Lunar Supply Pod Mover
Semi-Finalist List
for
NASA HUNCH
Design and Prototyping 2021

Congratulations for being chosen as a Semi-Finalist for NASA HUNCH Design and Prototype 2021. Your design was chosen as a semi-finalist because you have a prototype that shows some or all of your idea, interesting/original ideas in your design, you did some valuable testing, and/or had some CAD designs that conveyed significant contributions. Despite the difficulties and not as many schools participating this year, I believe that HUNCH has received as good of quality of projects as ever. You should be very proud of your prototypes and ideas especially because of the difficulties surrounding this school year. Some schools have been out of class all year and others have been in class all year but students were being pulled out of class for weeks at a time. Some students were only able to work and build from home. One school was only able to work together on their project for 3 weeks before their CDR. Everyone should be commended on your resilience to finish your project and the great ideas and work you have put together in front of your own eyes. Prototyping and testing are the first steps in any engineering project and all of you have learned the value of it.

It is from the Semi-Finalist list that we will narrow down our choice for Finalists. We at HUNCH are very proud of how difficult you as students and teams have made it to choose which designs should go forward. **Congratulations!!!**

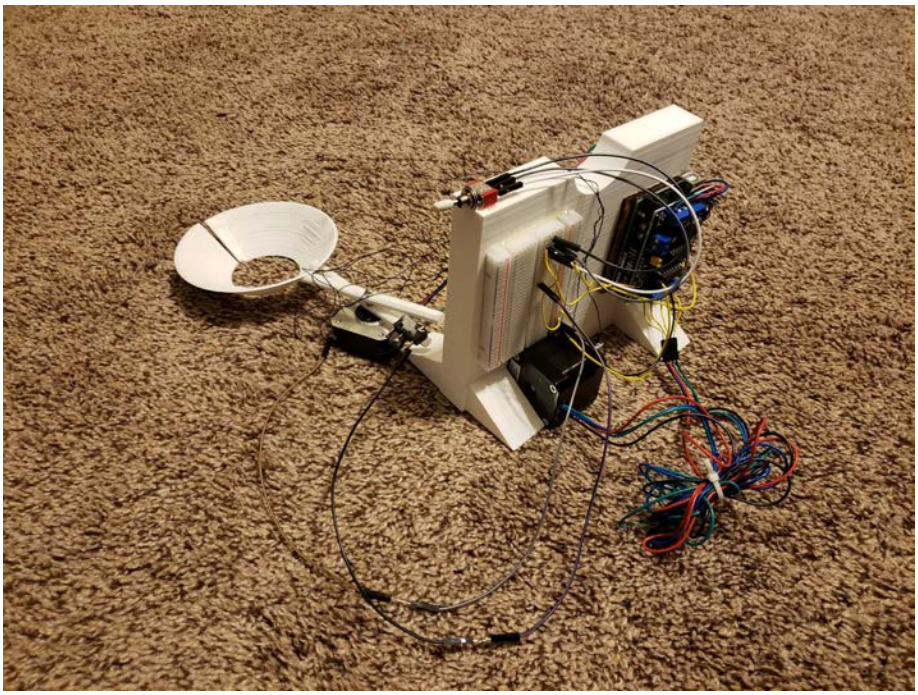
This list may be updated in the next day or two if we find we are missing a few team's brochures.

We expect to have the list for the Final Design Review in the next day or so as well.

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

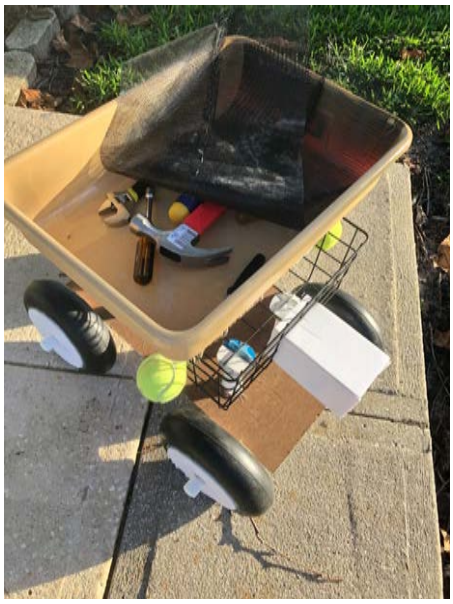
Team Members and Contact Information

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

Critical Design Review

Project: **Lunar Supply Pod Mover**
School: **Space Coast Jr./Sr. High School**
Teacher: **Mr. Luis Reyes**
Team: **Lauren Marquez, Graham Keener, Santos Chaves, John Cantalupo**

The Lunar Supply Pod Mover project wants the supply pods that have landed on the moon brought back to the habitat on the moon. They already have the rover to drive out to the pods but they need something that will pick up or bring the pods back to the habitat. The supply pods are not specified in size, weight, material, and etc. but they are filled with supplies, food, water and tools. For our original design, our prototype is based off of a shopping cart. We decided to use this type of design because they are easy to maneuver and they can hold heavy weights. We thought a shopping cart would be the best design because of the size and we decided to modify some parts of the shopping cart. Instead of the basic wheels on a shopping cart we are going to be using Beach Wheels that will easily glide through the moon's dusty surface. In the prototype, the wheels are made out of inflatable inner tubes that we put together with a drive shaft so the wheels could move. In the beginning we thought that the astronauts would be pulling the shopping cart but instead, we decided to put a truck hitch on the shopping cart itself to connect to the rover. The rover would have the ball and the trailer hitch will be on the mover. That way the astronauts can get onto the rover and drive back the whole supply pod mover to other areas of the moon or back to their habitat. In our updated design we kept the prototype small and used a metal basket to show the wired cart like basket.The back of the cart opens like an actual shopping cart so that the supply pods can be pulled into the cart.To pull the supply pods into the cart, the winch has a magnet and a clip or hook to connect to the supply pods then it will be reeled into the cart. Our winch is just a pole with rope that can be pulled and reeled out easily. We do not know the material of the supply pods, so using a magnet to pick the supply pods would be difficult if they were not metal. The basket itself was lowered closer to the ground because it would be easier for the supply pods to get into the basket. We also wanted to add a place for the astronauts to put their tools that they may need on the way to the supply pods. We added a shelf that sits above the cart or basket that will be able to hold the tools and it will be high enough so the astronauts do not have to bend down to reach them. We made sure to keep in mind that the prototype will be in space so if the astronauts did put tools on the top shelf, there would need to be a cover so they did not float away. Since the prototype will be in space, the materials of the cart need to be able to stand the harsh conditions of the space environment. Most of the parts of the prototype will be made from aluminum.



Tool Shelf

Pod Mover

Winch Test: Pulling Supply Pod in Cart

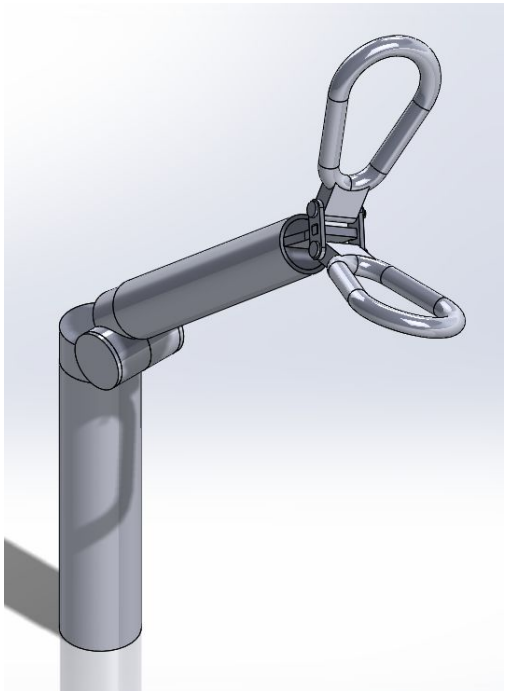
Critical Design Review

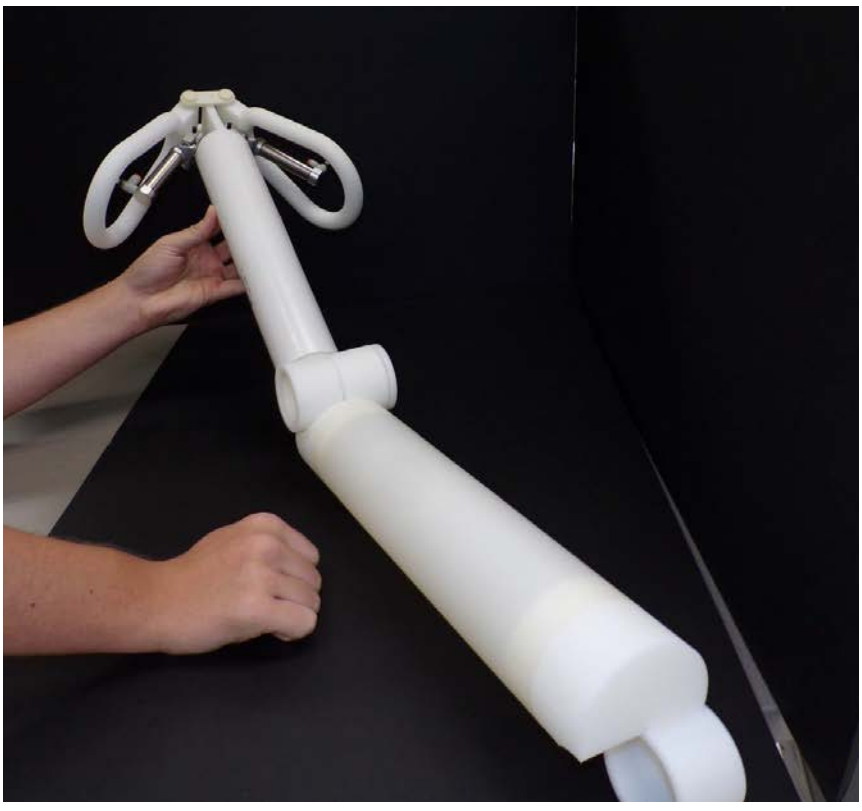
Project Title: **Lunar Supply Pod Mover**

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

Teacher: **Mr. Luis Reyes**

Team Member Names: **Kaylee McDowell, Zoe Ward, Nathan Stottlemyer**





Description

The structure and geometry of the sample pod mover prototype has been through the process of trial and iterated several times since the design phase. The group developed an initial design for the claw and pivot points. Once the model was created we began to generate ideas to make it more efficient.

