

THE LUNAR USERS UNION - AN ORGANIZATION TO GRANT LAND USE RIGHTS ON THE MOON IN ACCORDANCE WITH THE OUTER SPACE TREATY

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Abstract

The Outer Space Treaty leaves a sovereignty vacuum. No one has sovereignty over outer space therefore no one can grant property rights. Without property rights there is nothing to prevent anarchy among potential users of lunar territory. Anarchy is not conducive to large investments of capital. Mining, astronomy, geology, solar power, manufacturing and landing facilities are not all compatible. Some form of land use regulation is needed to prevent interference. One possible solution, within the framework of the Outer Space Treaty, is the Lunar Users Union (LUU). It would deal with lunar territory the way the International Telecommunication Union (ITU) deals with radio spectrum and orbital slots. LUU would regulate use of the moon to insure non-interference between users. Rights would be granted for specified activities in specified areas. Other users who wished to use the area for an activity which would not interfere with the first user could be granted the right to use the same area. If rights to an area are not exercised than they would be lost. Rights would be granted on a first come first served basis. LUU would be governed by a board of representatives of States which were engaged in lunar activities.

Introduction

The Outer Space Treaty states that celestial bodies are not subject to national appropriation by claim of sovereignty, but it

does not give sovereignty to any other entity, this leaves a sovereignty vacuum. An unintended consequence is that since no one has sovereignty no one can grant property rights This can pose problems for those wishing to use Lunar territory, since there is no authority to regulate use of territory therefore adds greatly to the risk of attempting commercial lunar mining. There is no way a mining company can legally keep some other company from coming in and mining an area that they spent a large amount of money doing exploratory surveys on. However the moon is a big place and the most of the resources are evenly distributed across the surface, so there is no reason why legitimate organizations need to conflict. The lack of mining rights does make it difficult to justify the expense of exploratory surveys. Also it makes difficult to assure potential investors of legitimacy, seriousness and safety of mining venture.

The lack of sovereignty was not intended to block exploitation but was intended to prevent wars, so there is a way to build a legal framework which facilitates profitable exploitation while staying within the treaty This paper will explore the principles relevant to use of lunar territory stated in the Outer Space Treaty and propose a solution to the uncertainty created by the sovereignty vacuum which is in harmony with those principles. It will also consider the types of lunar resources, the types of interference which will need to be regulated and the infrastructure necessary to facilitate safety and Lunar development.

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Principles in the Outer Space Treaty

The Outer Space Treaty allows use, requires free access but implies that access does not mean interference and encourages coordination to eliminate interference. The right of use is stated in Article 1 paragraph 2 "Outer space, including the Moon and other celestial bodies shall be free for exploration and use by all states without discrimination of any kind on a basis of equality and in accordance with international Law and there shall be free access to all areas of celestial bodies" The right of use is restated in Article 4 paragraph 2 " The Use of any equipment or facility necessary for the peaceful exploration of the Moon shall not be prohibited".

The principle that free access does not mean interference is stated in Article 9 Paragraph 1 "shall conduct all their activities in outer space including the Moon and other celestial bodies, with due regard to the corresponding interests of all other state parties." It is also contained in Article 12 "All stations, installations, equipment and space activities on the Moon and other celestial bodies shall be open to representatives of other states on the basis of reciprocity. Such representatives shall give reasonable advanced notice of a projected visit, in order that appropriate consultations may be held and the maximum precautions may be taken to assure safety and avoid interference with normal operation of the facility to be visited."

Coordination to prevent interference is encouraged in Article 9 "If a State Party to the Outer Space Treaty has reason to believe that an activity or experiment planned by it or its nationals ... would cause potentially harmful interference with activities of other States Parties in peaceful exploration and use of ... , it shall undertake appropriate international consultations before proceeding with any activity or experiment."

