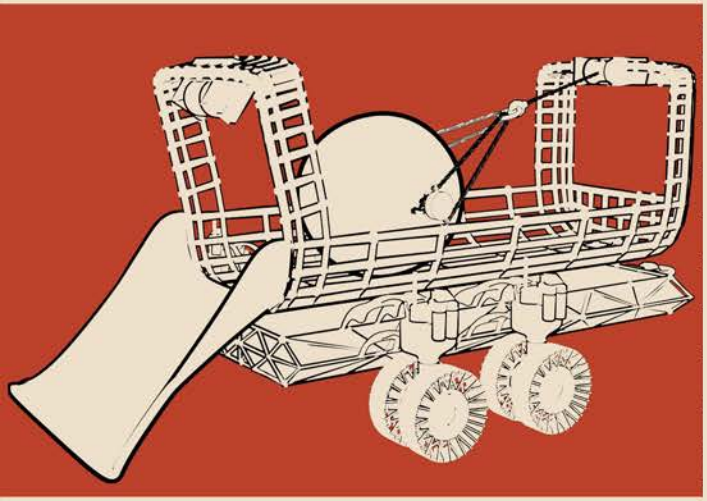
Lunar Supply Pod Mover
Honorable Mention
for
NASA HUNCH
Design and Prototyping 2021

Congratulations for being chosen to receive an Honorable Mention for NASA HUNCH Design and Prototype 2021. This is to provide more praise for those who have done significant design and testing. Take pride in knowing that your work demonstrated many significant innovations and ideas. HUNCH recognizes that your team put a lot of thought and time into your design and testing. You had multiple prototypes you worked through, completed several interesting ideas, did testing with each prototype, demonstrated a deeper knowledge and skill in CAD.

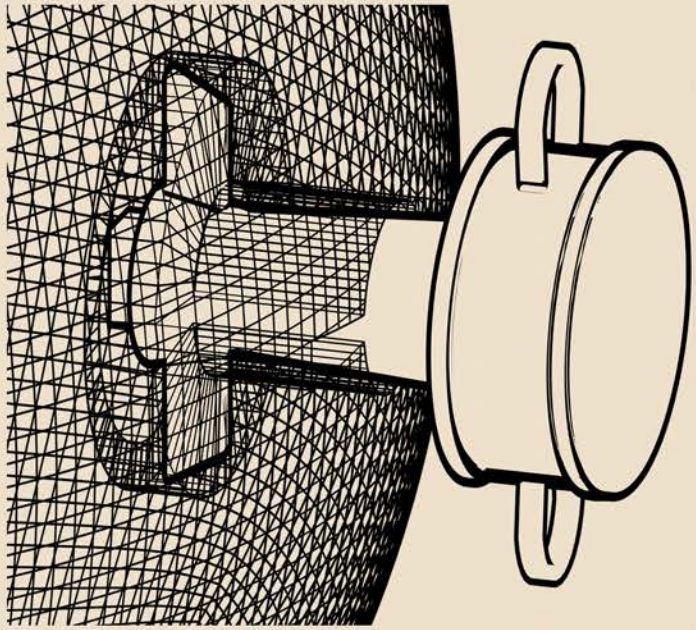
Although you are not being invited to the Final Design Review, your work will remain on the HUNCH design and prototype page where it will continue to show the hard work your team put into the project.

The Trailer



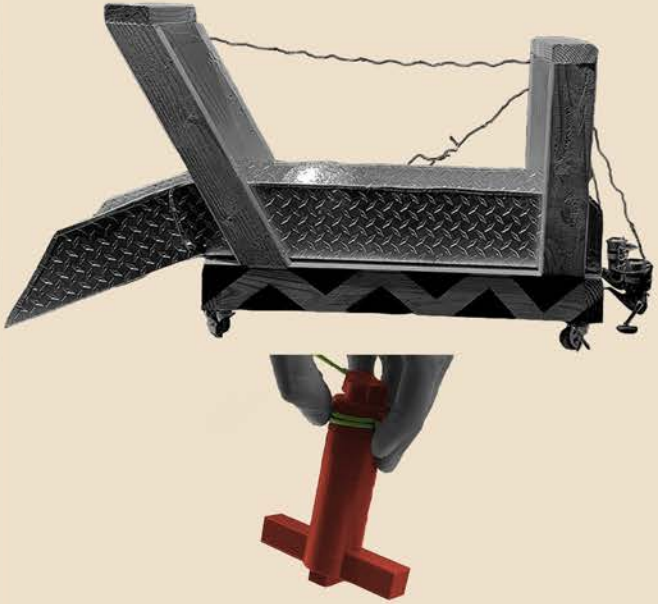
We decided that a trailer is the most optimal method to transport the supply pods because a trailer can transport multiple supply pods per mission. The carriage for the pod only needs to hold the pod during transit. Therefore, the carriage will be composed of metallic bars to reduce its mass. Two crossbars will be suspended above either end of the trailer. Each will hold a remotely operated winch. The winch on the far end will pull the supply pod in, while the winch near the ramp will extract the pod from the trailer. The ramp has a flat opening, which curves inward towards the trailer, in order to better funnel the supply pod into the trailer.