The prototype that is before you now, meets all the requirements sent to us from NASA, the design of the prototype allows the sample pods to be easily transported from the surface of the moon to the space station. Careful consideration was given to the design of the claw. Using aluminium joints allows for movement. While we use steel for the claw so it remains sturdy The claw is universal and has the ability to adapt to any shape and work. We had trouble with designing the arm, being able to hold the momer. Our design is unique, like a puzzle every piece is important. Designed to assist the astronauts.

Designing the prototype in SolidWorks renderings of all our parts for our prototype for ease of recreation.The SolidWorks parts are created scaled down to the size of our prototype. We brainstormed ideas for our design based on the robotic arm toy from the 1990's. The grabber part was modeled after a golf ball retriever.

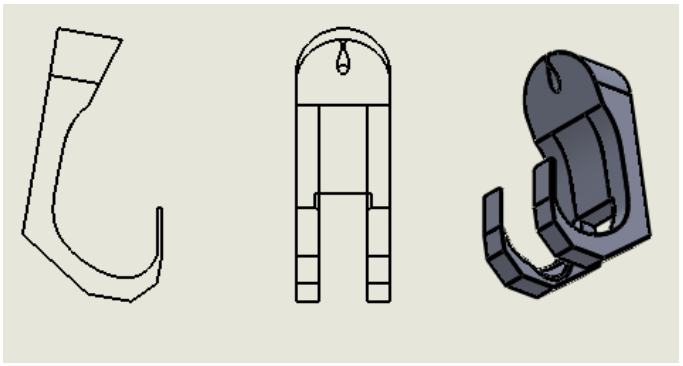
As a group we noticed the difficulty that comes with creating this prototype because of the harsh environment of the moon. Designing a pod mover that can do its job efficiently,

Problem Statement:

On the moon, NASA will be supplying the astronauts with supplies through the use of supply pods. These pods create the need for a device capable of attaching to the rover, in order to pick up and transport said supply pods from their location of impact back to the lunar base.

Future plans

- ❏ Fully automate the hook and scoop system to function without the need for astronauts.
- ❏ Test with heavier weights and the use of a stronger motor.
- ❏ Develop a plan for collapsibility.
- ❏ Continue efforts to improve the pod scoop method of lifting (shown below).



Summary of Results:

- ❏ Capable of lifting a weight of 70lbs
- ❏ Holds pod steady, preventing swinging
- ❏ Requires minimal astronaut effort to attach to pod

L.O.M.P.
The Lunar Operational Mover of Pods

Created by: Desmond Decker, Max Howerter, and Tommy Donovan

Sponsored by Chatfield Senior High School HUNCH program

Team Members

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Max Howerter

Desmond Decker

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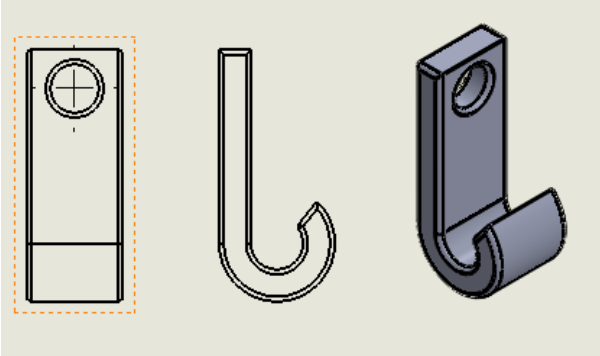

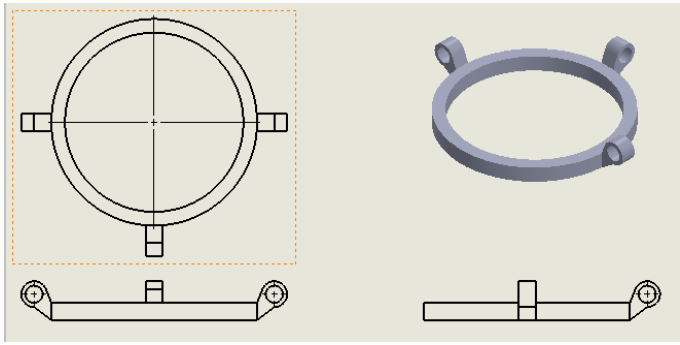

Interface Hook

- Made to be attached to pod by astronauts
- Hooked to cable that can be lowered by a motor to the level of the pod
- Aligns with attachment points that are built into the supply pod
- Is currently a flat, curved piece in order to prevent sway while lifting

Automated Tensioning Ring

- Allows for any size pod to be held stable while in transition
- Prevents swaying of the pod
- Rings around the upper half of the pod and is attached to cables tied into the frame of the device.
- Hook pulls pod up through the center of the ring which holds it in place
- Can function with both a sphere or cylinder design of pod

Pod Lifting Support Body

- Triangular pyramid in shape
- Distributes weight evenly to wheels and attachment point
- Support struts on the side add more structural integrity
- Positioning of the frame ensures that the pod is centered in the design.
- Is capable of supporting a 70 lbs dumbbell (¼ Scale)

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.


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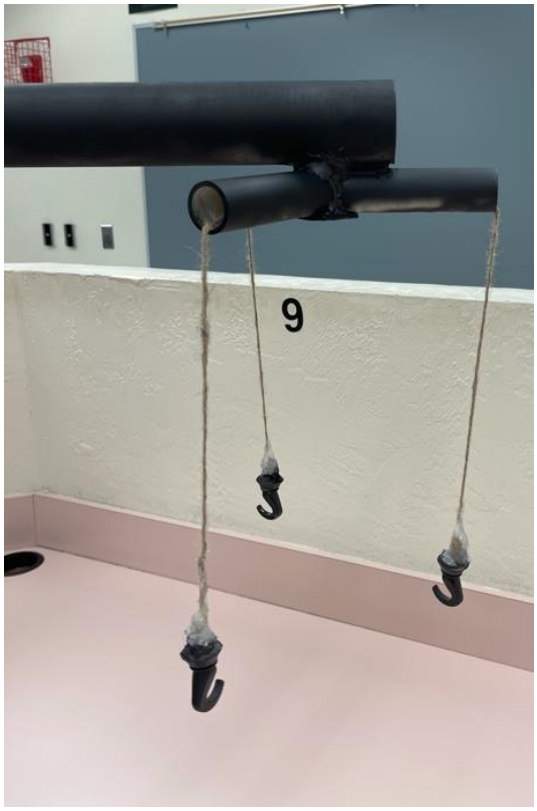
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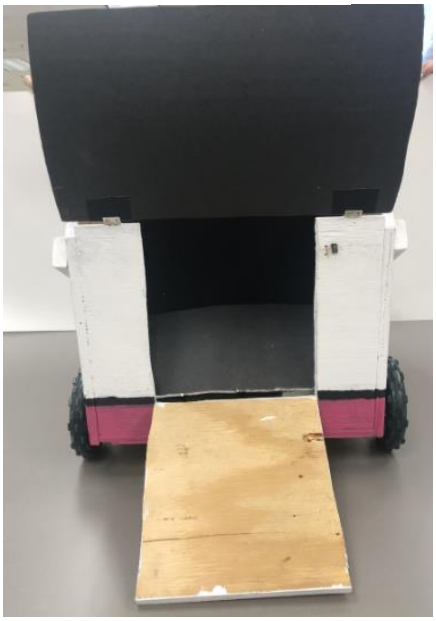
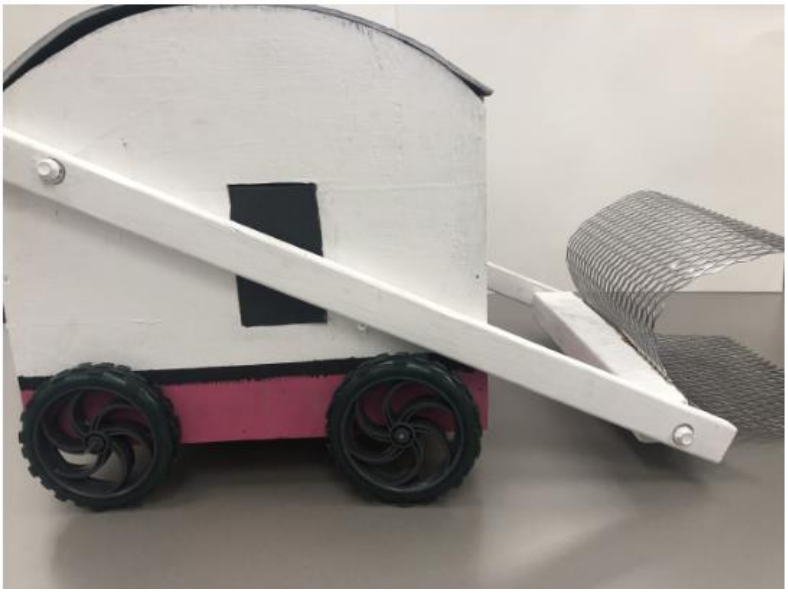
CRITICAL DESIGN REVIEW
NASA HUNCH

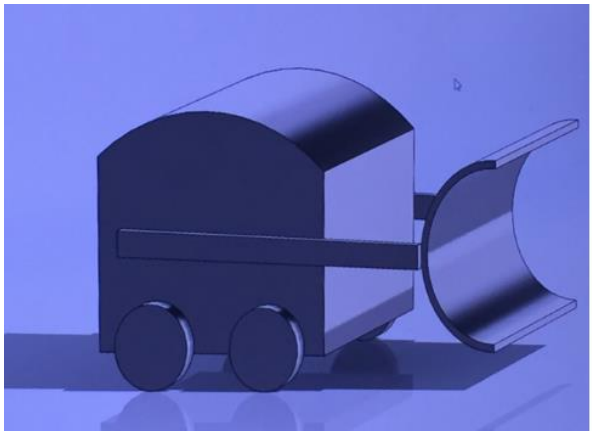
Project Title: **Lunar Supply Pod Mover**
School Name: **Space Coast Jr. Sr. High School**
Teacher: **Mr. Luis Reyes**
Team Members: **Samantha Delashmet-Rolfe, Sheena Dorgan, Lisa Dey, & Nick Ortiz Torres**

