Lunar Dust Baffles
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.

NASA Hunch: Lunar Baffles

February 10th, 2021

Product Overview

In outer space, there are many factors that make space-travel dangerous. From extreme temperature fluctuations to space debris, many things can cause trouble for astronauts. One of the most pervasive issues that NASA faces is radiation. Radiation is far more lethal on the Moon than on Earth due to the lack of an atmosphere or magnetic field. Because of this, radiation will prove to be debilitating for the crews that are working/living in their habitats.

Solution

In our group, we aim to help NASA with our solution to the problem of radiation. Since the habitats are inflatable, we took inspiration from the Bigelow and thought of an idea of covering the habitat. In the image, you can see our prototype that demonstrates how the entire system will work. It only consists of two parts, which are the tarp and the foam layers(not including the stakes in the ground or the brads connecting the tarp and the tarp).

Before you inflate the habitat, you place the tarp on top of the deflated habitat. This tarp will have brad-like ends sticking throughout the tarp. After the tarp is secured into the ground, the foam sheet is expanded and placed on top of the tarp. The brads are folded

out onto each hole, making it the ideal attachment method instead of something more arduous like tape. Once everything is connected, the habitat can expand. As the habitat expands, the tarp and foam will stretch out with it. Once done, the baffles are ready to collect soil.

Advantages

Our product can give NASA certain advantages that other products can't. Some of the strengths of our product are the light-weight materials, which will help during transports and setting up the system. Another strength is that the product is very simple. This means it will be easier to build, design, and test. This means that no complicated or innovative technology will be required. Something else to know is the flexibility of the product. Our group has thought in the past of using multiple layers to collect soil to reach the 5-foot height required. This is why the prototype has a line on the side, demonstrating the size of a layer of foam. If we needed to implement this technology or we found out it wasn't necessary, then we can simply change the size or type of foam we use. The main brand we planned on using was open-celled polyurethane foam, which is already used on NASA spaceships.

Contacts

Leader- Braden Johnson

Trey Golden

Jaxon Lloyd

NASA HUNCH
Critical Design Review

Project Title: **Lunar Soil Baffles/Waffles**

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

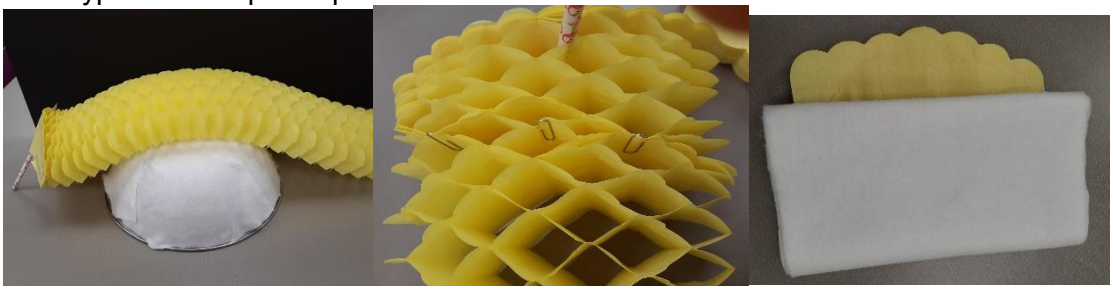
Teacher: **Mr. Luis Reyes**

Team Member Names: **Shayley Dauphinee, Alicia Merrell, Devon Merrell, Rachael Dey**

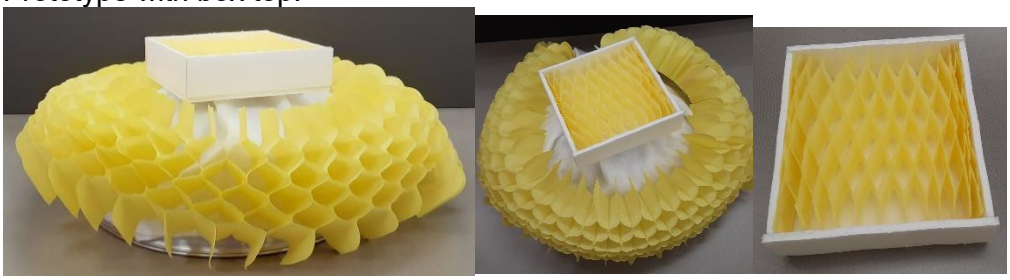
Description:

