Lunar Base Design Technical Report

Tom Orrel

Virginia Aerospace Science and Technology Scholars

Abstract

Establishing a lunar base on the moon will enable humanity to explore and inhabit future planets. To allow human beings to survive on the moon requires a lot of planning. Placing the lunar base near the vicinity of the moon’s south pole is important to establishing a successful base due to a stable supply of water and exposure to sunlight. This Lunar Colony will include five basic stages that will transfer manpower and important tools and structures to make a sustainable colony. The first stage will be the launch of engineers with equipment such as 3D printers that use lunar dust to create structures, solar panels and oxygen splicers. Once the dome is made habitable with enough oxygen, a second stage will be launched with parts needed to make greenhouse domes. When the domes are built, botanists will arrive with seeds needed for grains and fruit trees. The fourth stage will bring in medical equipment and doctors to ensure the health of the colony. The last stage will import farm animals to produce fresh food. Domes will be built surrounding the main and central dome. The central dome will be sustainable on its own and surrounding domes will be built to provide for specific purposes.

Lunar Base Design Technical Report

The mission to create a lunar base will be set to launch in the year 2030. This should allow for enough time for technology and training to be completed and enable the mission to be a success.

The Lunar Base will be set near the south pole of the moon in a location that receives constant light from the sun so that the greenhouses will receive light for the plants to grow and so astronauts, engineers and colonist are able to function in daylight. Light has the ability to improve mood and if people were to live on the moon, hundreds of thousands of miles away from Earth, they would need to feel less lonely ([Souza,](https://www.archdaily.com/922506/how-lighting-affects-mood) 2019). Placing the lunar base near the south pole of the moon also benefits from being near a potential water source that can be made from the ice. This will provide the colonists, plants and animals with the water they need to live and survive on the moon (Tabor, 2018).

The Lunar Colony will have a main, large dome in the middle surrounded by smaller domes around it. The main dome in the middle will act as the capital and will house the first homes and control center. The main dome will have radio receiver that can communicate down to earth. The center dome will have its own closed ecosystem and will be able to house the entire colony in case of emergency. All of the connecting domes, around the main dome, will have the ability to close themselves off from the other domes to prevent cross contamination in an emergency situation. It will also contain a large telescope to help scientist study space from the moon.

There will be greenhouse dome laboratories that will be able to use the heavy water from the crater to supply plants and trees with the necessary water for the plants to survive and start producing oxygen for humans to breathe.

People will live and work in large domes. They will produce oxygen from splicing water molecules and eventually from plants and trees in the greenhouse domes.

The Lunar Colony domes will be powered using both solar panels and nuclear generators. The Helium from the moon’s crust-Helium 3- can be used to power the nuclear generators. These power generators will be used for computers and other scientific equipment. The excess power generated will be used to charge the many battery packs. Using the plants in the glass domes, a closed ecosystem will be formed.

The battery packs will be large boxes filled with rechargeable batteries that will be able to power any tool or equipment as well as provide emergency power. More power-hungry tools such as vehicles will be powered by multiple battery packs. Vehicles will also have a solar panel that will provide power to charge the batteries as well as power the vehicle itself.

When oxygen from lunar dust is taken away, iron is left which can then be melted and used to create tools and equipment required for the construction of the domes and laboratories (Dorrier, et al., 2020). The lunar base will use specialized 3D printers that utilize lunar dust and turn it into glass that can be used for the exterior of the domes as protection from radiation, extreme temperatures, and small asteroid particles that are known to hit the surface of the moon. The 3D printers can also be used to produce various tools to help with the construction of the domes. Melting lunar dust at certain high temperatures produces glass that can be used for a greenhouse dome. The metals and glass formed from lunar dust could also be used to pave roads and create bricks and other structures on the moon that would protect astronauts from radiation.

Using the glass like material and the iron made from the lunar crust, engineers will be able to design vehicles to travel on the moon and perform research, exploration missions, and transport equipment and people to various places.

Several research labs will help scientists learn more about the moon and help them prepare for missions to other planets. These laboratories will enhance the study of the soil composition of the moon and provide mining facilities that will enable digging into the moon and retrieving metals to send back to earth. In addition, there will be labs that take the moon’s lunar regolith (crust of the moon) and extract the oxygen and disperse it into the domes. The oxygen produced will supplement the oxygen made from plants in the greenhouse domes.