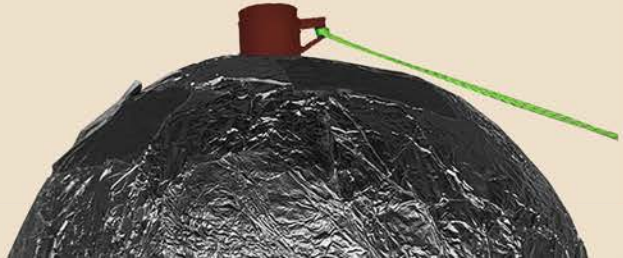
The Lock and Key



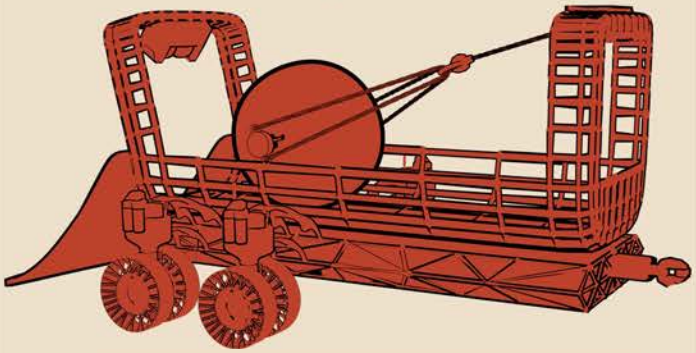
The focal point of our project is the "Lock and Key." The key is compromised of a T-shaped body, a deadbolt running through the center, and a bearing on the end. Because the supply pod is launched onto the lunar surface, it cannot have protruding hooks; therefore, a locking key must be inserted into the supply pod. Once rotated, the key's deadbolt will be engaged and prevent any rotational movement. The key will now be locked in place. As the pod rolls, the key rotates with it, while the exposed bearing does not rotate relative to the pod. This allows the winch to roll the pod into the trailer.

The Prototypes

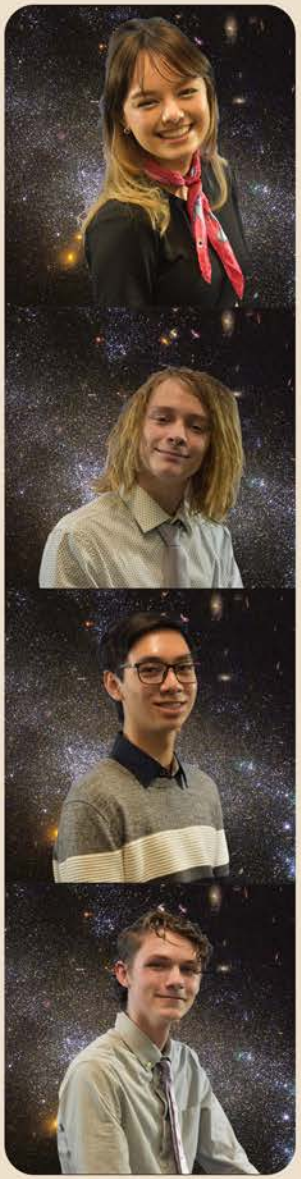




The NASA Lunar Pod Mover utilizes the spherical shape of the supply pod to roll it across the lunar surface. This functionality is overall more efficient than either dragging or lifting the pod because it will require less energy and supporting structures. Rolling causes less friction and requires less power than dragging or lifting. This allows us to reduce the size and weight of the motors. Additionally, by rolling the supply pod onto a trailer, less strain is applied to the trailer structure, thereby reducing the amount of bracing and other heavy load-bearing parts needed.



