

# LUNAR COLONIZATION

SETTLEMENT AT MOON

Online Project Presentation:

[www.lunarcolonyhsa.com](http://www.lunarcolonyhsa.com)

A Lunar Settlement Design Proposed By:

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## INTRODUCTION

**“The earth is the cradle of mind, but one cannot forever live in a cradle.”**  
- Konstantin Tsiolkovsky, 1896

The 20th century is marked by great scientific and technological developments to explore the hidden facts about the Space. Even high altitude Rocketry can make man’s dream true by making successful landing of on moon’s surface on 1969 by Apollo 11 mission. Thus it leads to the expansion of human ambition to get healthy settlement beyond the perimeter of earth.

**Lunar Colonization** is the expansion of humanity on moon’s base. Healthy settlement at moon’s base is the only objective of Lunar Colonization. As moon is the natural & nearest satellite to earth, thus efforts to make healthy self sufficient lunar settlement at moon’s surface is higher and is also logically true. Lunar Colonization will leads to the scientific upliftment of the human civilization by bringing cultural & economical prosperity.

## MOON & EARTH

As Moon (Luna) is the Earth’s only natural satellite and is formed 4.6 billion years ago around some 30–50 million years after the formation of the solar system. The Moon is in synchronous rotation with Earth meaning the same side is always facing the Earth. It seen close and intact to human beings residing on earth. Calendar months on earth are roughly equal to the time taken by moon from one full moon to the next. The Islamic Calendar is strictly based on moon’s orbital stage.

The Moon affects the oceanic tides and the depth of the oceans which affects the currents such as the Gulf Stream and the El Nino current that

affect our weather. Hence, moon plays crucial role in human civilization, and always in the curiosity of human beings. Thus, Lunar Colonization not only helps people to know more about moon but to live & feel the lunar life from its surface. (Figure 1)

## LUNAR TOPOGRAPHY

Moon is the only space body other than earth itself for which our scientist has detailed geographical knowledge about its geological structure & its environment. The discovery of moon significantly increased by 1960 with first lunar landing mission. The First Manned mission is completed in 1969 with successful launch of Apollo 11.

The location of Lunar Colonization is situated at South Pole, the most efficient location for the human settlement due to availability of proper sunlight and ice-water (As per discovery by NASA on Sep.24, 2009).

Lunar Colonization at pole region has much advantage over different orbital settlement at Lagrange point. The overall cost of healthy settlement at Lunar pole are comparatively low then the orbital. Abundant availability of resources like Silicon, Titanium, Aluminium, Carbon & Iron help not only to develop lunar colony infrastructure but also support the economy of lunar colony by earning revenue through export.

Moon has low gravity i.e.  $1/6$  g, thus, gravity is maintained at lunar colony by making slop over base area of the domes. Thus, it permits residents of lunar colony to use Centripetal Force rather than gravity for healthy lunar settlement in lunar colony. Due to less gravity, cost of transporting materials from moon is lower it doesn't require any heavy cargo spacecrafts to move materials. Special Lunar Rover Vehicles are used to transport materials from one place to another at Lunar Base. (Figure 2)

## CONSTRUCTION & SETTLEMENT

Lunar Colonization is being designed to utilize the maximum available lunar resources thus to minimize the construction cost and to maintain the economical feasibility of the project.

As moon is rich in elements like Silicon, Aluminum, Iron, Carbon, Titanium and Regolith thus, we use special glass developed from silicon for the outer crust of the lunar colony, we can also use iron and aluminum to strengthen the outer crust and to protect inner resident from moisture and harmful cosmic radiation. Lunar soil is also used to shield the outer crust of lunar colony. Construction equipments & machineries are imported from earth to facilitate in construction process.

As per Lunar Colonization design two residential and one industrial dome is to be constructed with one central connecting zone with proper connecting link between each and every domes.

In initially phase an Outer Port area is to be constructed for proper landing of rockets from earth and to create warehouse to store imported materials from earth. Rocket Fuel tank with workshop is also developed near Port area. (Figure 3)

### PHASES OF SETTLEMENT:

**Phase1:** Firstly Northern dome of lunar colonization is assembled and is coated with silicon glass and Iron to create outer crust of the dome, it is also coated with lunar soil to protect resident from harmful radiations. After completing the construction of outer region, inner resident complex is to be created for the healthy residing of 500 people. Sufficient Park and green zone is to be developed for maintaining ecology of the lunar colony. Atmosphere, environment is developed for dome residents as per their varied requirements. Now, Basic facilities are to be developed like Roads, Power supply station, Communication systems and Sewage & Water management system within Dome.

