Lunar Supply Pod

Finalist List

for

NASA HUNCH

Design and Prototyping 2021

Congratulations for being chosen as a Finalist for NASA HUNCH Design and Prototype 2021. Your design was chosen as a Finalist because your team has fulfilled all or most of the requirements for your project along with quality in design and manufacturing the prototype. Your team demonstrated good testing of your prototype and knowledge of the problems and extensive understanding of the environment for your project. There was a lot of really amazing competition for these spots and all people from the semi-finalist

By being a Finalist means that you are a winner but this does not mean your idea will fly to space. This is real engineering. Although it is possible the reviewers could see one design that is exactly what they want, it is more likely NASA may choose one or a few ideas from each team to incorporate into a different design. It is also very possible that requirements or needs have changed since the beginning of the school year and they are not interested in the idea at this time. This is the nature of engineering but it does not diminish your accomplishments.

Design to Flight

The goal of HUNCH is to keep your names attached to these ideas and to have you assist with later developments of your projects when possible. Your projects and information will be provided to Mike Bennett who runs the HUNCH Design to Flight program that will coordinate the sending of your ideas to the engineers as they request it and working with your team to give engineers assistance whenever possible. This might include updating or making new CAD drawings, assembly of prototypes, choosing flight components and/or assisting with presentations. You will receive an email through your teachers in the coming days requesting specific information about your project.

Patents

In general, NASA does not seek patents on materials that are only related to space, however, if there are other potential uses for the device or ideas related to Earth bound applications, HUNCH will ask NASA Tech Transfer to assist in working through patent process. It is our goal that students and schools are included in any patents with as much credit as possible. We do not anticipate this as an income generator but more as value to your resumes.

Presentations:

General:

- Practice your presentation.
- Look sharp and professional.
- Everyone from the team should talk.

- Briefly introduce yourselves including your name and grade and school and state.
- Reviewers will already be aware of the problem and the constraints– I'll take care of that.
- Start with a demonstration of your prototype and briefly describe the testing that has been done.
- Point out details that make your design innovative, more robust, cleanable, repairable or desirable.
- Mention one or two things that didn't work initially but you were able to make changes and move forward.
- Briefly talk about how your prototype is different from the final product would be and include the materials you think will be used on the design that would fly to space.
- Answer questions quickly and concisely but completely so you can answer more questions and receive more comments. If you don't know something, say that you will have to check on it and plan to get back with them with an answer by email.
- Relax. These people are interested in what you have to say and know what its like to be on the spot.

Specific to Supply Pods

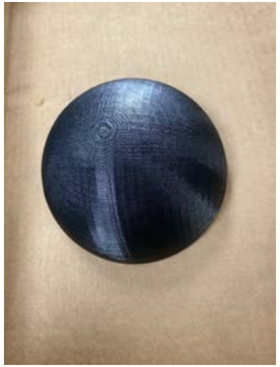
- This is a new idea for NASA so you are helping to convince them of this projects validity. Your calculations, software models, prototypes are going to be sparking ideas and questions. Stick to what you know. Don't try to speculate too much.
- If you are doing the computer modeling, support your data and methods with other similar research you may have encountered—crashes, bombs, supply shipments.
- If you are showing a prototype pod, talk about any existing hardware that inspired your ideas—hatches, shipping containers, material usage.
- You will be giving your talk with the other Finalists on **April 29—2:30 to 4:00 CT**
  I will be sending out invites for a Microsoft Teams meeting in the next couple of days to the teams.

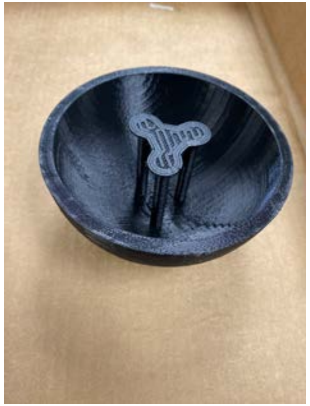
-Our 3D printed prototype-

Note: the supports in the structure were for printing purposes only

With the spherical design there are no weak points that are at the threat of cracking upon impact.