The Proposed Solution

The Outer Space Treaty clearly encourages coordination to prevent harmful interference between parties using the moon. The question then becomes what form should this

coordination take. Bilateral coordination would be highly inefficient if there were three or more States which had a presence on the moon. So it must be multilateral organization to be effective. The organization must include all those countries which will engage in Lunar activity. Countries not engaged in Lunar activity have no reason to be involved in this organization. The organization will regulate interference between activities between states.

There is an organization that regulates interference between users of a scarce resource which acts voluntarily and is internationally respected. That organization is the International Telecommunications Union (ITU). The ITU is a good model since it has operated successfully for decades in an area which requires a great deal of cooperation and has high economic stakes for all countries. While it is noted that the ITU is presently having difficulty filling all the requests for bandwidth and has many slots reserved by organizations who are not able to fill them these are minor administrative problems which are solvable by minor administrative changes. These problems are also caused by the spectrum shortage which will not be a problem for lunar territory for a long time.

The Outer Space Treaty allows use, encourages coordination to eliminate interference, requires free access but implies that access does not mean interference. The International Telecommunications Union was set up to insure non-interference between radio signals. The ITU insures that other members of the union will not cause interference with activities. The ITU is joined by all parties since the cost of telecommunications satellites is so high no one wants to go it alone and risk losing the investment. The same would be true of the Moon. Permission for use from the ITU is not considered a property right. It is legally recognized right of use which can allow potential users to raise capital.

A Lunar Users Union (LUU) could be set up to insure non-interference between groups exploring and using of the Moon. Membership would be open to Sovereign States which have soft landed equipment on the Moon. Countries planning such activities may become affiliate members. The purpose of the Lunar Users Union would be to maintain and extend international cooperation between all members for the rational use of the Moon, and to promote development of technical facilities and their most efficient operation to make lunar habitation and development as safe and profitable as possible, and to harmonize the actions of nations of those ends. To this end the Lunar Users Union (LUU) will effect allocation of uses of Lunar territory and registration of those assignments in order to avoid harmful interference between activities of countries.

The LUU will coordinate efforts to eliminate harmful interference between parties and to improve the use made of Lunar territory both in terms of financial profit and scientific value. The LUU will promote adoption of measures which ensure maximum safety of humans on the Moon, in space and on earth. Each member will have one vote. All members will pay equal shares of the expense of the Union. A Member which is in arrears of its payment shall lose its right to vote.

Territory Allocation Historical and Scientific reserves should be set aside before any other territorial assignments are made. These areas should include historical landing sights, geologically important sights and an area reserved for astronomical observatories. Geographical locations with special potential uses should also be reserved for activities that do not interfere with those potential uses. Areas like equatorial longitude 33.1° E, which is the ideal site for a mass launcher and other areas which are ideal for power beaming to the Earth. Placing 20% of Lunar territory in these reserve should be sufficient to protect all the important historical, scientific and geographic sights.

The possible deposits of water ice on the south lunar pole also should be considered. If they are found to be small, they too may

need to receive special protection, but if they are large and over a wide area it may be best to treat them like the majority of the Moon. No entity should have the sole right to use the water ice on the Lunar South pole. A monopoly on lunar water could be very detrimental to lunar development.

Once areas to be preserved are set aside member states should make requests for right of use of territory. Requests should be evaluated to consider possible interference with previous assignments or other requests. If a member has not used the assigned territory in the manner stated in the request for non-interference within 5 years then the right is forfeit and the requests of others can be granted. If a member ceases to use an area and does not resume use within a period of 5 years than the right of use is forfeited and other request for use can be considered.

Some may feel that this is not a suitable legal structure since it depends on cooperation and does not grant private ownership of land. The price of lunar activity will be high, so parties will cooperate. As for the lack of private ownership of land, it is very difficult to achieve under the present treaty.

The main effect of the LUU would facilitate maximum benefits to be gained from the Moon by allowing mining and other uses while protecting of the scientific treasures which could easily be squandered unintentionally.