General Overview



HANA HUSEK ANDREW OLAESRUD AUSTIN PHAM JAXEN FLEGEL

MAKAYLA CHRISTIANI

SUPERVISED BY FREDERICK HERRMANN YCEDEMY

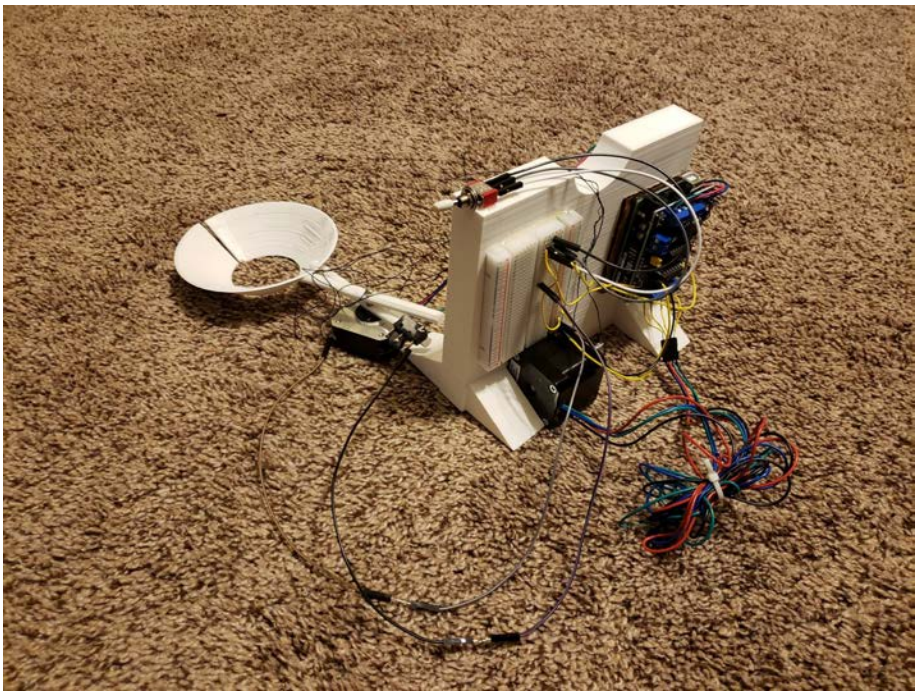
Our Team

NASA LUNAR POD MOVER

Supply Pod Movers

Product Overview

We have built a product that will enable the movement and transportation of the supply pods that will land on the moon. Our device enables the retrieval, movement, and release of these supply pods.



User Experience

Our supply pod mover is attached to the back of the SEV. From there the SEV will back up to the supply pods and using the control system the mover will pick up the pods, lock them into place, and the SEV can go back to its home base.

Design Details

Our project utilizes a dual half cup design to lift the pods. As the SEV backs into the pods, the cups will open, allowing of the retrieval of the pods. From there the

winch allows the cups to raise back up. Our unique and simplistic design gives users very easy control of our systems while still maintaining a high level of functionality.

Testing

We have successfully been able to lift the small sphere, large sphere, and cylinder, we are still working on testing under all possible circumstances, but so far it has been very promising.

Link to testing video:
https://drive.google.com/file/d/1QvNOdJ4TTQFlKwXKL6KEWr25Omkl8nLh/view

Team Members and Contact Information

Website: https://sites.google.com/students.responsiveed.com/capstonewebsite

NASA HUNCH

Critical Design Review

Project Title: **Lunar Supply Pod Mover**

School Name: **Space Coast Jr/Sr High School**

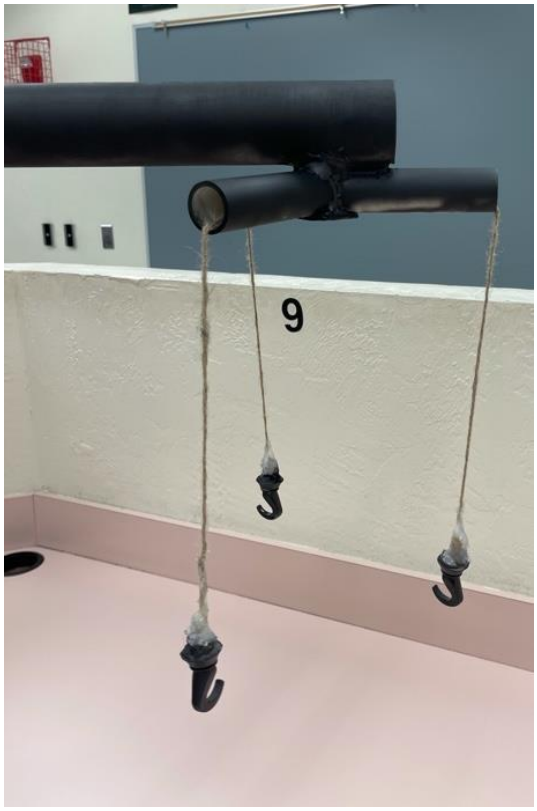
Teacher: **Mr. Luis Reyes**

Team Member Names: **Mason Hall, Joseph Dodd, Cort Vanderpool, & Jayson Crowell**

Description of Prototype / Data collected

Our project definitely meets all the requirements. The prototype is designed to be able to lift 3 tons on earth, and our prototype is not too big so it can be transported easily. Also, our supply pod mover hooks can retract so that the pod does not swing when it has been lifted up. Our device is hand operated and cranked. The hooks can hook onto a wide range of sizes and it can be attached to a rover easily. We clearly show you how our lunar pod mover works, we showed how it moves and how it hooks on to the pods with ease. We also showed you how it can connect to a rover easily. In our document we give all the materials. There is not that many materials to begin with, and we roughly show how to put it together step by step. To make the project even easier, all of our materials are off the shelf products. For example, we used PVC pipes, off the shelf hooks, and basic string. All these items you can get almost anywhere. Target, Walmart, or Home depot are all good examples for this. We actually did think of the whole microgravity situation because we had an original idea of a vacuum that would suction to the pod and hold it tight, but as you know, you can't use any type of vacuum device in space because there is no air to vacuum. We have been working on a prototype that is now functional and working along with a 3D rendering to go with it. On our prototype we included COTS items such as, Hooks, String, a valve handle, and a metal bracket to add support and maintain a constant 90 degree angle for the arm that extends out. Buying these items instead of trying to handcraft them really helped speed up the process and you know what they say, time is money. Purchasing the items instead of making them saves a lot of time and money in the end.