The sphere also provides a larger surface area which leads to an increase of friction with the surface (leading to a faster stopping time)



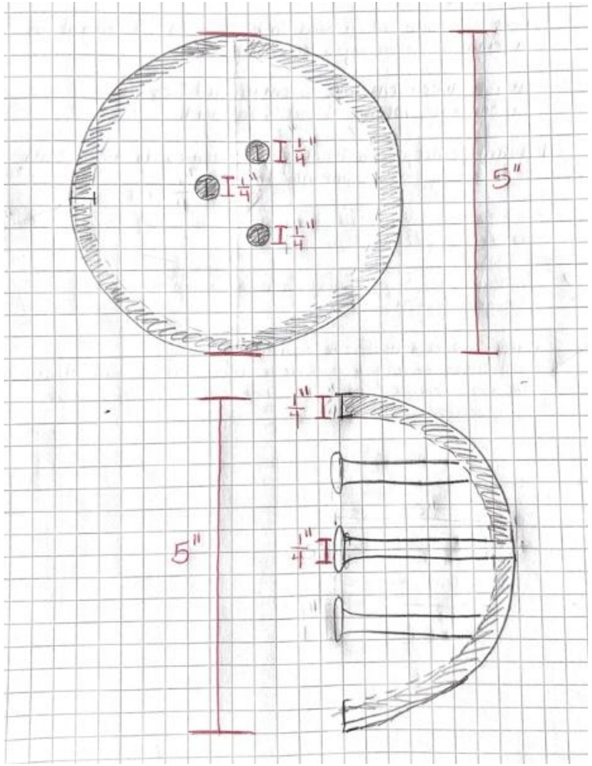


NASA HUNCH- Fairport High School, Fairport, NY.

Vincenzo Stornello, Donna Himmelberg

Lunar Supply Pod

Kayla Maxwell and John DeWaters



Print is 5” in diameter, outer shell is ¼” thick. Outer texturing would lay over top of this shell.

Things you asked us to model

- Mass of the container: 5,000kg
- Mass of contents: Currently unknown
- Velocity at touchdown: 447 m/s
- Angle of contact with the surface: 24.3 degrees
- Surface particle size: N/A KSP doesn't model the physical sand on the moon
- Undulation of the surface: Lots of highlands along with some valleys
- Coefficient of restitution: 0.84
- Spin of the pod: Steady to fast forward spin
- Internal or external dampening of the pod: Custom textured surface outside of the pod
- Advantage to pod being smaller: None, a smaller pod caused more airtime and longer distances traveled by the pod
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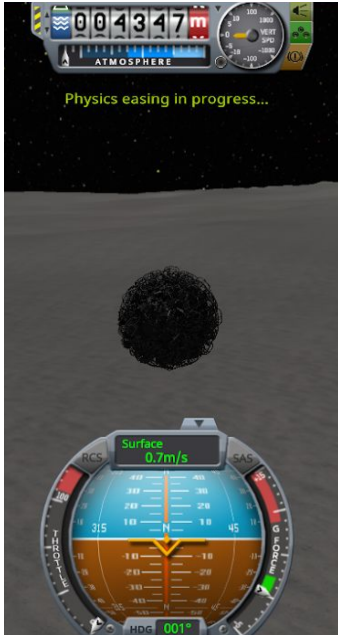
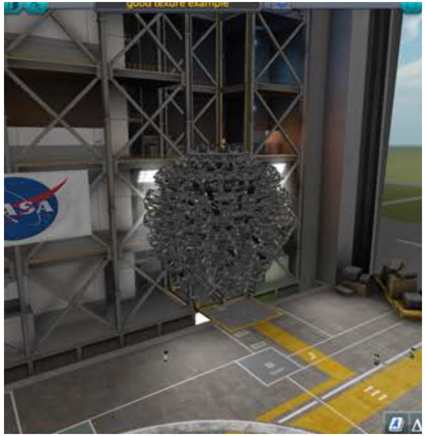


-Sizing/texture-

- woven wicker basket design (wicker basket weave provides stability in the give of the metal)
(The twisted texture shown below adds to friction as well)

With the texture pictured to the right in conjunction with the large amount of friction on the surface of the moon our calculations lead us to believe that the coefficient of friction is approximately 6.4

We created this texture in the virtual simulation in an attempt to replicate the actual texture we had planned



With permanent human presence, development, and colonization on the moon rapidly approaching, we need to solve key issues regarding resource deliveries. We've developed the Interactive Resource Impact Simulation, a computer model and tool able to simulate a practical method of delivering supplies to such inhabitants. It is the most comprehensive and accurate simulation available that can investigate the possibility of lunar supply pod deliveries to the moon (or other celestial bodies), saving time and money by accurately displaying the exact way the pod would land, the amount of damage entailed, and a quantified likelihood of survivability of the pod and its contents, possibly revolutionizing how we transport goods throughout the solar system. Our product provides a key platform for furthering the research and development possible on the moon in a practical and inexpensive manner for years to come.

