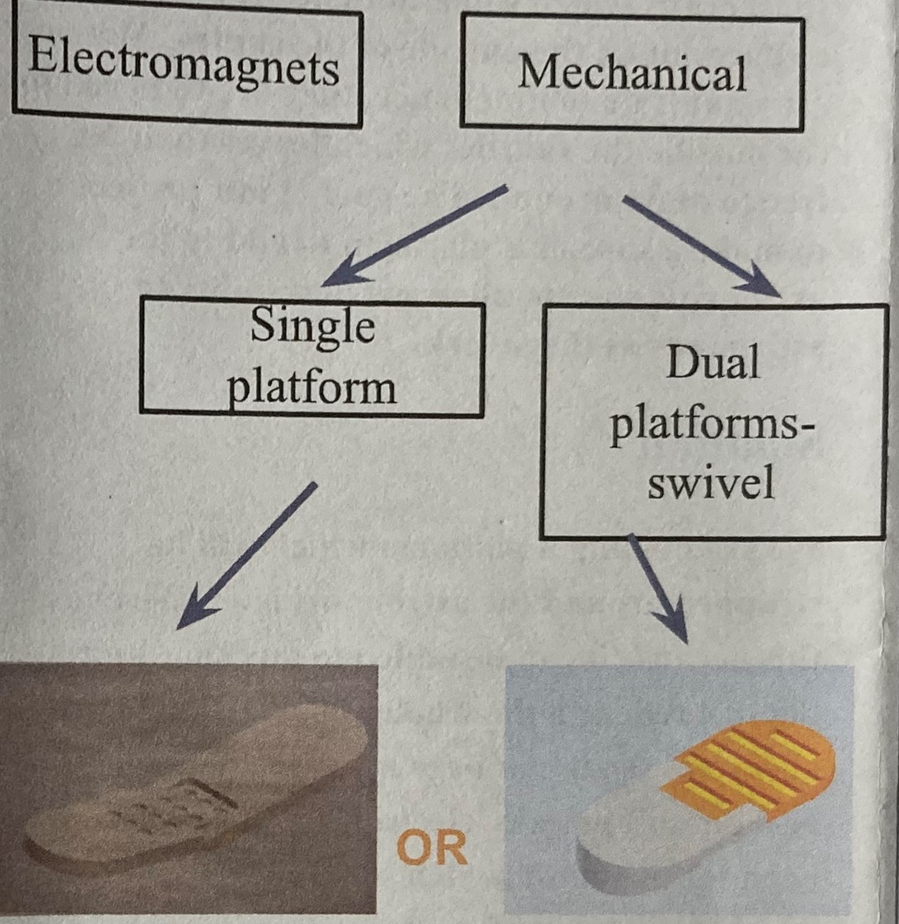


Axle



Magnets

Thinking Map



Magnet Placement:

Any type or shape of magnets can be used, we used both circular and rectangular in out models

Emails:
WREI1274@GMAIL.COM
SVAZ781@GMAIL.COM

Cypress Springs High School

Industrial Technology

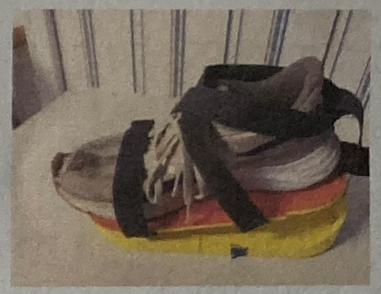
Engineering design II

Cypress Fairbanks ISD

Cypress, Texas

NASA HUNCH PROGRAM

Magnet Shoe



Team members:
Whitney Reinkoester
Samuel Vazquez

Instructor:
Steven Marcus

HUNCH Advisor/ Mentor:
Glen Johnson

OBJECTIVES:

Create a magnetic shoe to aid astronauts with maneuvering on the outside of Space X's Starship

MATERIALS:

7075 Aluminum (shoe platforms)

Kevlar or Nomex (straps)

CONSTRAINTS:

- **Easy to engage/ disengage**
- **Withstand heavy weights and sudden movements**
- **Easy to attach to the astronaut's foot**
- **Light Weight**

TECHNIQUES:

We looked into electromagnets but decided to go with a mechanical option for simplicity. Using a lever and pivot system

CHALLENGES:

We need to keep the design as simple as possible to aid in manufacturing, maintenance, and

Description/general information:

A large part of space travel is being able to conduct experiments and maintenance on spacecrafts which sometimes needs to be done in a spacesuit on the outside of the shuttle. When astronauts do maintenance, they are tethered to the outside the shuttles which leaves their leg free to move around. The goal of our project is to make a shoe or a platform to add to the astronauts shoe to allow extra stability to astronauts as they work.

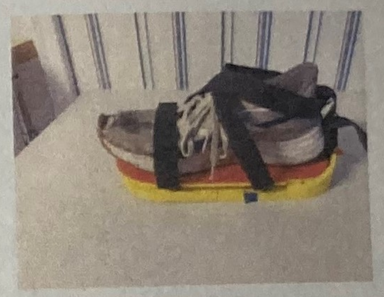
Solution:

We are making a platform which will be strapped around the astronauts boot. We chose this because it can be added to any shoe and doesn't redesign the whole shoe. It is also adjustable so it can fit to any size shoe. The shoe also doesn't use any electromagnet so it has no need for an on/off switch so it is 100% hands-free, except for when you put it on.

Note:

The astronauts would have to walk like they have skis on, their feet can never be in a straight line or parallel to each other. This will help with stability and limit sudden movements, it's also similar to how people normally walk.

