CASE STUDY ON HUMAN COLONIZATION OF TRITON

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Abstract— Mankind on Earth has been beset by problems such as overpopulation, pollution, overuse of natural resources which have impacted Earth and its life forms. In the event of a catastrophe which will no doubt cause extermination of a species, an alternative permanent human habitat at other planetary bodies becomes increasingly inevitable. One of the preferred locations are the asteroids, mars, moon but in the future more and more colonies will need to be exploited to compensate for the resource scarcity back home , hence the moons of the gas giants are the next favorable targets as the gas giants themselves have no solid crust or surface and possess a powerful magnetosphere . Jupiter for instance, has a magnetosphere 98 times more powerful than that of earth. The atmospheric pressure hence in such planets are immense and cannot be colonized . The moons of these giants however are potential targets.
This paper will observe the feasibility of colonization of Neptune's moon Triton and Theoretical Explanations as to why should it be chosen for a potential permanent settlement. This paper will be a follow up paper to the topic "An insight into the comparisons of space colonization of heavenly bodies in the inner solar system".

I. INTRODUCTION

Triton is one of the largest moons of the solar system and is also the largest moon of the planet Neptune. Its Atmosphere is composed of mainly Nitrogen, water ice and carbon dioxide, all three in frozen states with traces of methane, Carbon monoxide, hydrocarbons and ammonia. Hence its atmosphere is similar to that of Saturn's moon Titan, our Planet Earth and Jupiter's moon Ganymede.

Triton's substantial atmosphere is also fairly large, extending up to 800 kms in altitude. It is also massive comprising about 99% of the total masses of all of Neptune's moons in orbit around it, thereby proving that all the others moons are gaseous and even their combined masses pales in comparison to Neptune's most prominent moon. Also scientific studies have shown that it has rocky material necessary for landing and its huge mass is due to this rocky material and water ice combined lithosphere. These are good locations for a soft landing. With our Planet Earth becoming increasingly polluted and resource dry, Moons such as Tritons are good future Destinations for Resource Mining and therefore the idea of a human colony becomes increasingly viable. With NASA and the other Space agencies actively involving themselves in mobilizing their resources to fund a Space Colonization to help mitigate the scarcity of resources and also of living space,

It is imperative that we also look at planets and moons with more favorable atmospheres apart from the usual sort of destinations like Mars , Venus and Moon . Although Triton is much far away compared to the usual destinations, It is also important to note that Space Propulsion has been getting better in Leaps and Bounds. Therefore it is Appropriate to start work and tests to check if Neptune and its moons are really compatible for Human Colonization and Exploration. This Paper will be a follow up paper to the topic "an insight into the comparisons of space colonization of heavenly bodies of the inner solar system ".

II. FEASIBILITY OF COLONY IN TRITON

Triton, the largest of Neptune's moons has a surface temperature of -238 °C. Triton's Atmosphere composition is of more than a half of frozen nitrogen, 30% water ice and the rest of frozen carbon dioxide with traces of methane and carbon monoxide as discussed above. This makes it very hostile for supporting human conditions .hence a controlled facility equipped with life control systems has to be incorporated in its design while setting up a base. CELSS systems and other state of the art facilities and future technologies can be used in the base for human sustenance.

There is one more issue ,Triton is located so far away from the sun that it receives very little amount of sunlight, Hence artificial sunlight needs to be created along with human life support systems to prevent diseases . Also since the sun is too far away, solar power cannot be tapped and the facility must depend upon nuclear energy to power itself. Hence most Feasible sources are plutonium and thorium which can be shipped from Earth in large amounts. Also there are traces of iridium present in the space outside of Neptunian orbit which can also be tapped for power. The major issue still remains to be the distance between Triton and Earth. They are so far way from each other that it takes a full eight years using today's conventional Technologies to travel to Triton transporting humans and materials for base. Considering that future technologies will make the time shorter and shorter, there is still speculation of "Interplanetary accidents". The region between Jupiter and Mars, the asteroid belt is a major obstacle path and Transporting safely means more trajectory

correction maneuvers and more energy. Even small debris less than 5cm in diameter can cripple the entire spacecraft as it hurtles at more than 9 km/sec in outer space. Hence such factors need to be taken into account while discussing the feasibility of Human Colony in Mars.