9


9

NASA HUNCH
Critical Design Review

Project: **Lunar Supply Pod Mover**

School: **Space Coast Jr/Sr high School**

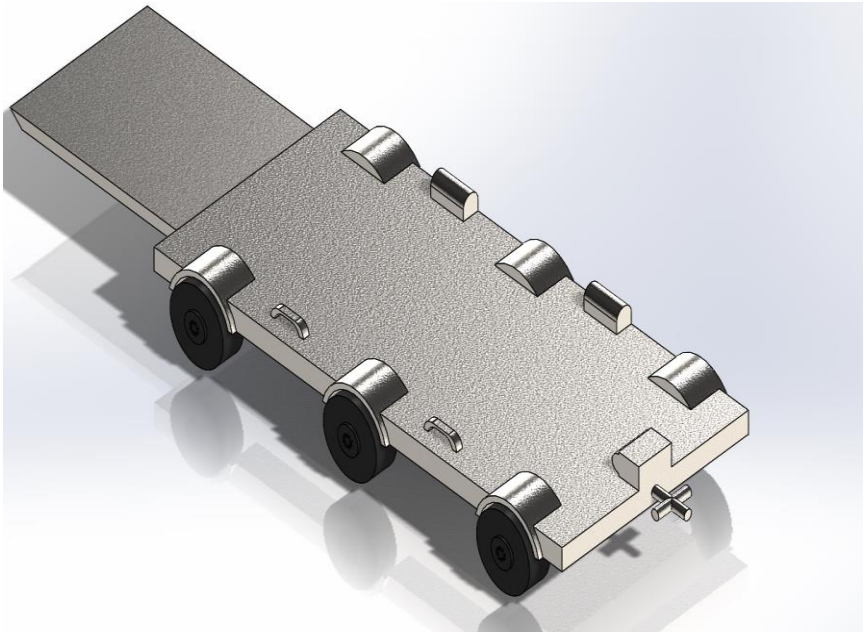
Teacher: **Mr. Luis Reyes**

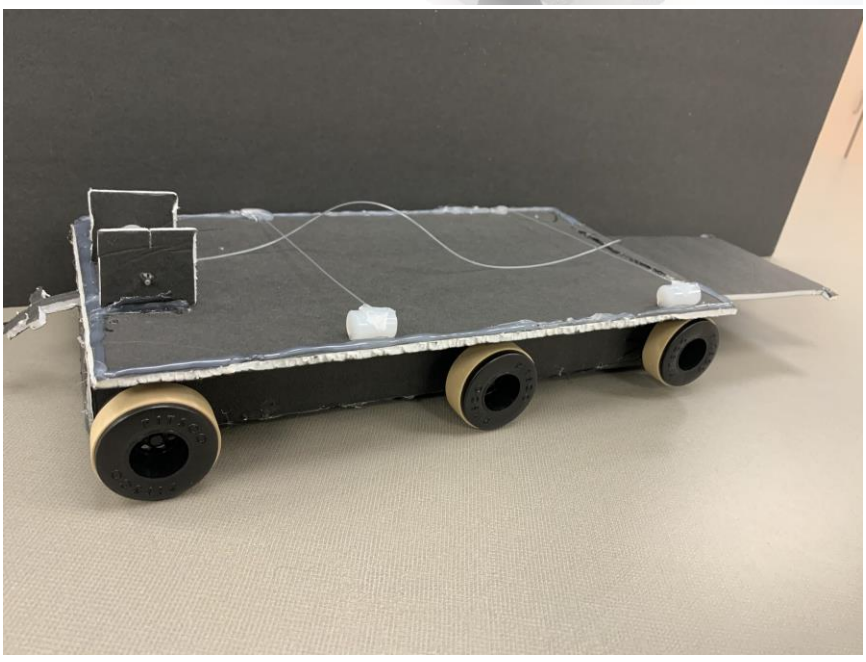
Students: **Jordan Parsons Stephon Crawford**

Description:

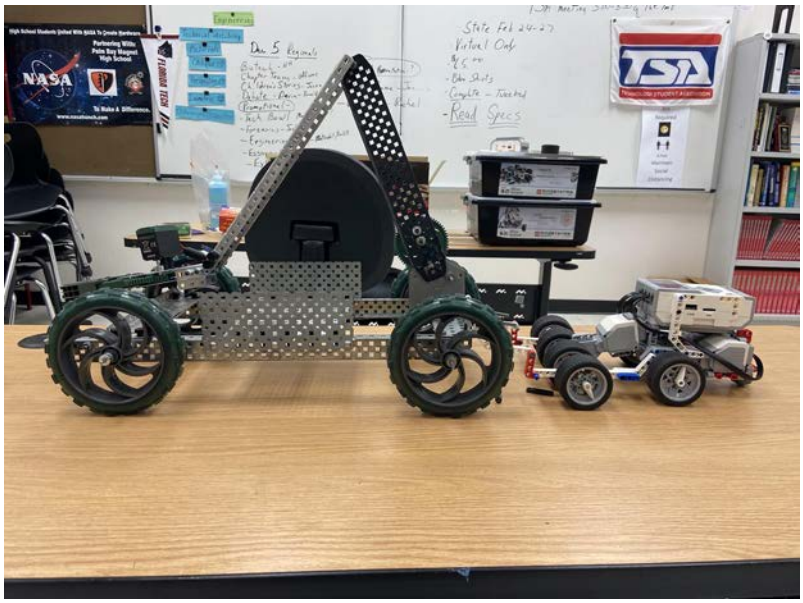
Our prototype exceeds the requirements and constraints by following the solid works design and the guidelines required by NASA HUNCH. Our project does have a working 3-D prototype that can be rendered if needed. If you open our solid works assembly of our prototype you will see every feature that we have put on our working prototype including the ramp that goes in and out also with the one winch in the front along with our no show tires that hide under the complete flatbed allowing loading and unloading to be as painless as possible. Our project has a clear detailed data sheet showing you that the working prototype is able to to be pulled using the three point hitch along with all six tires that will allow you to put major weight on the bed without damaging anything and dragging your heavy object comfortably. Along with all of that we have equipped with the heavy duty wench along with two side cargo straps to allow the object to stay in place so it won't get damaged. The last part of our trailer that I'm proud of is our ramp system that we have put into play. Our ramp is equipped with a hydraulic system allowing you to move it in or out with a push of a button. Our data has concluded that everything that we need to work on our final prototype does in fact work. The final project does come with very detailed and very oriented to make it very easy for replication. As long as you follow the instructions the way they are put you should be able to get the same results. Our material used for the lunar trailer will be the same as the space station so it will be easy to obtain. We are aware that in space the gravity change is drastic and that things work differently here than on the moon or space. Our working prototype is designed to withstand the harsh weather and freezing temperatures that happen in space along with the extreme heat the sun gives off.The inside of the trailer will have 4 good sized weights to allow it to stay on the surface you need it to but does not have any effect on the way it should pull the object