Description:
With the body type, the supply pod mover will be able to move at least 3 tons on the moon and more. There will be an enclosed section in the back of the vehicle so that the supply pod can safely be transported without swinging back and forth, keeping the pod safely secured in the back of the mover. To make sure that the pod mover will be able to transport pods of different sizes or shapes, the bucket and the container are modified to do these specific tasks. The bucket itself will be able to adjust and secure the pod in the bucket/claw itself when transferring to the mover body. The container in the body will be able to fit just about every size and shape with all the space, given it would have to fit the dimensions of the body. The finished prototype is an almost complete working model, given there will be someone in control of the vehicle and materials are limited. For the body there are “passenger” and “container” like quarters. The “container “room has a slanted floor so that the pod can slowly be let out of the back with two angular walls helping to guide it straight. There is an opening roof that will work as a door for the pod to be dropped in by the scoop. The rounded roof is also a way to guide the pod into the compartment. The door on the back also acts as a light sloped ramp so that the pod can move out slowly without hitting anything on its passage out. The scoop is a rounded type so that it can pick up any size or shape. The arms itself have a way of moving above the vehicle and twisting the scoop in any way so that it can angle itself towards the door in the scoop. Of course in further modeling, there will be a working control room with better windows and doors. Most of all of the parts in this vehicle is going to be made up of titanium metals. The mover itself has been shown to easily maneuver a pod like type, and successfully be secured. For now, the simple basis of the prototype makes it easy to replicate. Materials for the actual mover would be titanium and some other possible things on further development. The manual mover for now, will be open to maybe further development into making it self-operating and smaller adjustments. The model will have a type of off road tire that you may see on a tractor or maybe a crane, giving it traction on the surface of the moon. The scoop is also specifically designed to filter outro clean the

pod before dumping it into the mover. Given this and the metal type of Titanium, the supply pod over would be able to survive and thrive on the moon's conditions. With the mass build of the model, costs to produce may be a bit much. It is quite in-depth of how it's going to work and has all the precautions. Note that this is a model for now, and that there will be much further production in the future.







NASA HUNCH
Critical Design Review

Project: **Lunar Supply Pod Mover**

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

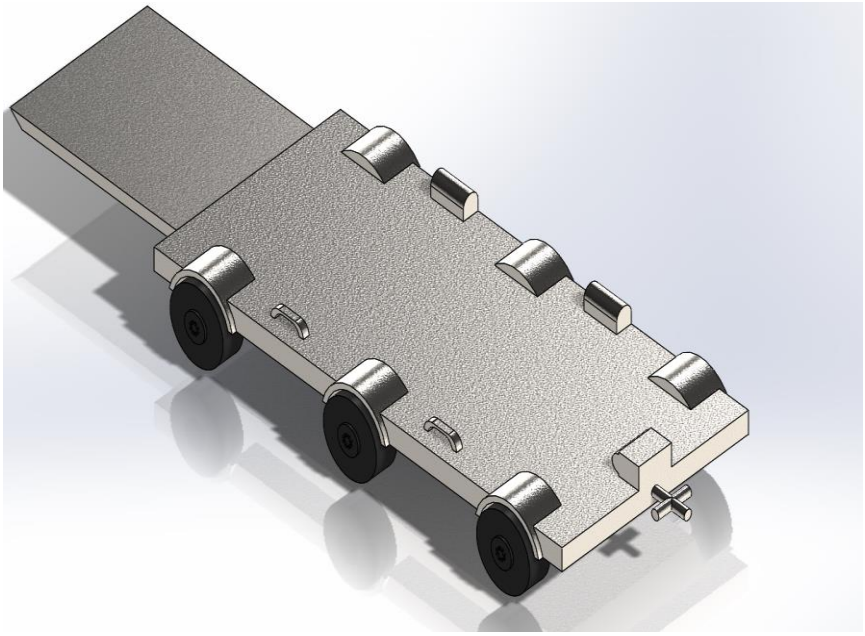
Teacher: **Mr. Luis Reyes**

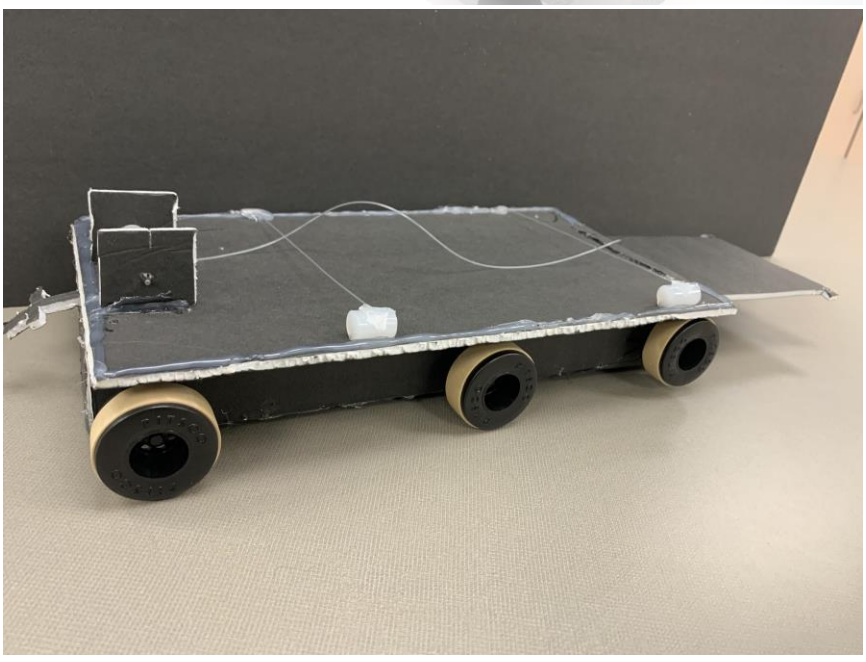
Students: **Jordan Parsons Stephon Crawford**

Description:

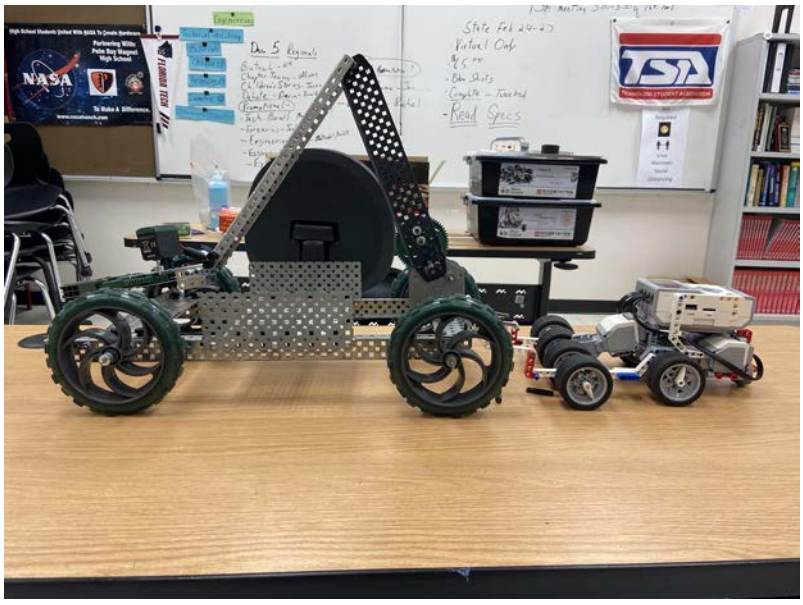
Our prototype exceeds the requirements and constraints by following the solid works design and the guidelines required by NASA HUNCH. Our project does have a working 3-D prototype that can be rendered if needed. If you open our solid works assembly of our prototype you will see every feature that we 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?

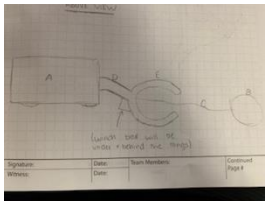
About

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.

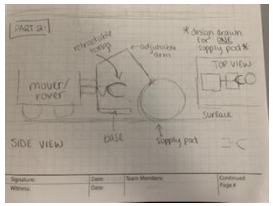
Material

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

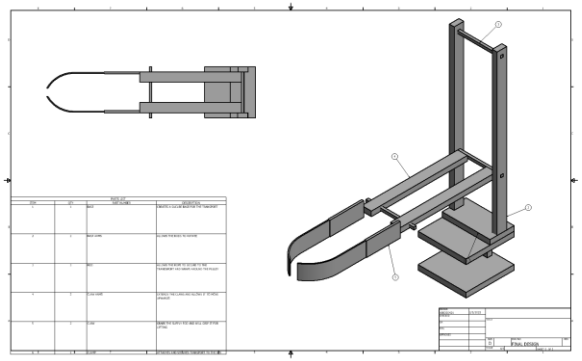
In the group's original sketches, they decided to create the transport as two claws that would reach down, extend outward, and grab the supply pod. For extra support, the group designed a wench that would sit under the claw, thus allowing to pull out the supply pod to grab onto it. In the instance that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

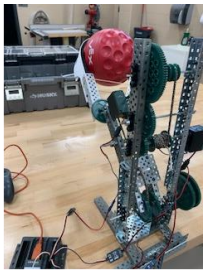
Inspiration to our design

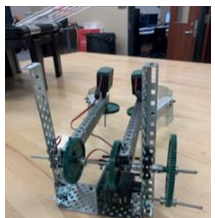
This garbage truck is a great representation of how our lunar supply pod transport will work. As the truck has adjustable claws and retractable arm, the group designed the model to mimic this process.