Step 1:
Set shoe up, clear straps

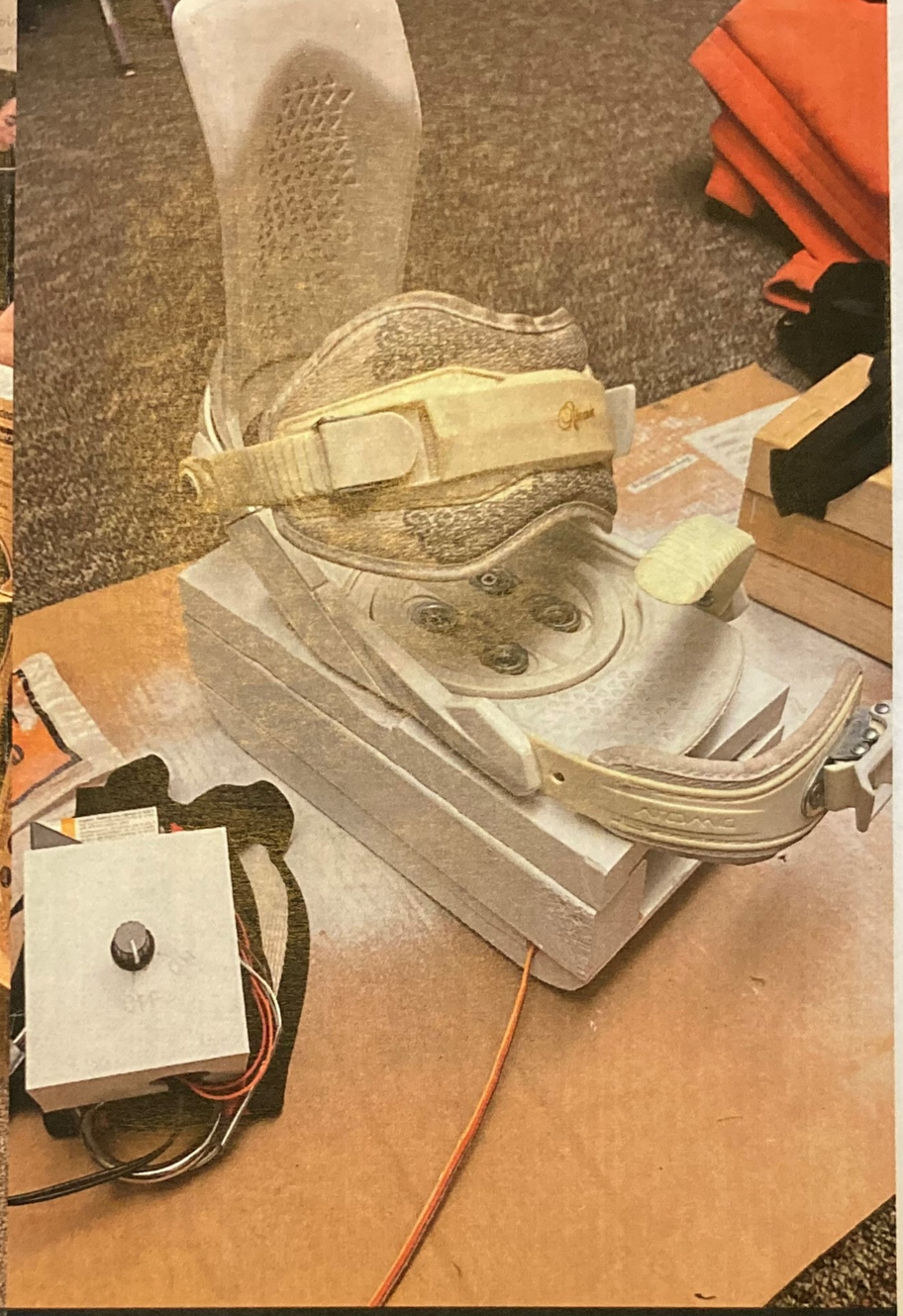


Step 2:
Secure shoe in straps

Step 3:
Lift shoe, causing the top shoe to lift the heel

Step 4:
Uses leverage to lift magnets, and walk!

To scale



Overview

The Space Kicks attach to the bottom of the astronauts boot, similar to a snow board. The boot is magnetic due to a switchable magnet inside of the boots that can be switched from magnetic to non magnetic. These Magnets can be turned on and off via a, potentiometer located on the Bicep. This allows for easy access and more maneuverability.

Key Materials

- **Wood (in lieu of Aluminum)**
- **Neodymium magnets**
- **Permanent Switchable Magnet**
- **Arduino**
- **Potentiometer**

How did we get here?

BINDINGS

For our Binding we took inspiration from snowboards. The bindings used for bindings help with griping to the board and not loosening the grip until wanted. This was the perfect idea for our boots.

MAGNETS

At first we used smaller static neodymium magnets. This worked for the magnetic strength but we found the magnets hard to remove from the surface. Then we tried an Electro-magnetic which while made it easier to remove it, but wasn't energy efficient enough for what we envisioned. Finally we settled on a permanent switchable magnet with a separate servo motor for more remote deactivation of the magnet.

ACTIVATION

One of the more tricky parts of this project was figuring out how you would be able to deactivate and reactivate the magnet for movement. At first we thought to have an activation method mounted on the outside of the upper thigh. This was unsuccessful due to design specifications. So instead we opted to move it to the biceps where it was much more successful.

Hunch Challenge: Magnetic Boots for SpaceX

School: Sanger High School, CA

Teacher: Mr. Cuaron

Team Members: Nolen Jaramillo, Ricardo Guerrero, Joey Rodriguez

Team Website: NRJ Magnets Website

Team Video: NASA Hunch Video

Description: Our design was made with the intent of reducing the amount of friction that would be produced by limiting contact with any surface to only three contact points. To do this, we used repurposed shower door bearings because of their smoothness and sliding capabilities. Our overall design incorporates a solid magnet as well as an electromagnet. All of the inner components are located inside the sole. We also incorporated a triangular sliding mechanism to cover all of the the items inside the sole.