Resources There are some attributes of the moon which must be considered when setting up a legal regime to allow for its efficient and profitable use. The moon has several potentially valuable resources, a delicate environment which is ideal for science but is a hazardous place for humans. These attributes must be considered so we can use the moon as financially and scientifically profitable and safe as possible. The potentially valuable resources must be considered when devising a system of non-interference. The Moon has 3 main potentially valuable resources Helium-3, Oxygen and possible water ice on the South Pole. The availability and value must be considered before they are legally distributed.

Helium-3 is concentrated to parts per billion over all of the lunar surface. It is more concentrated in Titanium rich regolith. Since Helium-3 is implanted by the solar wind it is found in the greatest concentrations in the first 3 meters of soil and is a renewable resource. It is potentially worth a billion dollars per ton if Helium-3 fusion becomes a commercial power source. If Helium-3 is commercially exported to Earth then large tracks on the Moon would need to be strip mined in order to meet the demand. This would suggest granting large assignments for mining.

Oxygen accounts for 60% of the atoms which make the of the Moon¹. All of the Oxygen is chemically bound in the rocks and soil of the Moon. It will be vital for life support and rocket fuel. Mining oxygen for use as return fuel will greatly reduce the cost of a lunar transportation system. There are many possible techniques for mining the Oxygen using various of the oxide minerals. The value of a given area will depend on the technology available and the minerals present.

Both Helium-3 and Oxygen could be mined simultaneously with properly designed mining equipment. One of the easiest oxides to release oxygen from is Ilmenite which is Titanium Iron Oxide, Titanium happens to be the element which allows for the greatest concentrations of Helium-3. Helium-3 and other solar wind implanted elements such as Hydrogen, Nitrogen, Carbon, Helium-4 (regular Helium), and other noble gases are trapped in the rough surface features of the regolith² and will be released if the regolith is disturbed. These elements are valuable for life support and scientific purposes. All that needs to be done to mine them while mining for oxygen is to seal the equipment, collect and separate the gases. If they are not collected they will pollute the pristine lunar vacuum for kilometers around the mining site. These gases will be extremely valuable for life support and scientific uses.

The pristine Lunar vacuum will need to be carefully protected from "air pollution" the biggest problems will be hydrogen-oxygen rocket use and mining. An electromagnetic

launcher will help as will use of alternate fuels such as Sulfur-Oxygen or Sodium-oxygen rockets.

Water ice on the Moon may be an extremely valuable and scarce resource. It is vital for life support and can be used as rocket fuel. At present we have some less than optimum data that there is some ice on the South Pole of the Moon. We also have evidence that it can only be in an extremely small area of the Moon. The Lunar Prospector which will soon go to the Moon will give us better data. We must keep its value and scarcity in mind when we build a legal structure for the Moon. It would be a terrible if one company managed to get the right of non-interfered use of all the lunar ice.

There is another possible place water ice might be hiding on the Moon, inside intact lunar lava tubes. These are permanently shaded and temperature stable. If water vapor from meteor impacts seeped in through the cracks it may still be there frozen to the walls. Intact Lunar Lava Tubes are also the best place for human habitation since they have thick stone roofs which block radiation and meteors. They are also believed to be temperature stable at -20°C ³ unlike the lunar surface which is between -150°C in the lunar night to 250°C during the lunar day. These Lava tubes meander for kilometers below the lunar surface. When assigning rights the possible presence of undetected lava tubes must be considered. Lunar lava tubes are a valuable resource but their value would be greatly diminished if they were irrationally divided because of purely surface phenomena.

Interference Considerations There are also environmental concerns. The Moon is a treasure trove of scientific data. Astronomy, geology, solar science and physics could benefit greatly by having access to the Moon. We must be sure that areas are surveyed by geologist before they are disturbed by mining and to keep a reservation undisturbed for the astronomers whose telescopes need to be far away from mining activities and radio waves.