Lunar Supply Pod Transport Autodesk Inventor Design



Progress Photographs



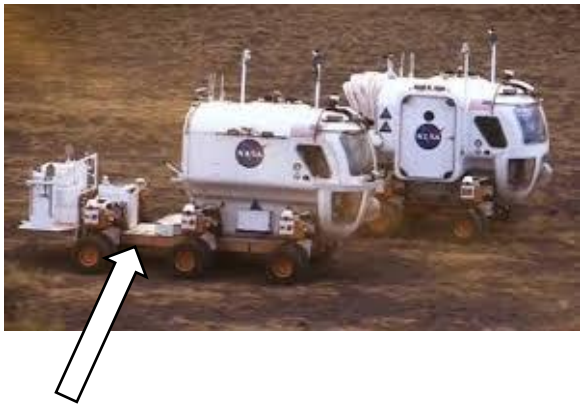


VEX

The group decided to use VEX Coding and Robotics for the lunar supply pod transport. With this programing, the transport arm will move outward to grab onto the supply pod and retract back. As of now, there will be three motors allowing it to function, but this will likely change when finishing up the transport arm.

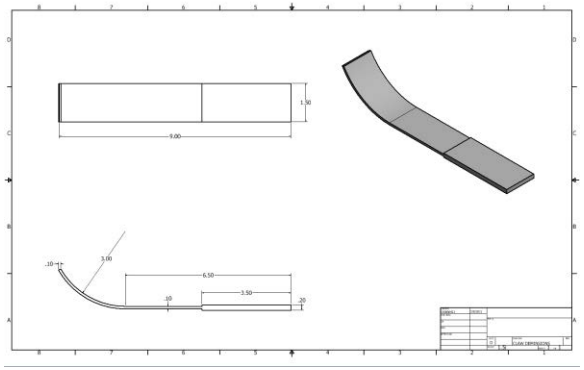
Coding

For this process, the group used a PLTW Template to insert the correct coding and allow the model to move freely. There will be one remote that enable this movement, outward and inward, for the entire model. Currently, the group is coding in the remote onto the program for the three motors they have finished to attach it to the model.



Here is where the group plans on attaching the transportation arm to the SEV.

Example Dimension



Lunar Supply Pod Transport

By:

Kristi Anderson and Zachary Gary

For:

Instructor Mr. Merritt

Architectural Civil Engineering

Clear Creek High School

Clear Creek ISD

League City, Texas

NASA HUNCH

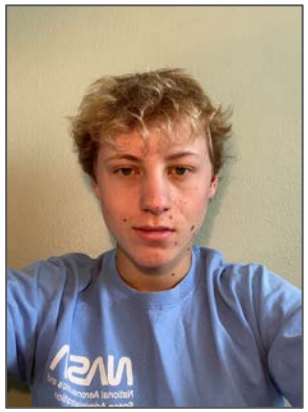
High school students United with NASA to Create Hardware

Meet the Team

Kennedy Solheim

Bryce Romero

Jack Snodgrass



Kyle Roszell

Chatfield Senior High School HUNCH Program
County: Jefferson County Public Schools
Address: 7227 S. Simms St. Littleton, CO, 80127
Phone: 303-982-3670

Contact Information (Instructor):
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Email: jbertels@jeffcoschools.us
Phone: 303-982-3537

Additional Information QR Codes

3D Printed SUPOR Video Test

Mock Robot Design SUPOR Video Test

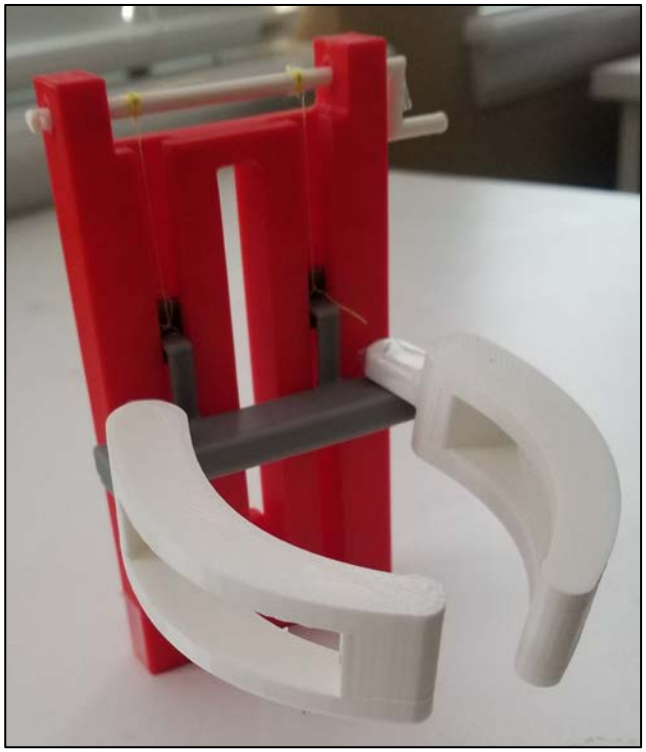
SUPOR Engineering HUNCH Portfolio

CAD Drawings

SUPOR – SUpply POd Retriever

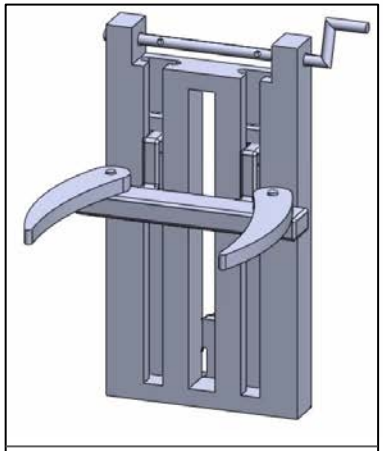
Lunar Supply Pod Mover Project

By: Kennedy Solheim, Jack Snodgrass, Bryce Romero, Kyle Roszell

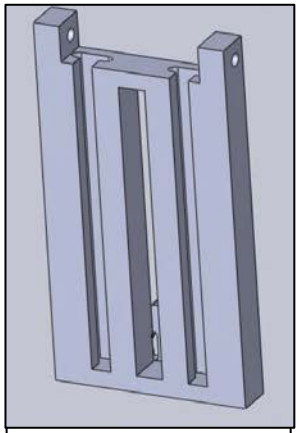


SUPOR is a supply pod mover that will efficiently, effectively, and safely retrieve a supply pod when it lands far away from the lunar base or weighs too much to transport by hand.

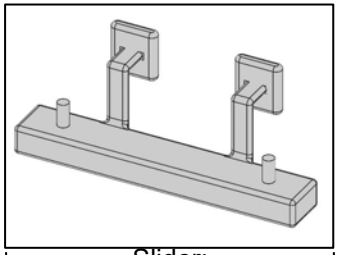
CAD Structures



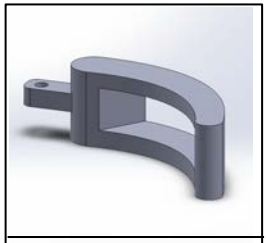
CAD Assembly



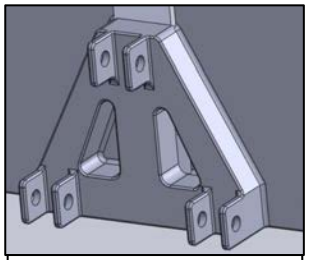
Main Support:
The main support has:
- a track system for moving the supply pod up/down
- holes at the top where the Winch Rod inserts



Slider:
- inserts into track system
- supports claws
- allows movement of supply pod up/down
- ensures disassembly



Claws:
- claws are angled slightly upwards to support the pod from the bottom and sides.
- Servos control the claws



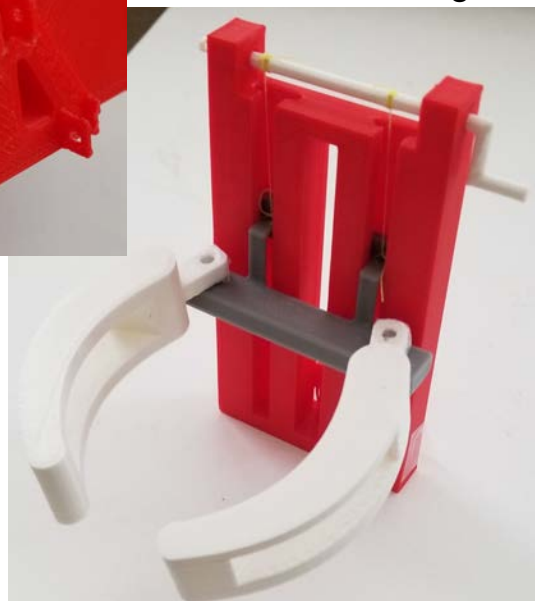
3 Point Hitch:
- triangular structure optimizes strength
- located on the back of the main support structure.

Winch Rod:
The winch Rod:
- acts as electric winch
- has holes for threading with string to represent the winch abilities

Testing and Mock Designs

3D Printed Design

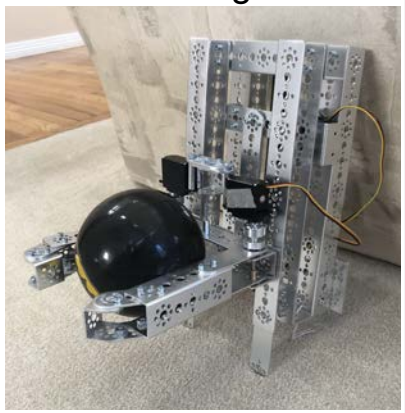
3 Point Hitch on the back of the 3D printed Main Support



Within our 3D printed design, the grey slider piece presents a smooth transition up and down with relation to the cranking winch rod. The white claws would need to be scaled down a little bit to reduce the weight in the front of the design and accommodate for a wider grasping hold. The slider arms having height to them allowed for SUPOR to accommodate for the distance that would be between the ground and the SEV.