you are trying to pull. Along with the counterweights our tires will be allowed with reinforced steel to keep the foundation sturdy. This prototype can be built fairly easy with the right resources and the right workers building it. Yes most materials you can get off the shelf or ordered to you directly but some materials you may need to special order only because it is a special kind of material. But most materials and components like the wench and the hydraulic fluid parts you can easily pick up on the shelf. In all we just took a regular trailer and customized it to our needs and constraints to make it the perfect thing to launch into space to start a new kind of observation.





Pod Mover



Palm Bay Magnet Highschool

Mrs. Allen

Mitcheal Ducote, Jovaniel Flores-Ruiz, Amaya Laing, Maria Penilla

The problem we are trying to figure out is a way to design something that astronauts could use to pick up the pod with the food and water and bring it back to their shelter. Something simply so that astronauts don't have to pick up or roll a heavy item.

For our project we decided to build a box with an arm. The surface of the box will help the arm not swing or bump into things so the items don't get mixed up. We also build the arm so we are able to pick up 2 different sizes of balls. We wanted to keep the project simple and keep it lightweight.

Problem Statement

What is the most efficient and easiest way to capture a supply pod and return it back to the habitat?

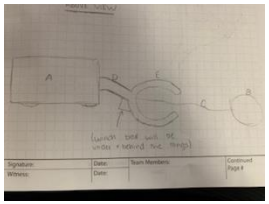
About

The lunar supply pod transport is designed to retrieve the supply pod, which is sent into space, back to the habitat. With this, this group has designed a prototype for NASA HUNCH. Some constraints and criteria kept in mind, when designing and building, were adjustable size, lightweight, size, weight, and shape of the supply pod. The team chose this project because it seemed like the most intriguing problem to research and build. Additionally, the team thought this project would challenge their skills of working in Autodesk, VEX Robotics, and coding.

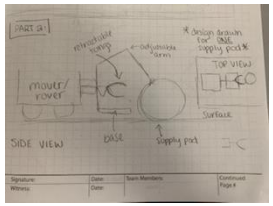
Material

The group decided to use an aluminum alloy for the actual lunar supply pod transport. This is due to its light weight, yet durable properties, and the extreme temperature fluctuations it can withstand.

Initial Sketches



By Zachary Gary



By Kristi Anderson

Explanation

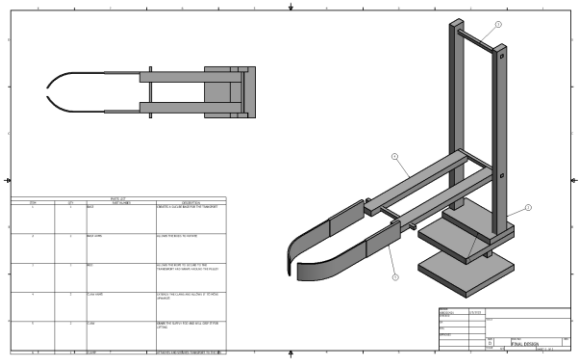
In the group's original sketches, they decided to create the transport as two claws that would reach down, extend outward, and grab the supply pod. For extra support, the group designed a wench that would sit under the claw, thus allowing to pull out the supply pod to grab onto it. In the instance that it was forced into the surface, this wench would be help pull out the supply pod.

The group chose this project knowing that it would require building a model using VEX Coding and Robotics. Because of the group's prior knowledge, this became more interesting to design and develop a solution.

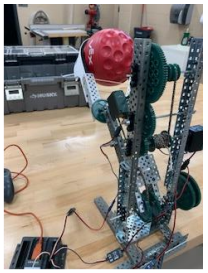
Inspiration to our design

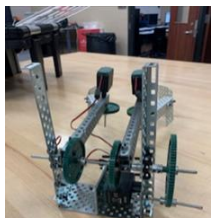
This garbage truck is a great representation of how our lunar supply pod transport will work. As the truck has adjustable claws and retractable arm, the group designed the model to mimic this process.