Our project/ idea has two different forms, the first involving split strips that drape over the whole habitat. Each strip will be divided into thirds so the creation can be folded up and easier to transport. The strips will have a honeycomb pattern of holes to gather the soil. Our design is connected to a tarp that will help provide a sheet of protection between the habitat and any possible sharp objects. The tarp will break in the same areas as the baffle strips and will be connected much like a quilt with zippers. The baffles will connect together with hook and eye clips. This strip type design would be used for habitats with a rounder structure. The second form of our design includes a box top. The box contains baffles the same as those used in the strips, just contained in a box. The purpose of this design is to fit habitat structures that have a flatter top. Because the strips are split into thirds the middle section can be removed so that the box can be connected in its place, the strips would then proceed to cover the rest of the habitat. In both designs the strips would extend to the ground and extend out a bit in order to help pin the structure (tarp included) in place. The baffles breaking apart into strips will make them be able to fold down smaller for transport. The width of the baffles will be about 5-6ft in order to provide the thick layer of dirt needed, and the height of the baffles can be adapted to any habitat to be as tall as needed. The materials utilized for our project will include; Kevlar for the baffles (which is flame retardant and abrasion resistant), and Nylon and Technora for the tarp (the same type of material as used in the mars rover parachute). The zipper type that we would look for would have large, aluminum teeth and lining it would be a fire retardant material (possibly more Kevlar).Our project will cover all parts of the habitat and be able to hold the required 5 feet of soil while also being lightweight and collapsing down into a small space for transport. With the testing of our prototype we used the box top that we had created. We used dirt and had simply thrown, (we threw it to possibly simulate a blower throwing dust over the top of it), over the box to see how well it would hold. When looking at how the dirt stayed in the box we could see that where it initially landed was where the dirt stayed within the baffles and the dirt built up quite nicely. With our prototype there was a small gap underneath the baffles that met with the box, so it was surprising to see that the dirt didn’t spread throughout the under layer of the box before building up within the baffle holes.

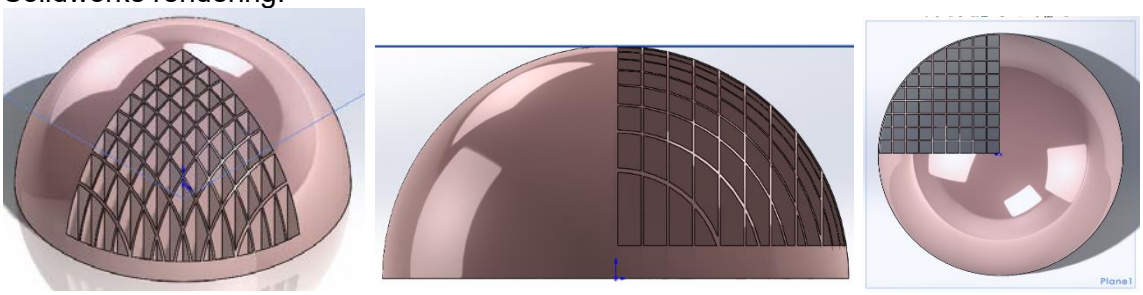
Prototype in third split strips:



Prototype with box top:



Solidworks rendering:



Testing our solution:

Waffle Baffle

Kevin Miller, Tommy Tracy, and Greg Kelley
Glenelg High School
Glenelg, Maryland
Mr. Gerstner

Waffle Baffle Brochure

April 2021

Final Habitat Design

- This design is similar to a pool dome. We chose to go with the arched roof because we believed this would lead us to use the least amount of parts, because we could be able to push the sawdust against the sides of the habitat.
- We plan for it to be brought in pieces and set up on the moon.
- Next Step: Making the habitat inflatable. We think the chicken wire frame can be an outline for the inflatable part.

Waffle Baffle Pieces

- We built them in a hexagon shape so they could easily fit in a grid like pattern.
- We eventually wrapped them in wire filtering cloth because it is a very strong material.
- Next Step: Develop a good grid like pattern to place on the habitat, develop a way that they can either stack or decompress.
- Also, make it into a sheet so they are already connected, and it is easy for the astronauts to put out.

All Coming Together

- In the first picture we wrapped in plastic wrap, but it is a good demonstration of how the pieces link together.

- In the next picture we placed gravel on our habitat, in case there were outlier pieces of lunar soil.
- In the second picture the habitat held 10.2 pounds of gravel.

Calculations

- The weight on the Moon is ⅙ of what an object would weigh on Earth.
- Lunar soil weighs 93.64 lb/ft³ on Earth.
- On the moon-15.6 lb/ft³
- Sawdust- 13.11lb/ft³
- We decided to use sawdust to test our designs because it's the closest to lunar soil in weight when it's on the moon.
- So, for 5 cubic feet of lunar soil it would be around 78 lb/ft³ on the moon.
- Structurally, we believe our build can hold this weight.

Notes

- We have a 1in to 1ft scale, so the 5 in of sawdust we put on the habit represents the 5 ft we need for protection on the moon.

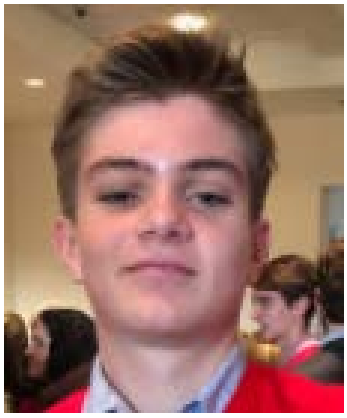
- We built the pieces to be around 5 in in height by 3 in width and 2 in length. So, on the moon it will be 5 ft tall.

