

Space Colonization: Reasons, Goals, and Methods.

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Abstract - Space colonization this is a idea created by humans on earth to create celestial bodies in the cosmos as a backup plan to sustain human race if something happens to our home planet earth. The idea here is to build massive projects such as ISS in space so that it can hold masses of human race and continuing it by meeting all the necessary requirements. NASA now for many years has been organizing conferences providing young minds to unleash their imagination and create models which would have the potential to continue humanity in uncertain circumstances. However, it is also important to understand the basic living conditions required by human beings to live peacefully which must be regulated so that humanity can live on even after facing disasters. This paper is about explaining the requirements needed and the practicality of actually carrying out these projects considering the negative sides and solutions for them to build one.

1. INTRODUCTION

The idea of space settlement was first introduced in the year 1984 in Ohio state university, back then considering this idea, it would be considered as to be an impossible project which humans can dream of because its just like building a whole new world right from scratch is quite impractical even considering modern day technology but saying "impractical" doesn't necessarily mean to be impossible. Finding appropriate solutions for the problems which are expected to be faced we can still hope for building a whole new world for humans to live their rest of lives.

1.1 Probable ways by which we can continue human race and why exactly should we consider building a body in space?

It is no wonder that in today's world anything unexpected might happen in any second as we speak. But "those are the intelligent of men who prepare for death, before death arrives" this is one of the lines told by prophet Mohammed to his companions. Lets go back 5 years in time if we would have asked ourselves that would be the possible reason for human race to end , we would have answered that it would be safe to say humans themselves would be reason for their extinction (which is also a possibility for human race to come to an end) but in year 2019 humanity has seen and experienced the worst case scenario in a century that is a pandemic. This proves that at any instant of time anything unexpected might happen for

which humans have to be prepared to face the worst and overcome it with proper planning structure and idea..

2. Ways to overcome these crises.

We have asked ourselves in these years of pandemic what can we do to help the people. The answer was very simple that we had nothing to do but just to wait for the disaster to go by itself and self-quarantining was the best practise humans can adopt this had happened because we were never prepared for this scenario, hence we couldn't actually assess the situation and get the best solution. But luckily, we now have chance to think about future of our race by which we can save them from extinction. Now to tackle some extinction level threat like clashing of big asteroid which could wipe out the human population which was happened during the time of dinosaurs we have to take all possible worst-case scenarios into consideration to acquire the best solution for our survival. There can be two possible ways by which humanity can survive when "once when we are sure that there is no other possible way to come out"

Those are:

☒ Building interplanetary bases and distributing population of humans in these bases to reduce the workload and force required to do the jobs. The capacity of population these bases can hold are based upon the structures made and living conditions considering topography.

In this mode of survival there are both advantages and disadvantages:

- 1) Making small bases on the planets require advanced telecommunication systems which would allow us to communicate which is not possible with current technology.
- 2) The small tribes located would make clear for the residents to their jobs and will make opportunities for people to conduct experiments on their respective planets this would eventually help humans to have better understanding of their planets and with proper usage this would be very productive.
- 3) The small population on the bases would make it easy for maintaining control over people whereas it would be difficult for the representatives to have control over large population at once.
- 4) Having small population would ease the process of distributing the resources among residents.

- 5) These planets depending on their sizes will have their respective gravity which cannot be changed hence at first humans would have problems, but their next generations would be accommodated because humans are type of species who can accommodate to the situations, they are living in.

Considering many advantages, one should not think that establishing base is the only thing which has to be done. Considering the environmental conditions and the life expectancy on these planets should be considered. With current day technology thinking of establishing bases is impractical but with minor improvements would make this thinking a reality. When first humans would be establishing bases on other planets will create history and a new chapter will open in the human history and these bases will provide the extreme authority with necessary information and the executive authority would take the necessary decision for the welfare for the people across the planets. One of the major advantages of these idea is that even if any of the planet gets on brink of destruction then the remaining bases can make quick decisions and continue.



☒ Building massive celestial bodies of certain shapes in specified orbits (goldi-lock) to accommodate whole human race:

This idea basically suggests that we should build massive celestial bodies and let them be in specified orbits so that they can orbit around, in these bodies if human race comes to end then the rest of the individuals who survived will board and these bodies will provide everything necessary for our survival. However, things which must be considered are that we should be having the basic requirements which are very necessary like gravity, water, sunlight, plants. there are certain shapes which are advised for building these structures those are:

- 1) cylinder.
- 2) Torus.
- 3) Sphere.

These shapes are taken into consideration for their special ability to produce gravity upon spinning at certain speed and at specified RPM.