**Phase2:** After creating sufficient covered area for workers and developers in a form of Dome1, now all efforts are being made to develop Dome2 at south eastern zone. Proper link way from Dome1 to proposed Dome2 is created in a tubular form and is covered with glass shield over top. Now Dome2 is assembled as similar to phase1 and then all basic facilities is to be developed within Dome2.

**Phase3:** Now all efforts are being done to assembled Dome3 (Industrial Zone) in a similar way like Phase1 & Phase2. Separate Heavy Power station is to be created within Dome3 to support industrialization.

**Phase4:** Link way for all three domes i.e Residential & Commercial is assembled. Eco friendly & rapid lunar means of transportation like Lunar Rovers are developed to move from one place to another in Lunar colony.

## **WEATHER & ATMOSPHERE CONTROL**

Lunar Colonization comprises of three Domes, which are manufactured by Lunar Glass (Developed from Silicon found at lunar crust) with metal coating to keep the moisture out of lunar domes. It is also shielded with 3mts of lunar soil to protect the inhabitant of the lunar domes from external high cosmic radiations from sun and other celestial bodies.

An artificial magnetic field is also to be created within Lunar Colony to provide radiation shielding for longer period.

Artificial atmosphere is to be created by controlled air pumps to regulate the air composition & pressure according to the varied requirements of all three Domes. The supply of O<sub>2</sub>, N<sub>2</sub> and other gases with in lunar colony is to be maintained air pumps and fully automated computer system to analyses the demand as par the requirement of residents within the lunar colony.

To provide healthy environment , the temperature must ranging from 20`C to 24`C for residential/commercial area with relative humidity of about 40%. These values are similar to earth’s environment.

Climate of particular dome within lunar colony is to be maintained according to the air pressure and humidity within the dome.

Residential & agricultural zone will experience the different climatic structure as par there varied requirement. Proper sunlight during day time is also maintained for proper plantation.

Tabular representation of gravity, humidity & air composition in all three domes of lunar colony-

Lunar Domes	Gravity (g)	Air Composition (O2 & N2)	Humidity	Type
Dome1	1	12:17.5	40%	Residential
Dome2	1	12:17.5	40%	Residential
Dome3	1	11:14.5	42%	Industrial

## ENERGY SYSTEM

Energy is the basic requirement to maintain healthy settlement at Lunar Base. Thus, nuclear fission power stations at southern most dome help to generate energy for lunar colony. Solar energy station is also developed outside the southern dome near the Malapert mountain of South Pole to illuminate the lunar colony during long lunar nights. Malapert mountain region records maximum sun light during all the time. Silicon Solar Panels are situated over lunar domes to minimize the cost of generating solar energy. As it also provide an additional shield over lunar domes. (Figure 4) It is also beneficial to use the larger temperature difference between sun and shade to generate energy by running heat engine generators at lunar colony. Lunar Colony is provided with different combination of solar panels for Day time operation and fuel cells for night time operations thus, to

make resident of lunar colony sustain during lunar eclipse and also for emergencies.

Direct sunlight during lunar day will also relayed via Mirrors and used in Stirling engines or Solar trough generators to generate power. It is also directly used for lighting & heat process.

## **WATER & WASTE MANAGEMENT**

For the healthy settlement at lunar colony an abundant supply of water is require. As lunar base is dried but on Nov.13, 2009 by the successful launching of LCROSS Mission NASA announced the presence of water on Moon in the form of ice at pole region. Such ice water is being condensed to normal water for the local resident of lunar colony. Water can also obtain from the atmosphere by process of condensation. Obtained water is then treated in Ultra-violet equipments to purifies it from impurities and to make it drinkable.

Water can also produced in lunar colony by recycling of liquid waste. Well equipped water purification system is used to process liquid waste and to produce maximum amount of clean & recycled water.

In Lunar Colony every dome has its own water management & recycle system, thus, to reducing the deficiency of drinking water and to supply abundant water for drinking and plantation.

As efficient Sewage system is also prime requirement for the healthy settlement at lunar colony. Thus, all household & Industrial waste is managed under waste treatment system/sewage system. All waste is centrally collected from each dome trough pipeline and then treated to make it clean. Again purified water is supplied to all household with separate pipelines.



## COMMUNITY DESIGN

Lunar colony enriched with bountiful & cultural environment for its resident thousands of kilometers away from the earth region. Thus, it set a perfect example of UNITY IN DIVERSITY. Cultural Harmony with healthy living standard is the basic motive behind the lunar settlement. Thus, it promotes HUMANITY at lunar base. Healthy, peaceful and calm environment leads to promote people to live in lunar colonization. Efforts are made to less production of CO<sub>2</sub> to prevent heat and to circulate plenty of O<sub>2</sub> for healthy living of its residents and for better growth of plants.