CONTACT US

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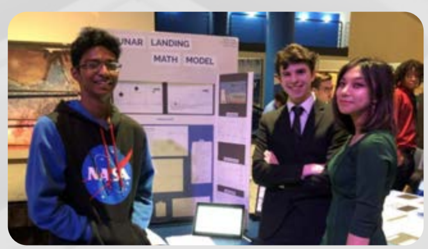
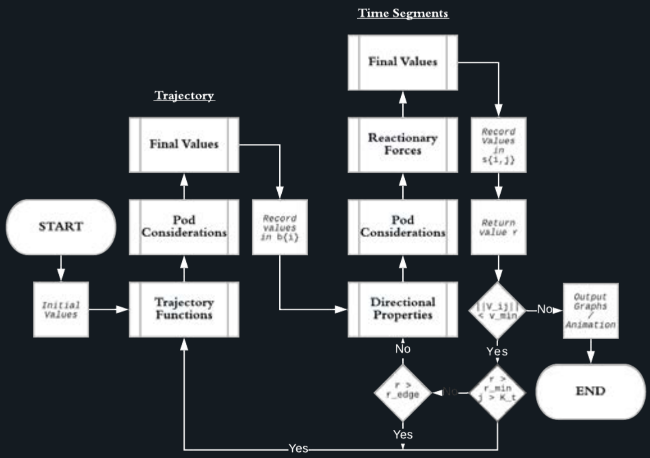


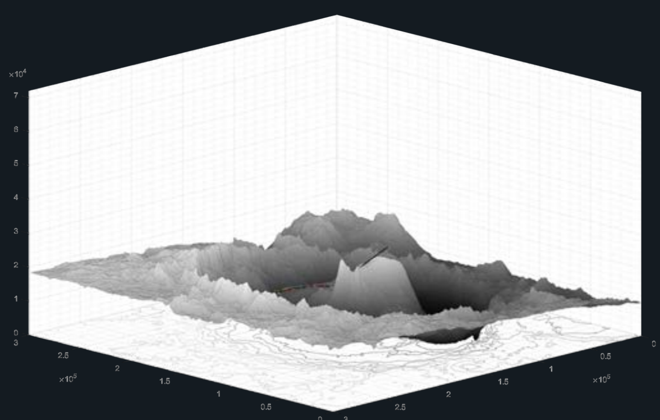
IRIS

INTERACTIVE RESOURCE IMPACT SIMULATION

N A S A H U N C H

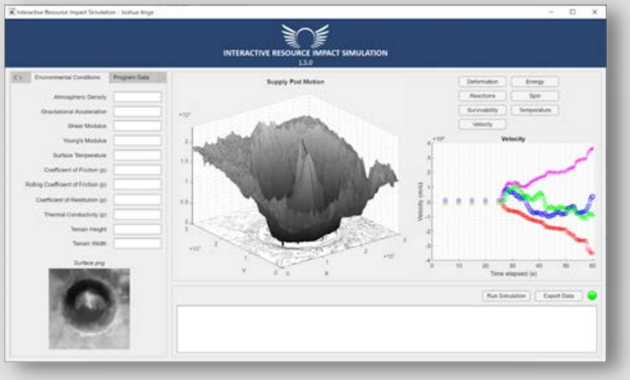


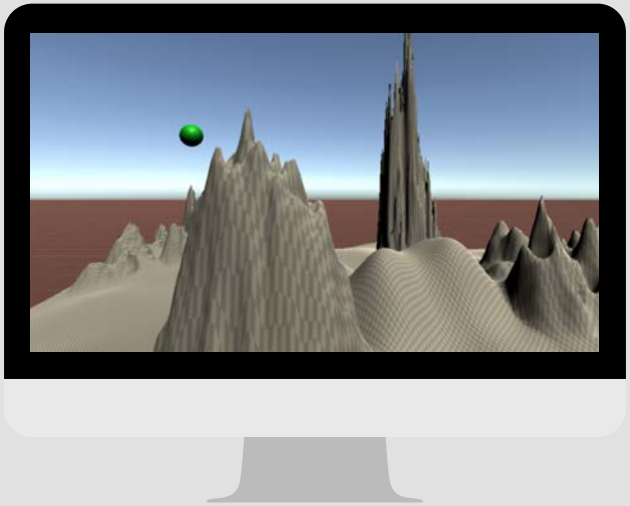
By utilizing nested iterative calculations, the Interactive Resource Impact Simulation is able to successfully predict the trajectory of launched supply pods above and across the surface as well as their spin, temperature, deformation, kinetic energy, and other physical reactions.



SIMULATION

GRAPHIC USER INTERFACE





In employing a layered approach with a strategic internal organization system to allow for maximum control, the suggested pod design efficiently highlights the individual strengths of materials such as Grade 5 titanium, ceramic matrices, and carbon fiber.