Lunar Supply Pod Transport Autodesk Inventor Design



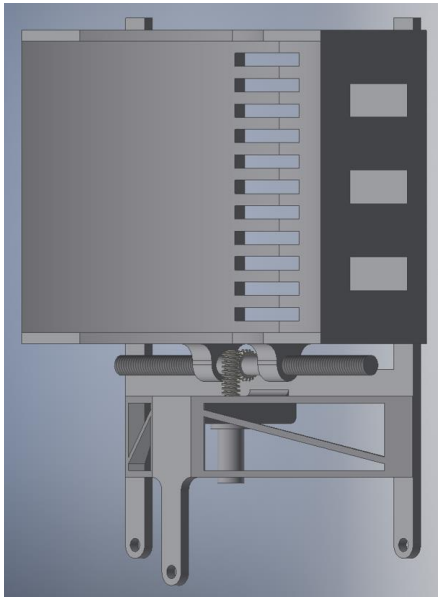
Progress Photographs





We aim to make the best supply pod mover to meet <u>your</u> requirements

We have designed and prototyped what we believe to be the best design for a supply pod mover while following all of the constraints that NASA put in place. We are confident in our prototype to perform the best job possible



Billings Career Center
Supply Pod Mover Team
Billings, MT

NASA HUNCH Program

Supply Pod Mover

Billings Career Center HUNCH Team: Gavin Hunt, Camron Hilliard, Jacob Anderson

Our Team

Our Supply Pod Mover group is composed of:

- Gavin Hunt
- Jacob Anderson
- Cameron Hilliard

Teamwork

We each have done our part to create this design and turn it into a full-fledged prototype for you beautiful people at NASA.

We each generated concepts and ideas for creating and improving our design, along with how to test our prototype.

> ” This design is so amazing! I could not imagine planetary exploration without it.”
> - Very Smart Engineer

Materials for Construction

We believe the use of titanium as the main component for constructing our mover is the best metal to use as it has been used by many NASA projects in the past, and for good reason. Titanium is lightweight and durable which makes it the best choice for this equipment.

For the elastic material that will be used to protect the threads from lunar dust we recommend graphene infused rubber. This rubber is highly durable and has a high elasticity that allows it to stretch for great distances.

Key Offerings

We have designed our supply pod mover to make it not only simple but also effective. This will help reduce the cost of building and transporting the mover for NASA as well as make it easier to operate for the astronauts that will handle it.

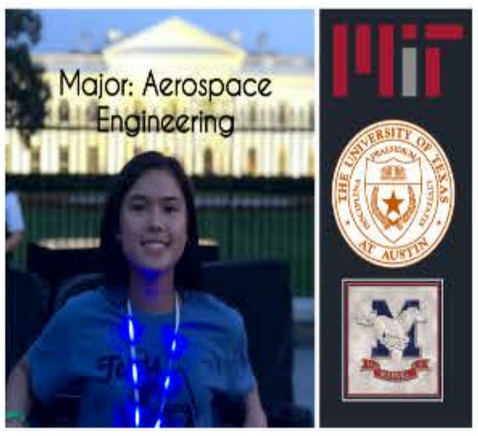
Key Features

These are just some of the crucial aspects of our design:

- Accommodation for different sized loads
- Slots to prevent lifting of excessive lunar dust
- Lightweight design
- Dual movement scoops
- Elastics thread cover to keep out lunar dust
- Three-point hitch mount