Robotic/Mechanical Design

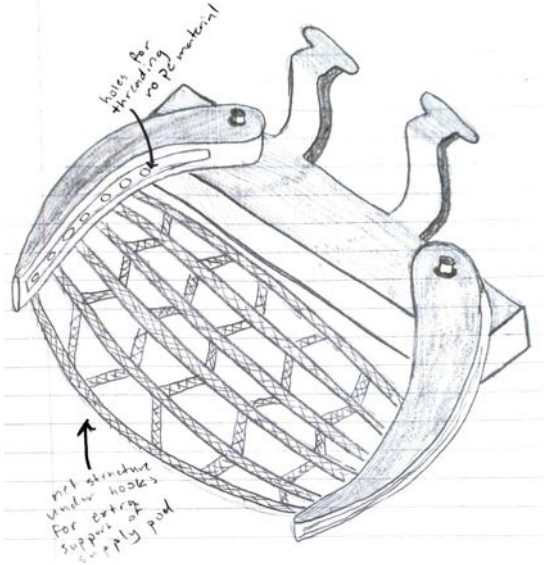
The mechanical mock design of SUPOR presents the servos' abilities to control the grasping mechanism of the claws while a track system and gear controls the up and down movement of the claws carrying the supply pod.



Videos of the working designs can be accessed in the "Additional Information QR Codes" section.

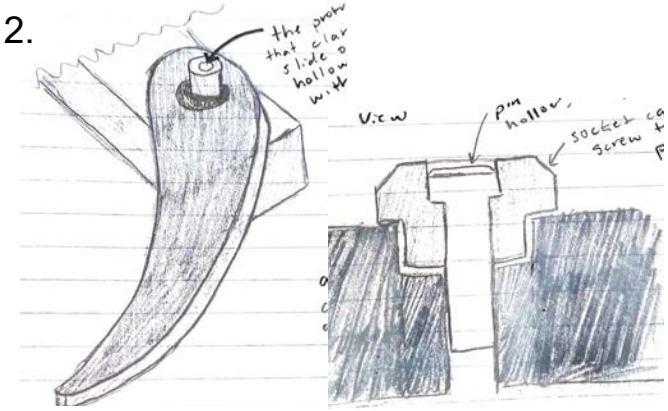
Next Steps

1.



We plan to implement a flexible yet sturdy netting structure that threads into the bottom of the claws to allow for additional support beneath the pod during transportation. They retract like curtains to move under the pod before grabbing it.

2.

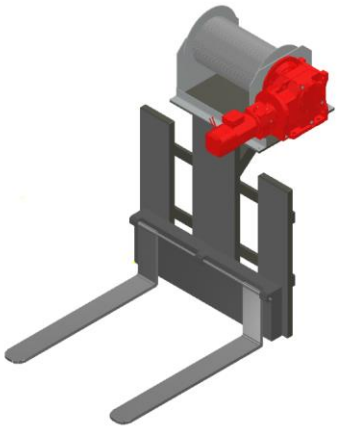


In order to secure the claws onto the slider and keep the claws from sliding off the cylindrical protrusions of the slider, we will create a pin structure in the cylindrical protrusions that hold the claws, meaning we would hollow the protrusions, line the inside with a helicoil structure to then thread a pin inside and place a cap on top in order to secure the claws in place.

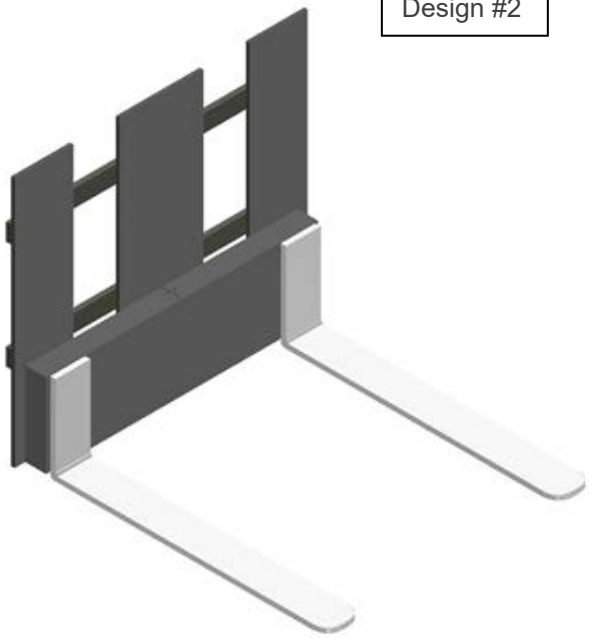
A Versatile Design: Optional Overlapping Methods of Transportation and Support

The versatility of the design is necessary for ease of use and accessibility into compromised positions of Supply Pods.

This design, with its multiple components, allows astronauts several means of use in order to retrieve the supply pod itself, making mission ease and success much more of a possibility.



Design #2



NASA HUNCH

NASA Supply Pod Transport

Team: Farrah Westfall, Ethan Heffernan, Chaz Cheramie, Connor Clark

Instructor: Mr. Merritt

Clear Creek High School
Clear Creek ISD
2305 E. Main St.
League City, TX, 77573

How these parts are supposed to look.

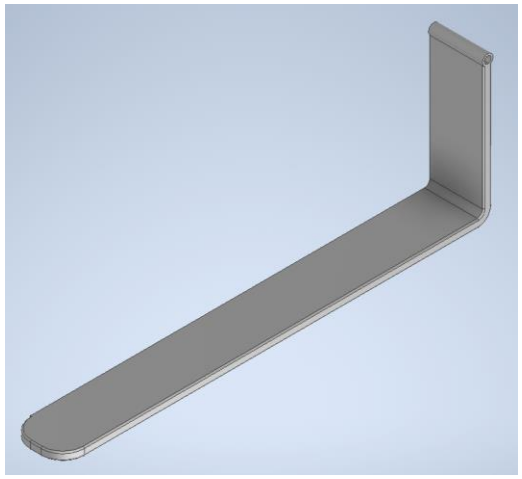


Figure 1: The forks are the main mode of transportation and support, allows a stable surface for a supply pod to be transported to the base.

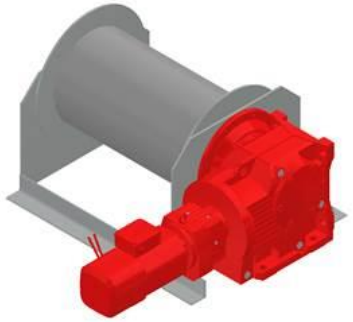
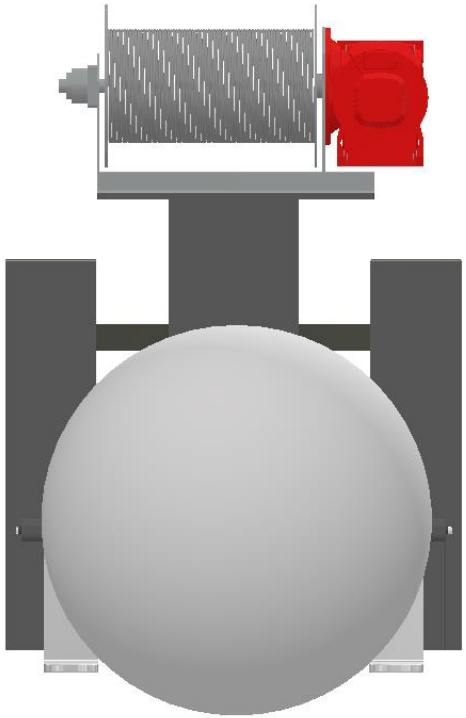


Figure 2: The Winch allows transportation of the supply pod from compromised positions, such as craters or ravines.

What is the purpose of this design?

The purpose of this design is to allow astronauts on lunar missions to easily retrieve the supply pods using a variety of methods for transportation.

Combining forklift components for the lifting and transportation with the use of an electric winch to retrieve and stabilize compromised supply pods.



Extra Important Information for the Design.

The design will be connected directly to the SEV via a winch. Electric components such as the winch will draw on the power supply of the SEV, making the need for separate supply sources unnecessary.

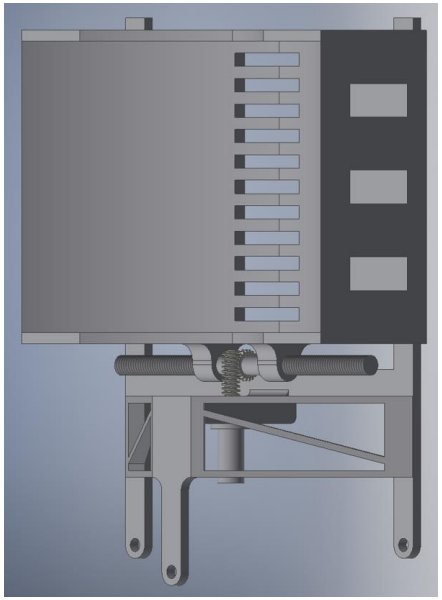
The forks are supposed to be connected to a back plate, which can be lifted or lowered via connected gears just enough to keep ground clearance on the surface.

Advantages:

- Versatility
- Ease of use
- Low maintenance
- Optional use of components

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

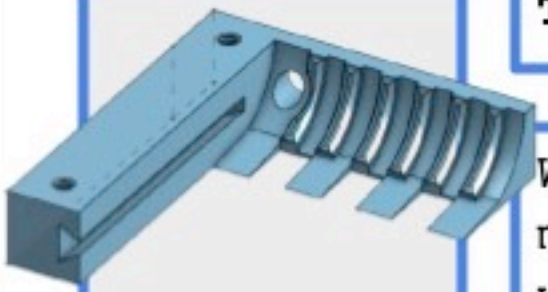
These are just some of the crucial aspects of our design:

- 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

Supply Pod mover

School: Council Rock South

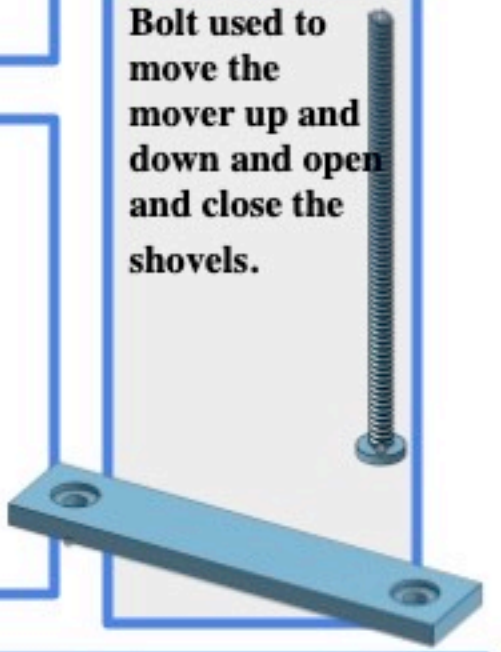
Teacher: Mr. Bauer

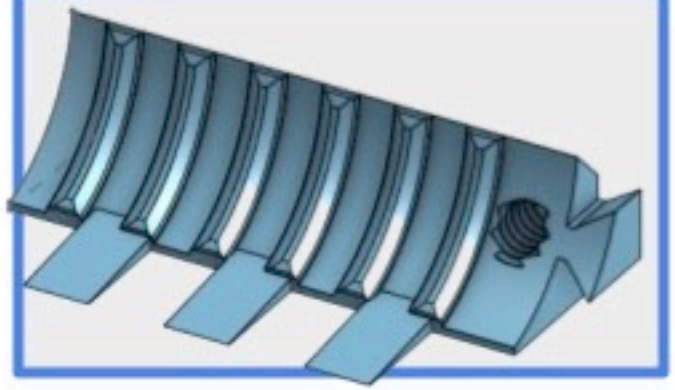


Bumps and the inclined base piece allows for lunar regulate to escape.