There are many important scientific resources on the Moon. The Far side of the Moon is ideal for radio astronomy since it is in a permanent shadow from man made radio sources on the Earth. This radio shadow needs to be preserved if at all possible. Care must be taken when designing a lunar communication system to preserve as much of the radio silence as possible without greatly compromising safety.

The Moon is covered with interesting geological sites. The youngest rocks on the Moon are older than the oldest Earth rocks. The surface of the Moon is littered with meteors which could provide geological data about the formation of the solar system and other planets.

Scientific reservations should be set aside. Scientific societies from all nations should have input into which areas shall be preserved. The requests for preservation should be ranked in importance so if there are requests for over 20% of the lunar surface area, the most important sites can be protected. All areas of the Moon will be accessible to scientists even once they are allocated for use as long as scientist do not interfere with that use.

Infrastructure Safety is a major concern on the Moon. The lunar vacuum, temperature extremes, radiation exposure, rough surface and total dependence on line of sight radio transmission for communication make human survival difficult. Lunar infrastructure such as emergency radiation shelters and communications systems will help. As will requiring assistance to persons in distress.

Communications on the Moon will be a challenge since radio signals only travel line-of-sight since there is no atmosphere to bend them. Also the horizon is closer since the Moon is smaller than the earth. On the near side of the Moon this is not a significant challenge since the Earth is always in sight and can be used as a communications relay. On the other hand an individual who is on the Far side of the Moon has no way to communicate with anyone who is not within a few kilometers. This problem could be

solved with surface relay towers every 10 km or with communications satellites. Any system should be designed with care so as not to cause radio pollution of lunar radio observatories. These observatories will be build on the Far Side because of the radio isolation. Solutions which could keep every one safe and happy include only using scientifically uninteresting frequencies for communication or using only towers to relay radio signals and not having any towers within 10 km of the observatories.

Navigation on the Moon is presently a challenge since there is no magnetic field to reference. The Apollo astronauts had great difficulty navigating on the moon. A GPS like system may need to be developed and deployed to assure safety and unintentional interference between users of lunar territory.

Lunar infrastructure will need to be constructed if there is to be a thriving lunar settlement. Things like communications and landing pads should be open for all to use. Also there is the matter of control over infrastructure. The main Lunar port must be open to all. It must have a solid landing pad to prevent landing ships from sand blasting everything for 2 km around. The main port also ought to have a constantly manned communications center. It should also have a bioregenerative life support system so as to minimize pollution of the pristine lunar environment due to human habitation and maximize use of scarce lunar resources. The port should be a base for rescue personnel and have excellent medical facilities.

Garbage disposal requirements will be necessary since nothing will decompose on the lunar surface. Bioregenerative life support systems can turn any organic wastes into food, fresh air and clean water. Recycling techniques for other types of garbage will need to be used as well. Nuclear waste will need to be carefully disposed of.

The right of non-inference does not mean the right of exclusive access and certainly not the right to block the access of others to the territory which an entity has the right to use. Provisions must be made to construct surface roads and to provide access to all parts of the Moon which are assigned for use. Through ways between claims or easements across claims should be considered when granting right of non-interfered use.

Conclusion

The non-appropriation clause complicates lunar development because it leaves a sovereignty vacuum. There is an existing organizations which has successfully dealt with allocating scarce resources without granting ownership for decades. That organization is the International Telecommunications Union. It should be used as a model for dealing with the need for exclusive right to mine an area while staying within the bounds of the Outer Space Treaty.

The Lunar Users Union modeled on the ITU facilitate lunar development, respect the treaties and protect the scientifically interesting sensitive areas so maximum knowledge can be gained.

¹ Lunar Source Book, Edited By G. H. Heiken, D. T. Vaniman and B. M. French, Cambridge University Press 1991, P.363

² Lunar dirt

³ Wendell Mendell personal communication cited in Lava Tubes: Potential Shelters for Habitats by F. Hörz Lunar Bases and Space Activities of the 21st Century edited by W. W. Mendel 1985 p.405