There are two residential domes each comprises of 500 peoples. Density should maintain low to keep residential environment healthy. Sufficient plantation ratio is maintained to keep every residential dome ecologically fit.

All essential service industries like medical, transportation, entertainment, shopping mall, are being the part of every residential dome. Along with Schools, Colleges, Libraries, Internet cafe & telephone booths are also plays an important part of Lunar Colony. (Figure 5)

Children Parks, Yoga/Gym Center also being prepared in every residential dome to not only entertain residents but to promote health of each and every lunar resident.

## COMMUNICATION SYSTEM

Effective Internal & External Communication is prime requirement for the lunar residents. As it's not only united the lunar community but to share information with earth resident too.

External Communication helps lunar colonization to share information with earth, moon regions, mining zones and other celestial bodies.

Electromagnetic & radio waves are used for external communication.

Internal Communication comprises of different modes like telephone cables, digital signals. Wireless communication devises are used to promote

man to man communication. Special antennas are used to receive and transmit signals with in lunar colony. Digital signals are transmitted through cable to communicate audio visually with in lunar colony.

Special high frequency antennas are placed above the outer region of residential domes to receive signals from earth and to transmit them within the lunar colony. Thus, effective communication is being maintained at lunar colony. (Figure 6)

## **TRANSPORTATION**

As on earth transportation is also plays a crucial role in day to day activity for resident at lunar colony.

### **EXTERNAL TRANSPORTATION:**

The transportation to, through and from space is fundamental necessity. Conventional rockets & spacecrafts are used to transport people & raw materials from Lower Earth Orbit (LEO) to Lunar Base. (Figure 7)

### **INTERNAL TRANSPORTATION:**

The Internal transportation system at lunar colony mainly consists of wheeled rover vehicles. All domes with in lunar colony are finely connected with broad roads and all routes are equipped with traffic signals & sign boards to prevent accidents.

Electric & Solar vehicles are mainly used to make the lunar colony environment ecologically fit. Mainly electric wheeled rovers are used as public transport which facilitates lunar people to move from one place to another.

Transport vehicles are equipped with covered trolley to transport raw materials from one place to another. (Figure 8)

### **LUNAR BASE TRANSPORTATION:**

Specially designed Lunar Roving Vehicles (LRV) are used to transport cargo & people to and from external port center to lunar colony. LRV are an open rover for upto 4 people and a range of 100 to 150 Km. during lunar day time. These LRV are also used to study & research the geographical condition outside the lunar colony for further development. (Figure 9)

### **ADVANTAGES: LUNAR COLONIZATION**

1. Lunar colonization will lead to the live environment for space exploration with engagement of different peoples & students thus, lead to the development of high technology workforce that will be required to address the challenges of tomorrow.
2. Test technologies, systems, flight operations and exploration to reduce the risks and to increase the productivity of future mission to Mars and beyond.
3. Economic expansion beyond the boundaries of earth will lead to the prosperity in home planet i.e earth.
4. Rocketry at lunar base is beneficial because of less gravity i.e  $1/6g$  of earth. Thus, less propellant help to decrease the cost of launching.
5. As moon is nearer to earth, thus time of sending products & permanent settlement at lunar base is economically beneficial than any other celestial body.
6. Low transmission time, help to get quicker response not within lunar colony but also from moon to earth or from lower earth region to moon.

7. Study of solar & space bodies from moon base are easy & economically feasible. Concept of healthy Lunar Observatory is only possible with permanent settlement at lunar base.

8. As from lunar base, earth looks much bigger & brighter approx 60times the moon seen from earth. Thus, it feels less remote to people going to settle at lunar colony.

9. Abundant raw materials like Silicon, Iron, Aluminium and Carbon help not only to develop infrastructure for Lunar Colonization but also help to earn revenue by exporting these materials to earth or other orbital colonies.

10. Energy generation at Lunar Colony is easy and feasible due to proper availability of sunlight at pole region and also with process of nuclear fission.

## **DISADVANTAGES: LUNAR COLONIZATION**

1. Solar dependency for lighting solution. Developing solar station at North and South Pole i.e. 'Shackleton Crater' for eminent continuous power supply during long lunar nights.

2. Big budget to get all arrangement at lunar base for permanent settlement for human being at lunar colonization.

3. Lack of basic elements in volatile state such as Nitrogen & Hydrogen. Carbon is also not found in proper volatile state as it is heavily required to form volatile oxides. The carbon and Nitrogen were found in cold trap as ice. Thus, for healthy settlement at lunar colony we required to import them from some other source to support life & industrial process.

4. Low Gravity at moon i.e.1/6g of earth is enough to cause physical disorder to people of lunar colony. Weightlessness can causes loss of bone and muscles mass and a depressed immune system.

