The Luna F.O.L.D. Mechanism

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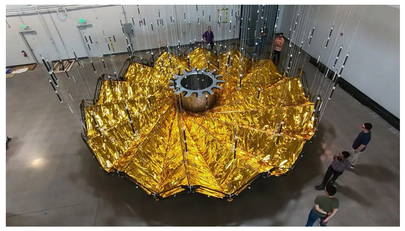
Problem Statement

NASA needs a systems level solution for mitigating or preventing the adverse effects of Plume Surface Interaction caused by the human lander when landing on the moon. HuLC Smash has set out to develop a portable landing pad capable of preventing the immediate lunar surface from being disturbed.

Inspiration

The Nasa Starshade's use of folding technology was a large inspiration for the geometric design of the portable landing pad.



The origami like structure allows for a large landing pad to be stored in a consolidated form making it much easier to transport to the lunar environment

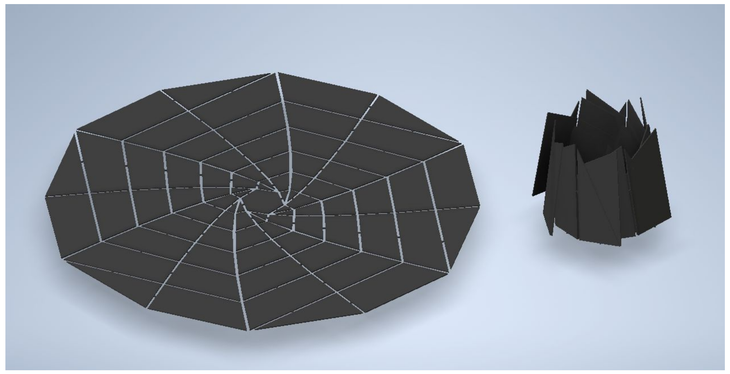
Lander Specifications

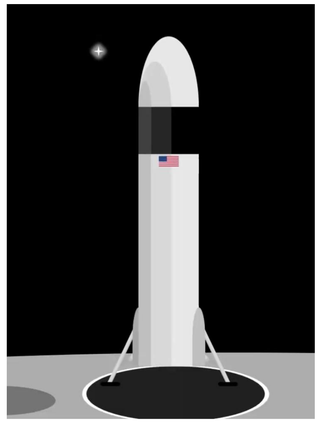
NASA render of Starship HLS

- Height : 160 ft
- Diameter : 30 ft
- Payload Mass : ~100 Tons
- Estimated Weight on Lunar Surface : ~ 500,000 lbf

Calculation assumptions were made based on the Apollo missions

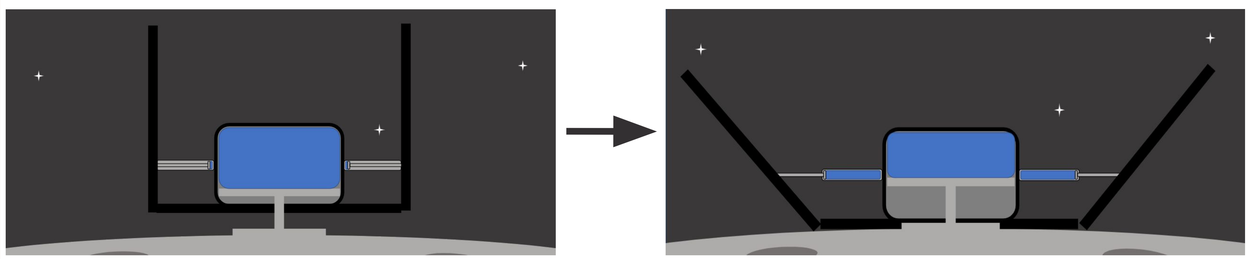
Portable Landing Pad





- The portable landing pad utilizes the origami-like geometry from the NASA Starshade system.
- This allows it to be compressed down for storage as shown above.
- Reduces diameter of the pad by 5 times.
- This means that a rigid barrier capable of supporting the weight of the lander and reflecting exhaust can be transported on the vehicle.
- Well within the capacity of the HLS Starship, both size and weight-wise.

Linear Actuators



Pre-Compression of Working Fluid

Post-Compression of Working Fluid

- Compression and the subsequent expansion of the working fluid from the pads centrally located reservoir into the linear actuators will mechanically drive the pad's unfurling process.
- Linear actuators provide more precise control over movement.
- More compact and lightweight than other mechanical systems that could have been considered in this design.

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Plume Surface Interaction

Plume Surface Interaction (PSI) - The interaction between a lunar lander rocket plume and the lunar surface

Dangers of PSI

- Damage to lunar lander
- Make it difficult to see where landing
- Damage space suits
- Leads to health concerns for astronauts

Full Scale & Future Considerations

- The full-scale design is 60-ft in diameter.
- It would be made with lightweight composites and heat resistant ceramics, similar to those on the shuttle.
- With a more robust origami design program, a higher effectivity fold pattern could be made, allowing even more compression.
- Further research and design is required to fully define the full-scale actuation system.

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