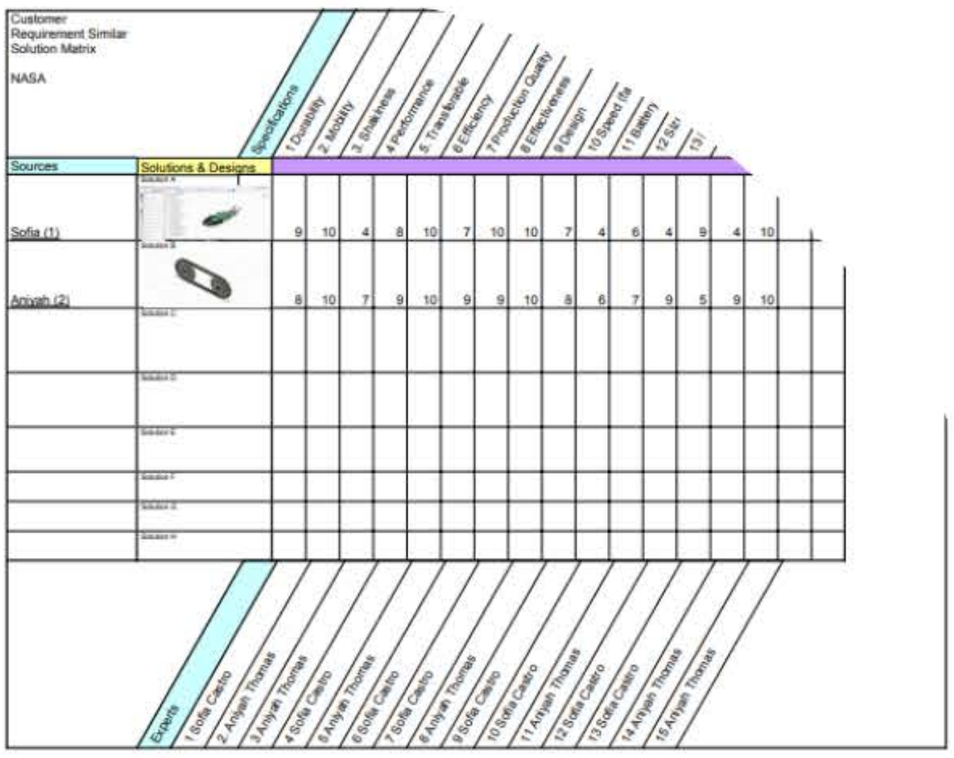
Aniyah Thomas and Sofia Castro

Lunar Supply Pod



We are students at Manvel High School, where Mr. Smith is our instructor.