POD DESIGN

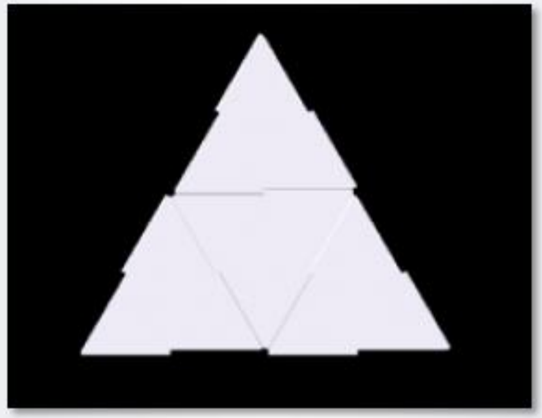
The Premise:

A contained Breakup of mechanically attached pods on impact, In order to disperse force evenly, is the central idea behind Our design.

Currently we plan on using 20 individual pods, attached using a type of Velcro, in the shape of a Geodesic Spere (approximation of a sphere using equilateral triangles) and contained within a Kevlar based wrap to safely land supplies on the lunar surface.

The wrapped set of pods will impact the lunar surface at a low angle and with a positive spin in order to reduce the force of initial impact as much as possible.

The non-ridged design will also discourage the supply drop from rolling too far along the lunar surface, further containing the landing.



Lunar Supply Pod

By

Grant Griffin, Dylan McGuire, and Wilber Garcia

For

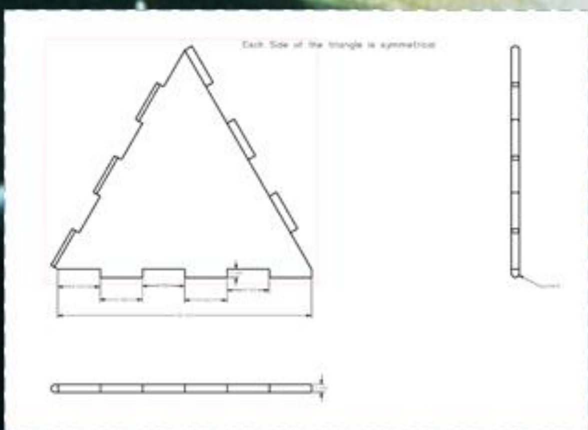
Mr. Merritt's

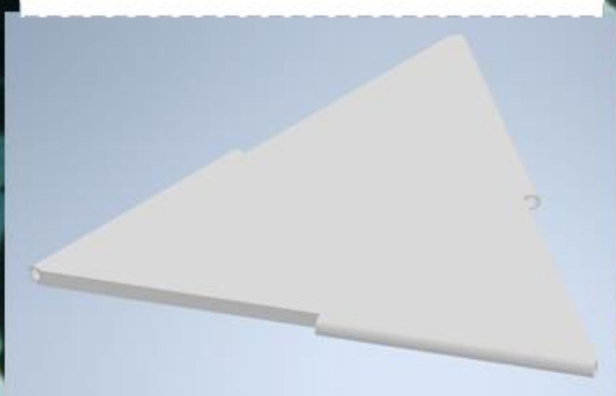
Arch and Civil Engineering

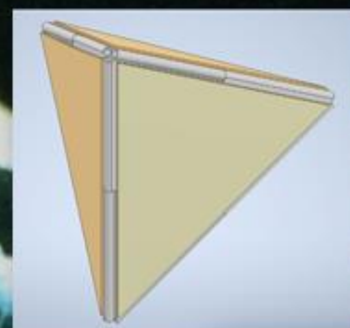
The Starting point for the supply pod assembly is the single aluminum panel, 4 of these will attach together using metal rods through the hinges attach the edge of each panel. They fold in to a triangular pyramid and are locked into place with a wire lock to each corner to form the individual pods that will be directly containing the supply drops.

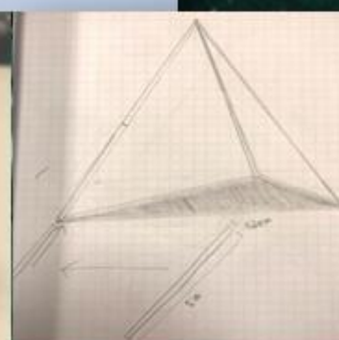
After the panels are assembled into the pods, the adhesive/Velcro padding on each face (save for the outside face) will be assembled into a single 20-pod large ball. This shape is called a Geodesic Spere, or icosahedron in this case. Which will act as the assembly during transportation and landing (crashing) process

As the pods are fully assembled, the assembly will be placed inside a loosely fitting Kevlar net. The net fits with a few feet of difference between their diameters so that the pods will have enough room to properly disperse upon impact with the lunar surface.









Stages of Assembly


HURLEY
1-A