We have motorized movement on the supply pod mover which utilizes an arduino kit and student written code. We have a 3D printed model of the SEV, as well as the supply pod mover, and a great way of holding the supply pod in place and sifting out unwanted debris.

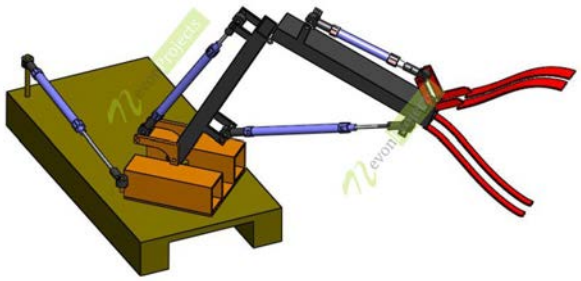
Bolt used to move the mover up and down and open and close the shovels.





Module wheels to attach to Supply Pod Mover.

Slingshot pouch that inspired the idea.



Pictured here is a robotic arm we ordered. Sadly, it won't be here on time for HUNCH. The arm is powered by 4 electric motors to perform all the movements it needs to pick up and transport the supply pod as needed.

Since hydraulics don't work in the vacuum of space, we chose to use Linear Actuators to maneuver our moving parts.

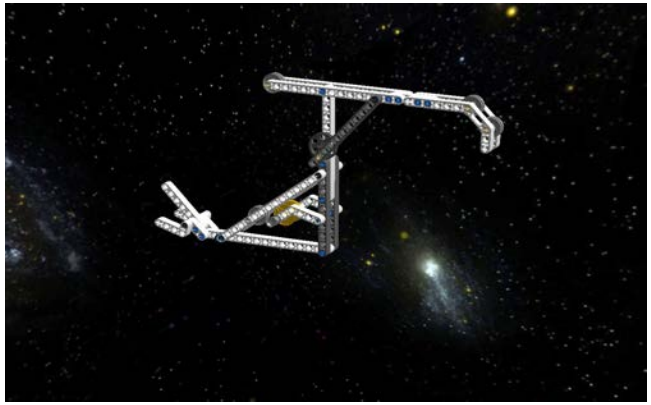
Resource, citation list

Google.com
Lego Designer Software

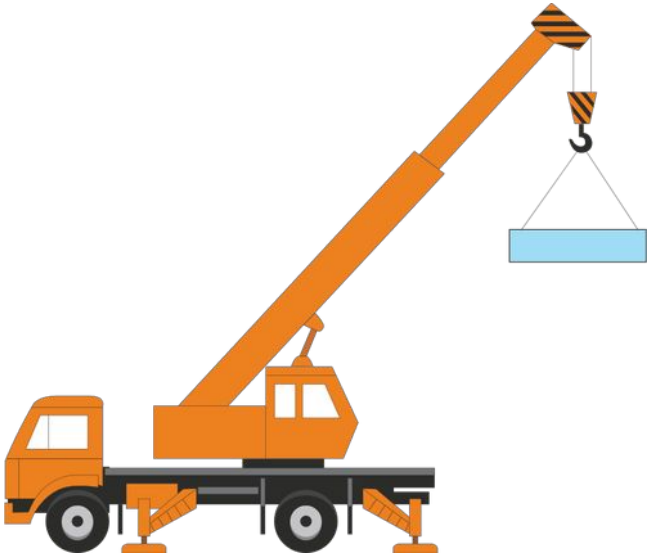
Lunar Supply Pod Mover

By: Noah, Dylan and Austin

Hunch 2021 Supply Pod Mover Team - SJVTC



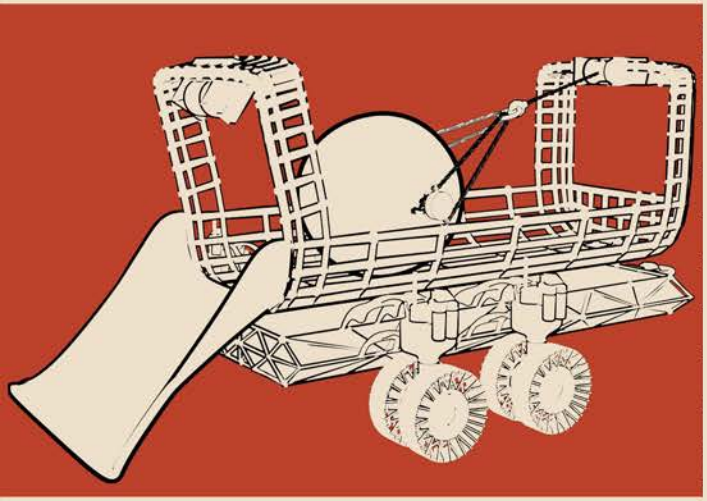
This was our original design. Created from LEGO Technic pieces, our basic draft included a chain and motor mechanism for the up and down motion of the arm. Also included was a cable system to grapple and move the supply pod.



We based our designs off of industrial cranes, with a tilting arm design. The arm is controlled by an electric motor instead of traditional hydraulics, which do not work in the weightlessness of space.

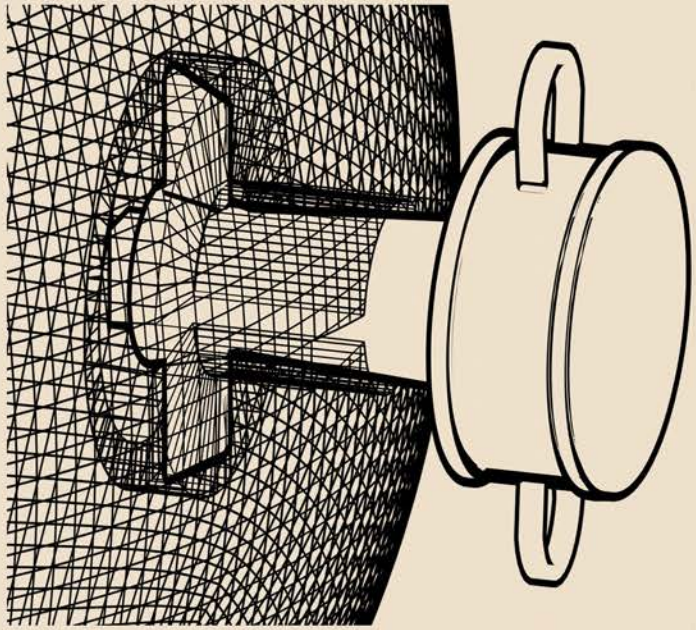
The grappling system is basically designed like a carabiner. A hook with a locking mechanism to ensure proper connection, eliminating the possibility of dropping the pod.

The Trailer



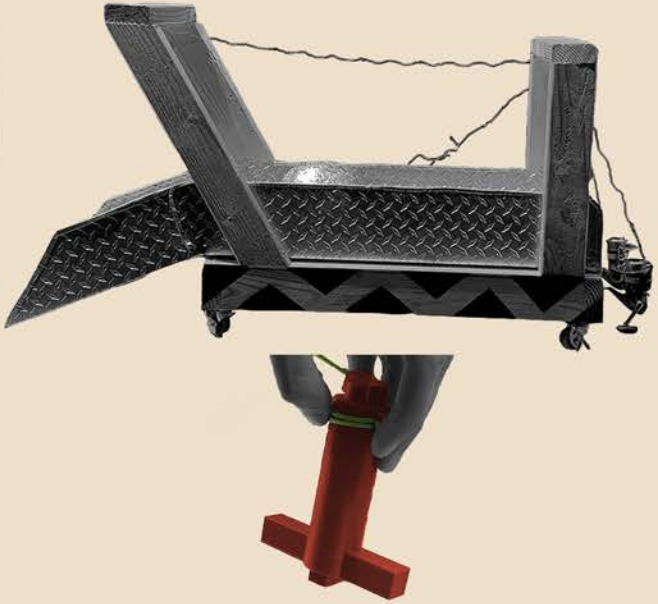
We decided that a trailer is the most optimal method to transport the supply pods because a trailer can transport multiple supply pods per mission. The carriage for the pod only needs to hold the pod during transit. Therefore, the carriage will be composed of metallic bars to reduce its mass. Two crossbars 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.