This Lunar Colony will launch in different stages with different people every launch. The first launch will carry the engineers who designed the domes and will know how to build the various parts critical for the colony, such as the solar power generators, as well as the oxygen splicer machine that can provide temporary oxygen until the plants inside the main dome are able to produce natural oxygen. Non-perishable food will also be brought with the first stage to provide nutrition for the until the plants inside the main dome provide fresh fruits and vegetables.

After the first stage is stable and the engineers make the dome habitable, the second stage will bring in parts for the see-through greenhouse dome with seeds to plant the crops and trees. Everything will be grown using the method of hydroponics (Dunbar, 2004). Joining the second launch will be four botanists who will be in charge of making sure the plants flourish and provide oxygen for breathing, and eventually produce fruits, grains, and vegetables to sustain life in the colony.

Once the greenhouse is built and enough plants and trees grow and provide stable living conditions, there will be a third stage that will bring the nuclear power generators that will attach to the current power grid and provide the main source of power for the colony. At this stage, five nuclear engineers will control and maintain the generators. The launch will also contain components for the battery charging docks and the rechargeable batteries.

The fourth stage will send over medical and workout equipment and five doctors trained in various fields of medical expertise such as internal medicine, orthopedic medicine, and even surgery. The workout equipment is vital to the health of the humans living in one-sixth pf the gravity that humans experience on earth. Lower gravity causes muscles and bones to lose mass and density (Tokyo University of Agriculture and Technology, 2019). The medical professionals will provide guidance and prevention measures to ensure the continued health of the colonists.

The fifth stage will bring with it farm animals to provide the colonists with fresh meat and milk to eat, as well as the ability to make blankets and tools from the animals once they die to make life more comfortable for the colonists.

For each of the stages required for the creation of the Lunar Colony, the groups will be determined based on the individual ratings of the applicants. A group of five people will compete against other groups across the world in competitions based on the purpose of the launch mission. After the lunar base is stable and able to support more people, then there will be a lottery held by each country and they will be placed on a waitlist.

The Lunar Base will have manufacturing facilities that can turn the minerals found on the moon into usable metals and compounds to sell back on earth as well as metals that can help build machines and technologies so that the base is not reliant on deliveries from earth.

Colonist will benefit from the one-sixth gravity of the moon to move around the base freely. For transportation of heavy equipment, the colony will be able to manufacture rovers and vehicles using the minerals and resources from the moon itself.

Because this base is international, the base will have its own blended government that is based on democratic values, but believes everyone should be equal and because of that, everyone is paid the same salary and can vote or be elected for government positions.

As the Lunar Colony expands, recreational activities will be added to it. Rock walls will be built, indoor parks that also act as oxygen producers when stable enough will be built, and pets and animals will be brought over to increase happiness.

Building a lunar colony takes a lot of thought and planning. Many aspects such as ranging from construction, biology, nuclear power, food, weather, and social sciences can play a critical part in the success of the colony. Finding ways to make oxygen is one of the most important factors and must be considered first. The lunar colony will enable humans to live and flourish on the moon. The colony is designed to be expanded as time and requirements demand. Perfecting methods of sending humans to the moon will help expand the capabilities if mankind and lead to establishing future colonies on Mars

Sources

Dorrier, J., Dorrier, J., DorrierJason, J., Jason, Singularity Hub, & Singularity Hub. (2020, January 26). This Marvelous Machine Splits Moon Dust Into Oxygen and Metal. Retrieved February 9, 2020, from https://singularityhub.com/2020/01/26/this-marvelous-machine-splits-moon-dust-into-oxygen-and-metal/

Dunbar, B. (2004, February 25). Greenhouses for Mars. Retrieved February 9, 2020, from https://www.nasa.gov/vision/earth/livingthings/25feb\_greenhouses.html

Souza, E. (2019, August 12). How Lighting Affects Mood. Retrieved February 9, 2020, from https://www.archdaily.com/922506/how-lighting-affects-mood

Tabor, A. (2018, August 17). Ice Confirmed at the Moon's Poles. Retrieved February 9, 2020, from https://www.nasa.gov/feature/ames/ice-confirmed-at-the-moon-s-poles

Tokyo University of Agriculture and Technology. (2019, July 25). Gravity changes mass of muscles and bones, experiments in space show. Retrieved February 9, 2020, from https://www.sciencedaily.com/releases/2019/07/190725100501.htm