Thus, in lunar colony all efforts are used to make use of centripetal Force rather than gravity by constructing slops on surface area to maintained healthy settlement.

## APPENDIX



Figure 1

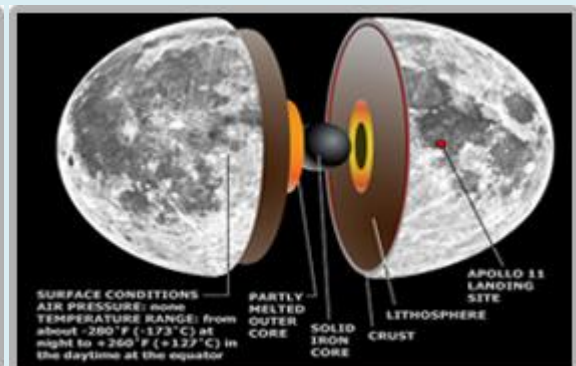


Figure 2

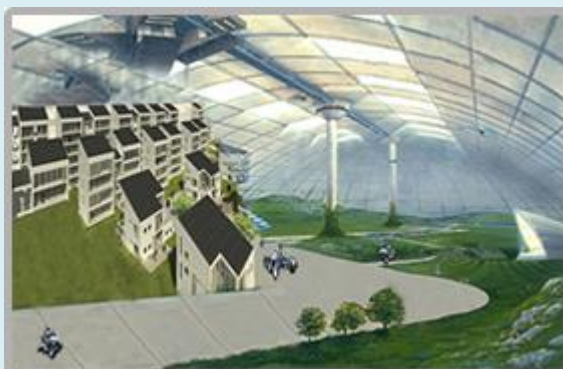


Figure 3



Figure 4



Figure 5

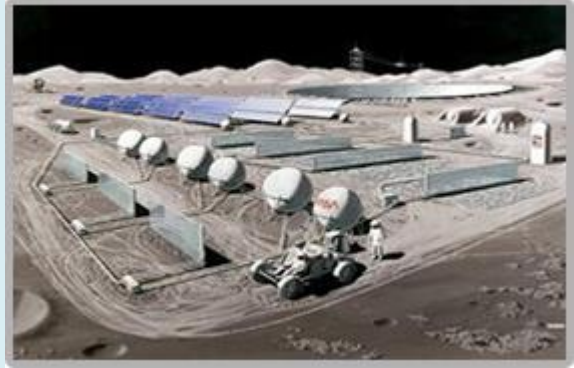


Figure 6



Figure 7

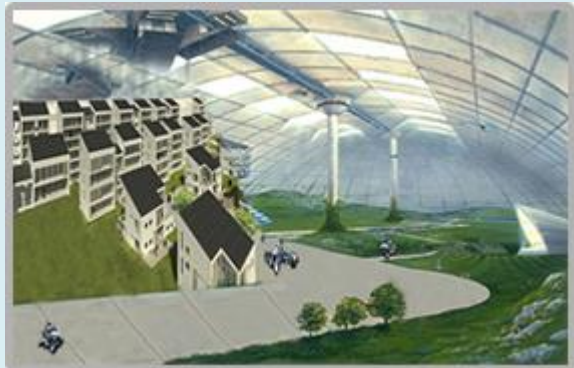


Figure 8



Figure 9

## CONCLUSION

As in the scientific era human being is continuing unfolds the secret of space and to spread its wings in the open area of space. Thus, Lunar Colonization is a small way to being the part of this scientific upliftment. It not only helps us to get settle in moon but to enhance the interest of people in space settlement. Exploitation of lunar base will lead to bring prosperity in society and to break the limitation of being permanent settlement at moon.

In the near future, when lunar settlements of all sorts will be viable, the uncountable amount of dreams and challenges that have been rendered in the entire history of mankind will finally be expressed in the solidified state of Lunar Colonization.

## BIBLIOGRAPHY

1. <http://www.permanent.com>
2. [http://www.nss.org/settlement/nasa/basics\\_what.html](http://www.nss.org/settlement/nasa/basics_what.html)
3. <http://www.space.com/28494-how-to-live-on-the-moon.html>
4. [http://en.wikipedia.org/wiki/Colonization\\_of\\_the\\_Moon](http://en.wikipedia.org/wiki/Colonization_of_the_Moon)

## ACKNOWLEDGEMENT

Figure images are taken from:

- <http://www.permanent.com>
- [http://www.nss.org/settlement/nasa/basics\\_what.html](http://www.nss.org/settlement/nasa/basics_what.html)
- <http://www.space.com/28494-how-to-live-on-the-moon.html>

Images are altered /photoshoped to explain properly.