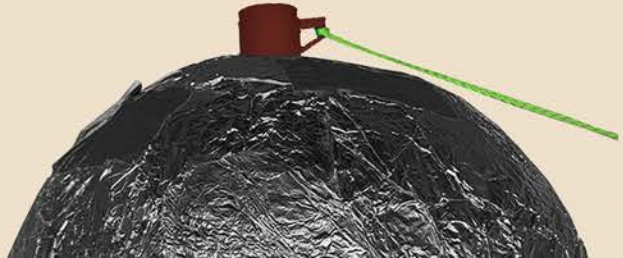
The Lock and Key



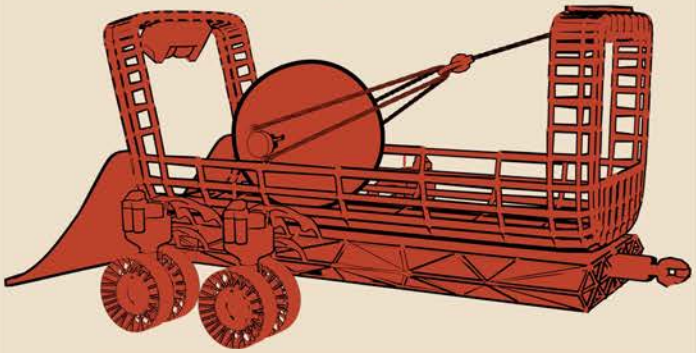
The focal point of our project is the "Lock and Key." The key is compromised of a T-shaped body, a deadbolt running through the center, and a bearing on the end. Because the supply pod is launched onto the lunar surface, it cannot have protruding hooks; therefore, a locking key must be inserted into 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

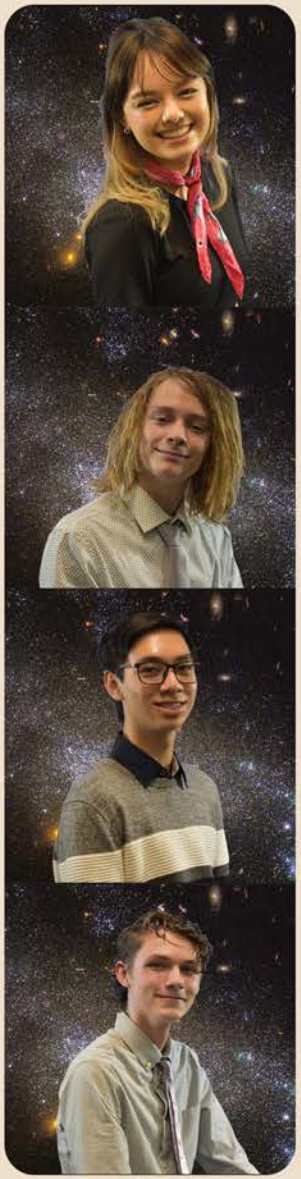




The NASA Lunar Pod Mover utilizes the spherical shape of the supply pod to roll it across the lunar surface. This functionality is overall more efficient than either dragging or lifting the pod because it will require less energy and supporting structures. Rolling causes less friction and requires less 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

