DIY Moon Base

Morgan Carroll, Anna Coleman, Austin Brickhouse, Patrick Hernandez, Kenneth Justice
Academy High School, Little River-Academy, Texas

Abstract

The cumulative product of our research is to determine the most logical and safe way to construct a makeshift moon base or other shelter on the lunar surface capable of sustaining human life. Until discovering Bigelow Aerospace's advancements towards lunar living, our research consisted of the base's location, enviromental needs and life support, the shelter's model and layout, possible construction materials and building tactics, UV radiation and CME protection, comunication needs, repair, and anything required for human life to thrive. While our group knows that Bigelow Aerospace has developed an expandable space habitat in coordination with NASA, our presentation is the evolution of our ideas and research up until our discovery of the B-330.

Why build a moon base?

Building a habitable structure on the lunar surface requires funding that can be fufilled through commercial and private contribution (whether national or international) in order to be plausible.

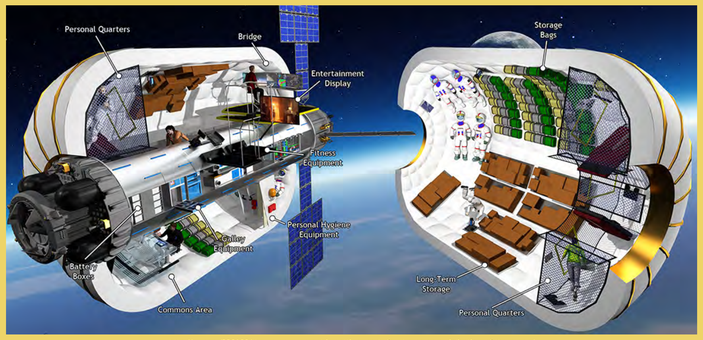
Because of the need for funding, one of the original purposes for the moon base was to be a small mining camp researching and extracting minerals from lunar regolith. This would provide partial funding needed to construct the base and includes a profit based motive for building on lunar soil in the first place.

The idea of mining on the moon led to the idea of the base being a lunar "pit-stop" for spaceships in the future to refuel and rest before or after longer journeys to other planetary bodies. In addition, the moon would be an ideal spot for ships during an emergency to land and wait for a rescue instead of risking the two days to earth with a need for resources.

Other options included:
-Exploration of craters for water, minerals and other research potential.
-Incentive for wealthy investors to persue personal or commercial endeavors.
-Monitoring Earth's atmosphere like the ISS.
-A more realistic test of the psychological effects of isolation in anticipation of Mars colonization, such as that currently being done in Hawaii.
-Building observatories for further astronomical observations both on the sunlit and dark side of the moon.

Current Advancements

We found Bigelow Aerospace when looking into an inflatable to protect our lunar base and found that the company has created an expandable, habitable space module, called BEAM, that could serve as a long-term lunar base. Another more advanced version of BEAM, the B-330 module would house up to six astronauts and have environmental control systems for temperature control and a potentially high water return rate. The module would be transported in the nose cone of the spacecraft traveling to the moon and is inflated on site through a pressurization and sealing process. The B-330 is designed with "pillows" of water as its innermost layer to protect from CME raditation. This opened up the idea of replaing the water with regolith in times of need, while still maintaining radiation protection. However, both the B-330 and BEAM have not been finalized. The inflatables are still experimental and have nomeans of repair besides a small patch kit, but could be the future of lunar advancements. The B-330 has the potential to lead future innovations in sending a human-friendly habitat to the moon and BEAM is being sent to the ISS for testing.

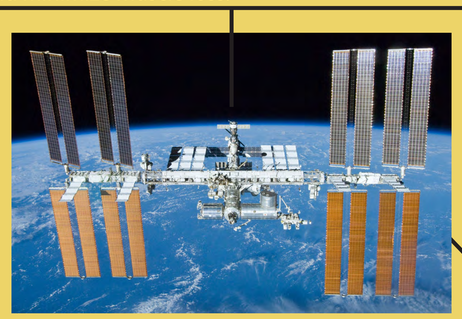


http://qz.com/338189/the-us-government-is-getting-ready-for-the-commercialization-of-the-moon/

Oxygen: Using storage containers, we can bring oxygen to the moon. Another possible way is vaporizing the lunar soil for a 20% return rate.
Water: The rocket Zarya would be useful in storage and the making of water in space. If this isn't feasible, the Waste Recycling System, from the ISS, is one of our major options.
Food: We will use MRE's or freezed dried food. We could also use a greenhouse to grow food. Synthetic biology is another thing we have looked at.
Temperature: A Thermal Control System will regulate the temperature and keep out radiation.
Exercise: We will use the 3D printers to make treadmills. Resistance bands will keep up the astronauts muscle mass and minimize muscle loss.