Pros to Our Design

- There is more usable space in this type of habitat then one that is more circular.
- This also leads to less weight on the sides, more potential support, and less chance is caves in, then for example an ellipse habitat.
- The pieces will have a hard time breaking if they are linked together.
- The pieces can be eventually made in sheets so it is easy to put out.

Team Members

Kevin Miller- I want to become a Mechanical Engineer at an undecided college.



Greg Kelley- I will be attending HCC for at least one year to play hockey, one more year for my club team then I will be attending a four year school.

Tommy Tracy- I will take gap years then major in Engineering at a 4 year school College undecided.

Contact us

wafflebafflektg@gmail.com

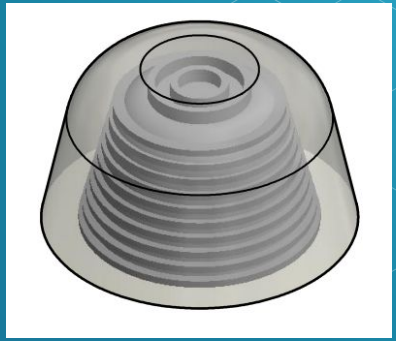
Waffle/Baffle Lunar Soil S.A.M.

Instructor: Carmen Garvis

Visit our website for more information
Website

School: Sanger High School

SCAN ME!



This structure has a large dome that goes over the actual shelter that will protect the astronauts from soil. There are also divots that go all around that will hold the soil as it stacks. There is a clear plastic lining all around.

Lunar Soil Baffles/Waffles For Habitats

School: Ranger High-Tech Academy

Teacher:Coach DeSciscio

List of all students: Colin Czech, Natalie Prijaya, Kyler Swanson

Description: We've created the number one baffle system designed to secure 5ft of lunar soil on top of the first human habitats. Our design takes aspects of all our original designs and combines them together. The bottom portion of the the human habitat will feature a ring like system designed to catch lunar soil that falls from the top of the habitat. At the top of the habitat is a combination of a netting and intricate baffle system.

Background

We began by brainstorming different shapes that we could use to hold soil and pretty quickly settled on a diamond/square shape as it's fairly easy to build and can hold soil effectively. We developed a cardboard prototype that outlined the general shape that we wanted to go with. We then expanded that idea and added hinges to allow the baffles to collapse and expand for transportation and allowed them to bend to fit the dome shape of the habitat. This turned into a prototype with smaller panels connected to each other with larger, more flexible hinges.

1. Be able to adapt to the dome shape of the habitat.
2. Hold a depth of 5 feet of soil on top of the habitat.
3. Easy to transport to the moon.
4. As little work for astronauts to install.
5. Any installation should be simple and safe for astronauts.
6. Attaches to Inflatable habitat.
7. Folds out as habitat inflates.

Moon Waffles

Chatfield Senior High School
HUNCH Program

Colton Giles, Tim Falin, Ethan Campbell

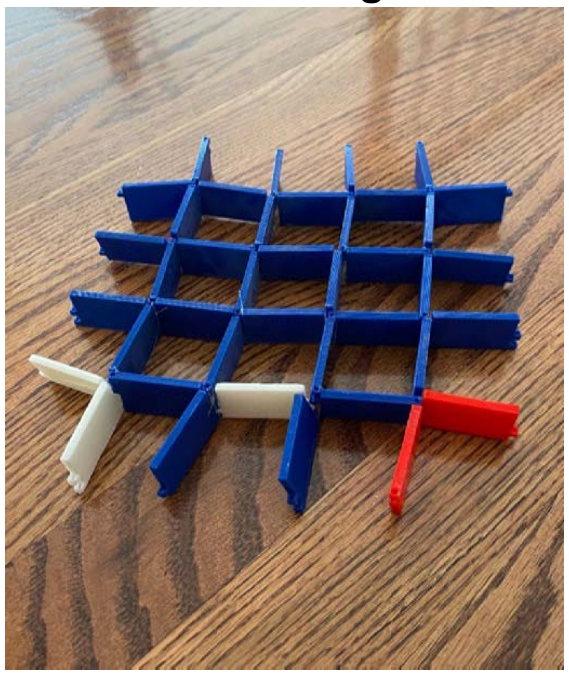
The first prototype was unsuccessful because it did not have enough flexibility to curve around a dome and stay curved.

This was our next idea, which was minorly successful because it proved that our pieces would attach together but made us realize that we needed to have more flexibility through a smaller pin.

The Project

Astronauts need a way to protect themselves from radiation while in their enclosures, and lunar soil is a cheap and easy way to accomplish that. We need to design some way to hold lunar soil on the sides of the lunar habitats to protect the inside from radiation.

Final Design



This is our final design. We achieved the design by searching for maximum flexibility while still keeping proper strength. This design succeeded in all of our decided criteria and held the sand well.

Testing