ADOBE SPARK LINK: https://spark.adobe.com/page/0YpExNGucElVf/

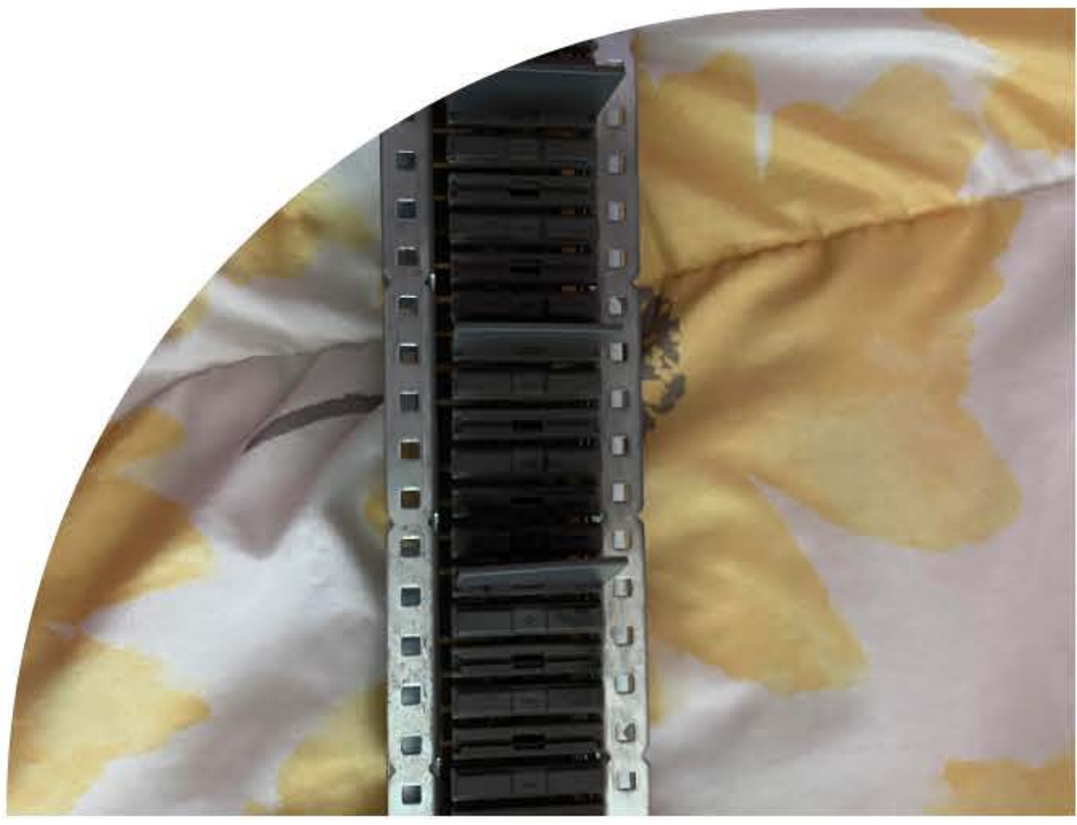


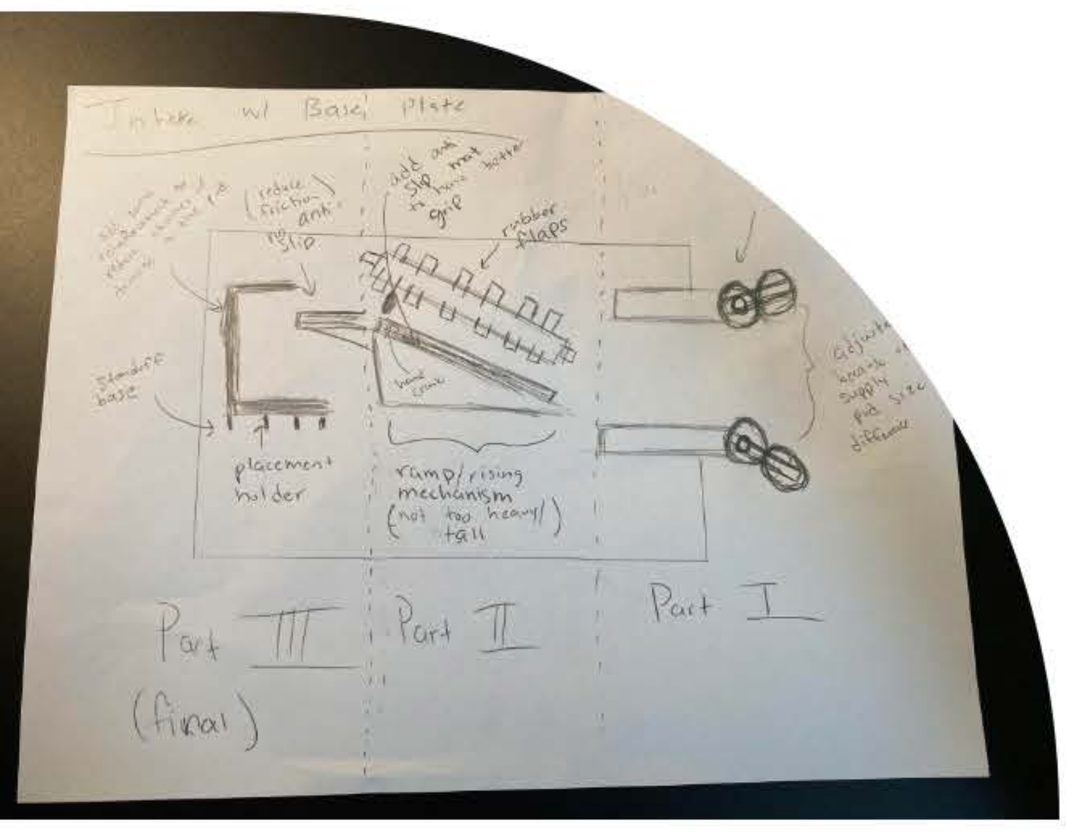
Component 1

We must first come up with our problem statement using the 5 attack paths and research current solutions using Google Patents. We then identify consumers with varying techniques such as the Love Triangle and Customer Requirement chart

Component 2

We brainstormed different concepts and ideas we had and created rough draft sketches. This mainly consisted of constant improvements and design changes with 3D models and thumbnail sketch innovations





Component 3

Once we have finalized our concept, we explore the varying STEM applications and viability of our design

Lunar Supply Pod Mover

In September 2020 the National Aeronautics and Space Administration (NASA) Hunch astronauts challenge the Project Lead The Way (PLTW) students at Manvel High School to build a lifting system. The lifting system may consist of two different modes of lifting. The system that my team and I plan to design and build will be operated on the Space Exploration Vehicle (SEV) on the moon.

Team Members

Judah Thurman

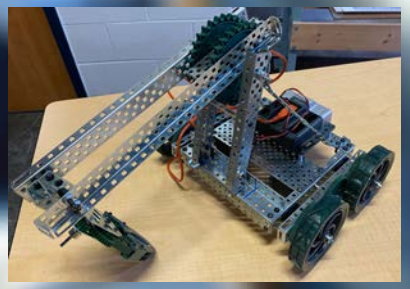
Matthew Cofer

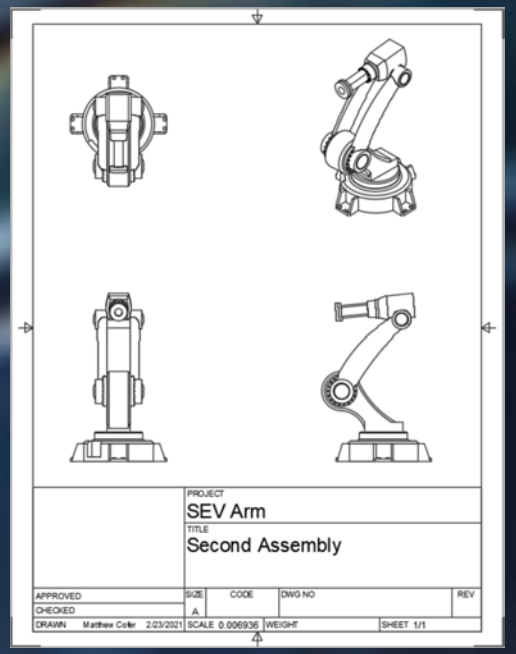
Estevan Lara

Troy Thomas

Our Vision

Engineering Design and Development (EDD) is the capstone course in the PLTW high school engineering program. It is an open-ended engineering research course in which students work in teams to design and develop an original solution to a well-defined and justified open-ended problem by applying an engineering design process.





Our team will perform research to select, define, and justify a problem. After carefully defining the design requirements and creating multiple solution approaches, teams of students select an approach, create, and test our solution prototype. While progressing through the engineering design process, students will work closely with experts and will continually hone their organizational, communication and interpersonal skills, their creative and problem solving abilities, and their understanding of the design process.

Our team decided to choose the Lunar Supply Pod Mover. NASA inform our group that supply pods are going to roll to a stop on the Moon with food, water and other supplies for the astronauts. NASA needs a way to bring the pod back to the habitat where it can be unloaded. Due to the supply pods immense size and awkward shape the pod will not be able to pick up by the astronauts. They will already have a rover that can be driven out to the pod but they will need a device pick it up or roll it back to the habitat. Our plan is construct a arm that is capable of lifting both a sphere and a cylinder.

All Stars
MAVENGINEERS