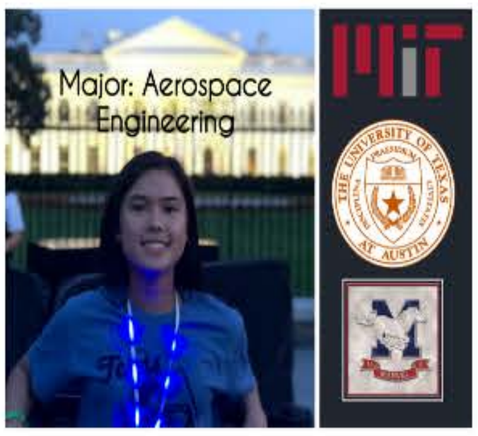
SUPERVISED BY FREDERICK HERRMANN YCEDEMY

Our Team

NASA LUNAR POD MOVER

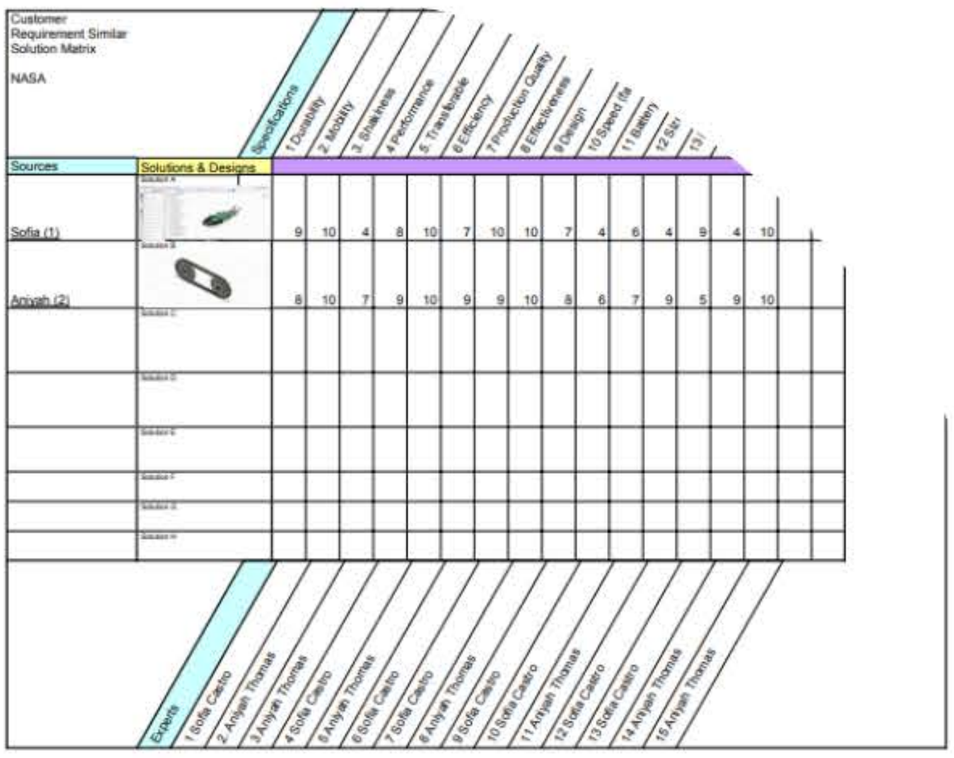
Aniyah Thomas and Sofia Castro

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/

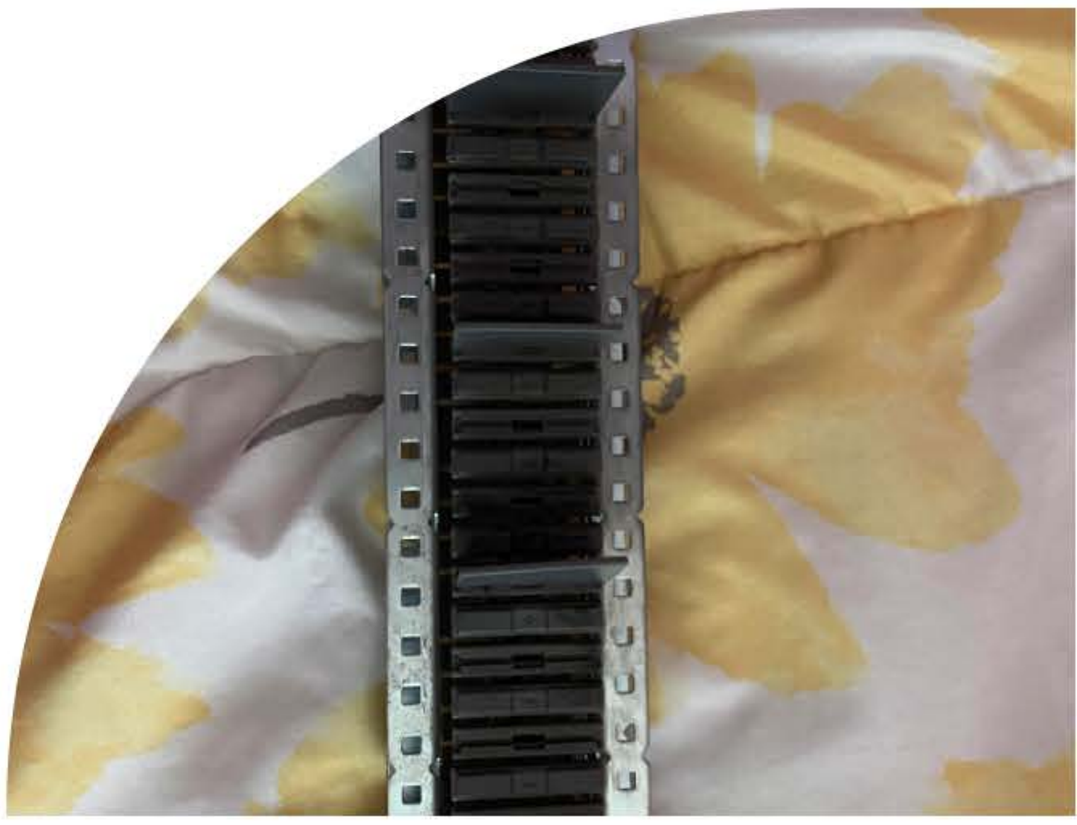


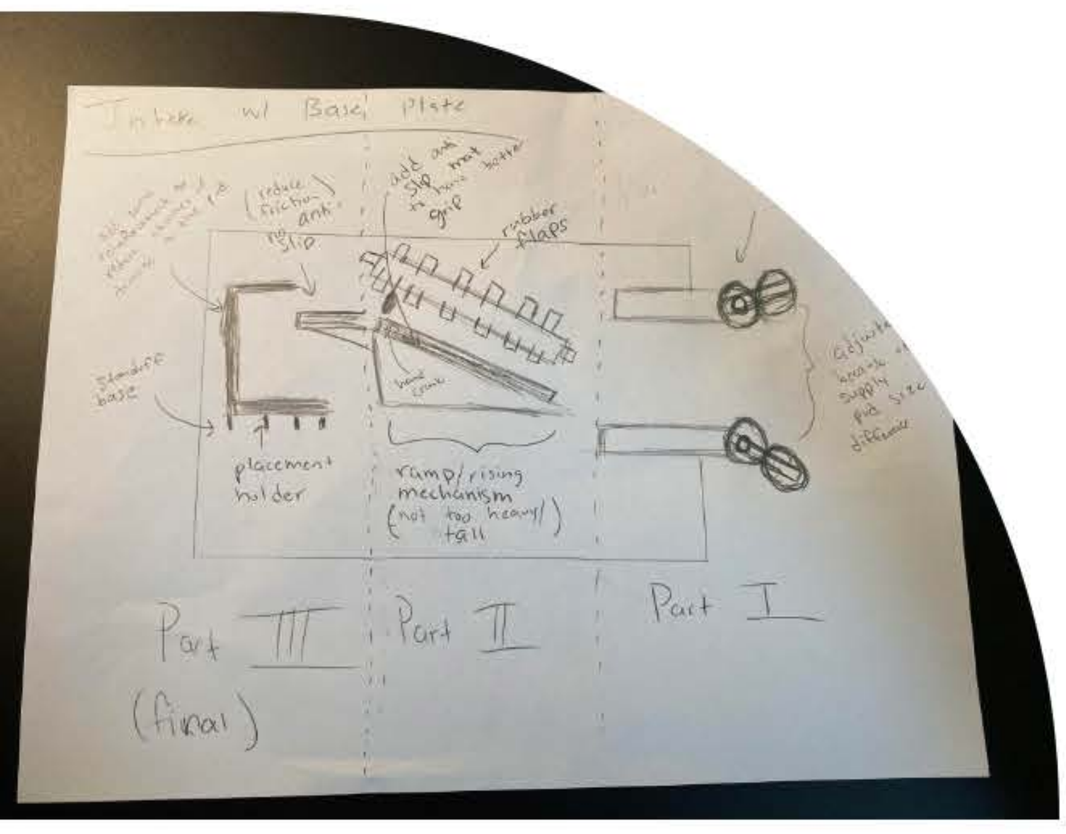
Component 1

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

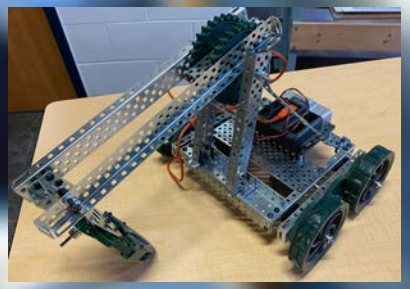
Matthew Cofer

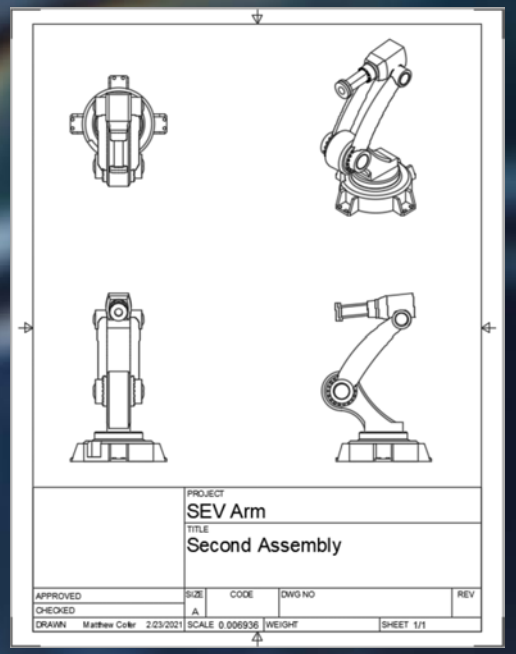
Estevan Lara

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

Cypress Springs High School

Industrial Technology

Engineering and Design II

Cypress Fairbanks ISD

Cypress, Texas

NASA HUNCH Program

Team Name:

Solo Moon Mover

Team Members:

1. Abel Rodriguez

Student Email:

Abel.a.rodriguez2003@gmail.com

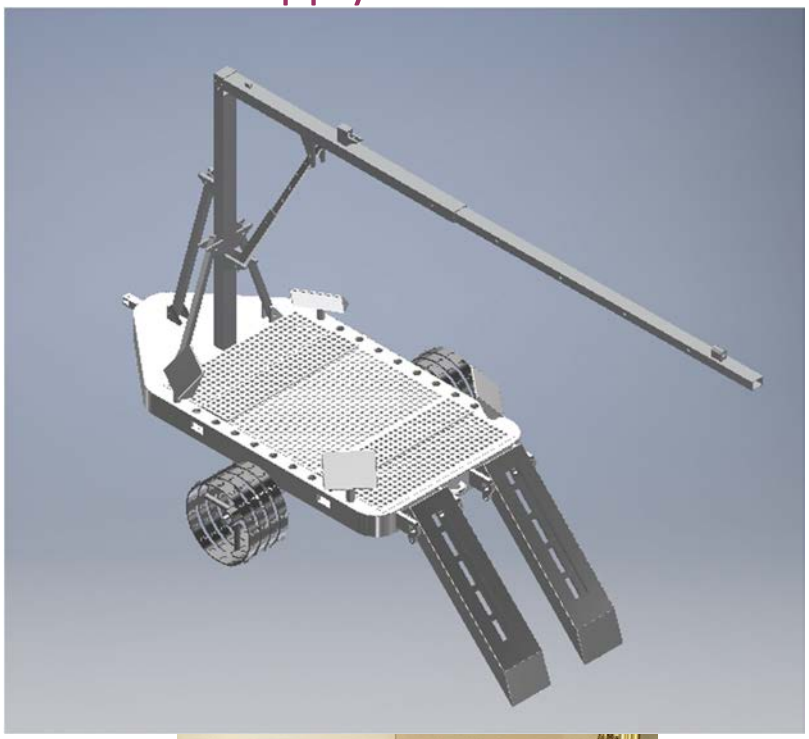
Instructor:

Steven Marcus

HUNCH Advisor/Mentor:

Glen Johnson

Supply Pod Mover



General Information: The moon has 1/6th of the gravity of earth. Additionally, the method to lift and carry the pod must be lightweight to cost NASA less money to send it. On top of that, the design must use a heat-resistant material to survive the condition the moon brings.

Objectives: The objective is to develop a supply pod mover for the moon to lift and carry a pod with a 3 tons mass on the earth. Also, the mover must be lightweight and be very simple to use

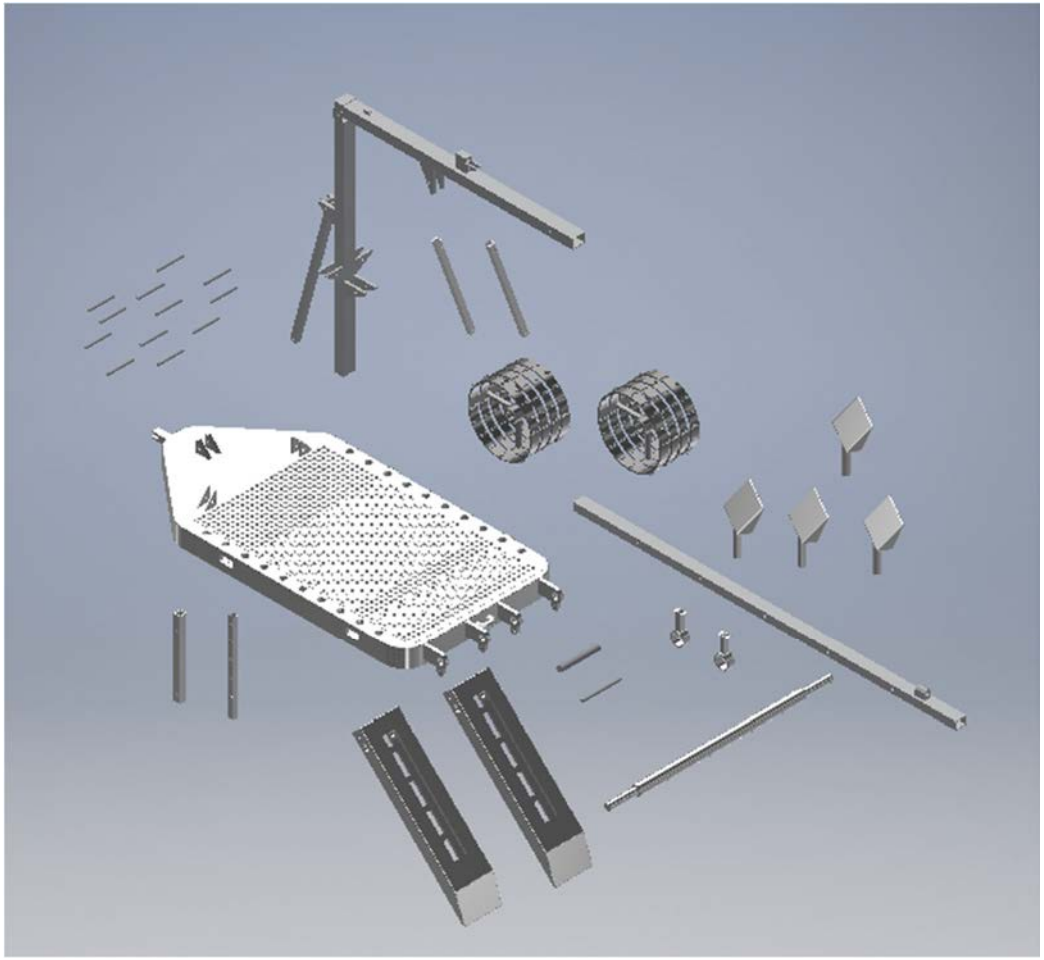
.

Material: Steel and Aluminum.

Issues: During this project, I had issues determining the right proportions for the design. Along with making the crane a simple design that astronauts could easily. Another issue I came across was making it lightweight as possible without damaging the structure of the trailer.

Problem: The problem to solve was to lift a 1000 pound pod on the moon, and keep the pod from swinging back and forth along with transporting it back to the lunar base.

BLOW UP VIEW:



Solutions: One resolution was to create pegs that the pod would sit on to act as a ball holder for sports balls. Also, to prevent bending of metal, I put in support beams since my instructor gave me that idea. Moreover, I put in two ramps to allow the pod to get loaded into the trailer. Furthermore, to prevent any movement, I chose to have an area where straps would be present to secure the pod down. Finally, the crane can move up and down to allow astronauts to lower the winch down attached to the end of the crane.

Challenges: One challenge I stumped upon was to develop a trailer and crane system that an average astronaut could use without using a ladder or other exterior object to use it. Furthermore, I need to make sure that the crane was stable and wouldn't bend under pressure. Finally, I needed to figure how I would accommodate cargo and how the pod would get loaded onto the trailer.

Techniques: I used a pencil and paper to stretch out multiple designs until I stretched out a practical and simple design. In addition to this, I used computer modeling (inventor) to design my project in a real-life shape, so I can see how my design works with the different parts attracted to it.