Initally, we found that the rim of a crater called 'Peary' on the lunar North Pole was a good choice. We had several requirements that this location needed to meet and it met almost all of them. First, it was almost constantly illuminated, which would allow for us to obtain power from the sun. Also, it is almost always in view of the Earth so communications would be able to be established easily. After doing more research, we found that a new location on the lunar South Pole not only met these conditions, but one the North Pole couldn't: landing capability. Our new location is on a plateau-like formation called Malapert Massif. The craters around the plateau are also much deeper, leading to the potential of more ice as a natural resource. This location is as close to perfect as we could hope for for our own base.

We chose the model to be a multiple storied, 12 sided dome made up of interlocking panels or possibly bricks. Essentially, it would be an igloo shaped unit with airlocks on 4 sides and also an inner core leading straight through the dome, vertically, for an added emergency airlock at the center of the dome's outer shell. Airlocks would have an additional room before reaching the inner structure to clean any dust, put on suits, and for added safety if an emergency does occur. The dome would reduce dust collection on solar panels and provide more space than a hexogonal dome. The structure would also be multi layered with a 2.5 meter thick layer of regolith within.



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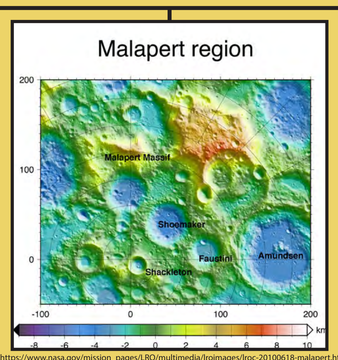

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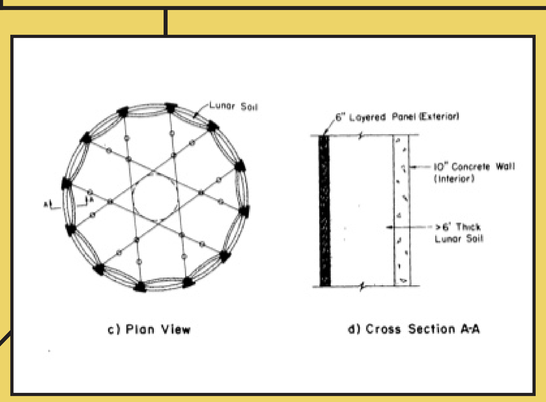
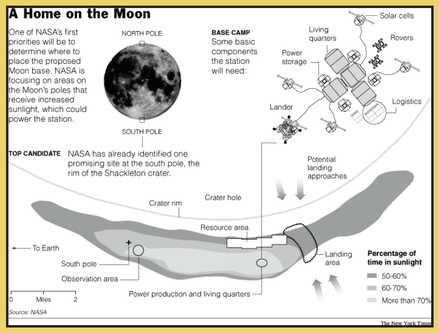
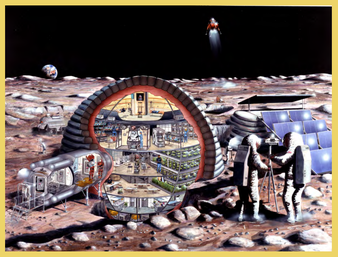


Location
Life Support
Model
Energy
Communication
Construction
Future Research

Original ideas for energy led to us deciding that the structure would have solar panels covering its entirety. The solar panels would be a clean resource in high aundance with little risk and maintenance. The panels would be retractable into the unit itself, able to be brushed off in rooms between airlocks and the unit's main rooms. Nuclear radiation using uranium bricks in portable cases was another idea that's safe and easy to manage.

Through our research we have found that communications can easily be established with Earth from the Moon as long as Earth is visible, we would be able to use any cellular satellite that is currently in orbit. Basically, we would have cell service on the moon.





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We had ideas of the structure being underground or in preexisting lava tubes for natural radiation protection. Lunar bricks could be stacked like an igloo to form the base and possibly block radiation to provide overall protection. 3D printed cranes can be used to lift heavy objects like lunar bricks as well as metal supports that can be welded together. 3D printers can be used as a single station or installed into mobile robots and have the capabilities to print using metal which can construct useful tools or whole structures. Metals like titanium, aluminum, and iron can be used to create parts of the base as well as the regolith.

A lunar base holding colonized residents could promote future research advancements in:
-synthetic biology
-the effects of low gravity on newborns
-studies on bacteria and viruses able to survive in space
-artificial gravity
-improvements in solar wind energy
-Neutrino research
These advancements would better civilization in a new environment and add new perspectives to research both old and new.

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