Eight years of interplanetary flight is also a long period, hence induced sleep of astronauts dubbed as cryosleep like the ones described in great detail in fiction can be produced. Apart from this , when the asteroid Ceres is colonized for resources , humankind will plan a series of expeditions to colonize heavenly bodies of the Saturnian and Neptunian orbits and will also probably target triton as it actually has a rocky surface unlike many other sister moons.

III. RISKS OF IMPACT CRATERS AND GEYSER ERUPTIONS

Although Impact Craters are fewer in number in Triton when we compare them with other dwarf planets, it still is a concern while planning of few permanent bases in triton and cannot be ignored. Concepts of underground facilities can then be used as an alternative while setting up bases. Although Triton's surface is made up of frigid ice and is not an ideal location for mining or drilling, there are still rocky regions near tritons many cryo volcanoes. Hence underground facilities can be set up around dead volcanoes which will be feasible.

Geyser Eruptions on the other hand are fairly common in Triton due to the prevalence of many volcanoes and voyager Expeditions have observed nitrogenous eruptions extending up to altitudes of 9km or more. This strangely has been believed to be the cause of a nitrogenous atmosphere which blocks the cosmic radiation and ultraviolet radiation entering inside to escape outside, thereby creating a greenhouse like effect. Geyser eruptions create geological abnormalities as they are closer to Tritons sub solar area and minor temperature deviations create a huge disparity in eruptions causing disasters in land. This may impact setting up of bases.

IV. HUMAN COLONY ON TRITON AND PROPOSAL

A base in Triton when set up will comprise of living chambers, labs and facilities for mining operations. Water ice can be heated and purified to a more earth like liquid and can be used for drinking or bathing. The CELSS system of plants being used to provide oxygen can be incorporated in this design and it can also include storage of nuclear power and fusion reactions to provide energy and power up the facility.
Our proposal for the colony is that taking into account the cold, stark and frigid temperatures of triton and its cold extremities, it is better if the facility is covered in the exterior by igloo shaped domes. The igloo domes made up of ice act as insulator and can easily reduce the temperatures to a maximum degree. This dome structures are necessary as they combat the frigid temperature disparity which otherwise is very lethal for human life even under lab conditions.

For maintaining oxygen levels, melting of water ice which is present below and then breakdown of oxygen from water under lab conditions can be done . Also there are also a great gravitational disparity between Earth and Triton.

The microgravity in space already creates bone weakness and other abnormalities for astronauts. Such Gravitational disparity can cause even worse consequences. Hence the conditions of the facility must be set up in such a way that it reproduces an earth like environment and minimizes gravitational side effects.

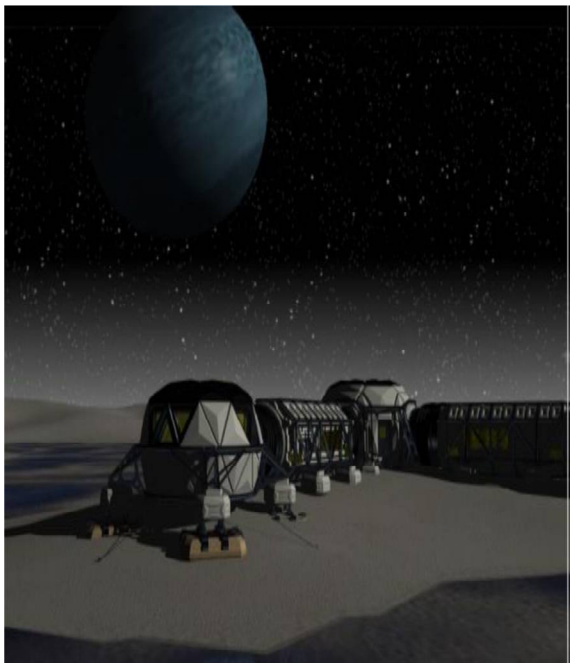

FIG 1 – AN ARTISTIC IMPRESSION OF A SPACE COLONY ON TRITON

CONCLUSION

Space colonization of planetary bodies of the outer solar system is still years away as conventional technologies are still limited to support such a large scale expedition.

This is further beset by the speculation that how are the astronauts going to sustain them as more than half the supplies which are taken aboard the spacecraft will be used up before they can reach triton .Also Triton's Frigid conditions does not help , with surface temperature colder than Pluto.
Traces of methane and ammonia which are believed to be present has however lifted the hopes of agencies

planning to lead a large scale expedition that somehow human life can be sustained there.

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