Constructing these structures often involve series of these shapes for different purposes such as cylinder acts as a supporting component and torus and spheres are given for accommodation and place for carrying out experiments and inventing things.

These structures can be always considered to be the best substitute for human survival but with current modern technology it seems highly impossible and can be expected to be reality in 50 years.

NASA has been organizing events where the students of 6th to 12th grade can participate and submit their projects. This idea was promoted for children to unleash their creativity do research in groups and submit their results. It was introduced in year 1994 with same objective of creating these structures.

What is common in both the systems?

The idea of both the concepts is the same that is to provide shelter to human race in uncertain times, by which human race could continue.

The other needs such as growing plants without soil (that is with the help of Aqua culture such as hydroponics, aquaponics and aeroponics). This concept is to be used in both the systems because both ideas would not have soil in them.

Having a proper involvement of the residents is require ensuring safety of whole crew. Weather it is a small base on TITAN or a giant torus revolving L4 orbit residents should involve, because if we consider the scenario where earth has been destroyed and only some of the individuals have survived the process of transferring knowledge to the left-over population. People required here would be generally scientist, engineers, and doctors.

The practicality of the idea:

Till what extent is this idea can be executed, considering modern day technology? The answer to this question is that it is not a good question itself. It totally depends upon us humans to make advancements in various fields such as sustainable development, advancements in AI, getting better tools, having good team and proper planning is required, sufficient budget. But considering todays technology it is highly impossible carrying out these missions on a large scale (building space settlement projects) and having control over planets atmosphere and changing the environment is also unlikely to happen.

Constant efforts are being made in making life inter-planetary and making humans inter-planetary species.

With best minds working on the idea, we can expect to see a actually interplanetary base in 10 to 20 years. To also promote this idea and to make it practical we should accumulate the best minds in their fields such as in biology, STEM, and defence systems to get the best results always ensuring a backup plan if anything goes wrong.

Solutions for some of the problems which are expected to happen in space:

Now speaking of problems there are many which we humans have to overcome if we consider that earth has been destroyed some of them are

- 1) dealing with gravity.
- 2) Maintain atmosphere.
- 3) Producing plants and vegetables for consumption.
- 4) Having good defence system against any other spatial-rocks and asteroids.
- 5) Acquiring minerals and ores without having them.
- 6) Distribution of work among people for growth.
- 7) Sanitization and disposal of dead bodies.

Now these above mentioned are only some of the problems which are expected to highly occur, now there might be completely another scene on these bases and projects when humans are transported to. Now dealing with these problems is not an easy job, a lot of clear understanding among the people is needed and with appropriate working and idea this would be reality. In the earlier sections we have talked about shapes which we thought of placing and their advantage of being able to create gravity

The shape shown here is a **TORUS**, it can produce gravity upon

Rotating at a certain speed with specified RPM. This type of structure is also accepted to be the most optimum and Is selected by vast majority of people for the space settlements



Everyone is familiar with cylinder and spheres, so it is not discussed in detail in this section. However, the basic principal is that to rotate this bodies just like how our planet rotates to create force of gravity.

Formulae for the force of gravity in RPM is: $9.55 \times \sqrt{\frac{g}{R}}$

Where g=force of gravity to be produced

R=base radius

For torus radius would be, R-r (R=outer radius, r=inner radius).

How can we produce atmosphere?

Well, this is a very hard problem where on earth we have appropriate dense atmosphere which would prevent us from being crushed by the pressure, but unfortunately, we don't have that in space. For overcoming this problem first, we have to have good strong force of gravity which would hold the gases from escaping the projects. If we have good gravitational force we can extract minerals from the asteroids, these are some of the best sources of the minerals and resources and if we once run out of the minerals on earth we can use asteroids as alternates, this also will effect the location of the projects because in our solar system we have our own asteroid belt, so if we also create these projects we have to place them near to the orbits of the mars and Jupiter meaning we would always maintain safe distance from the asteroids which would provide us with the minerals and resources required to sustain life. But here we are talking about building extensive huge machines which would be last hope of humanity in the worst-case scenario.

But on the other hand, the bases which can be established on the planets would have a thicker and denser atmosphere. The planets (for now lets consider moon) already have a thin atmosphere, the idea here is to launch nuclear warheads towards these planets hence breaking the rocks and crust of the planets now there is release of many gases which have been trapped inside these rocks, now once this gases are released then again they go up in the higher altitudes once done continuously we can release enough gases to make a thick atmosphere for human survival[1]. Once we humans establish a thick atmosphere, we would be left with more 100-year time gap which is enough for us to figure out whether to continue the bases or move for the space-settlement projects situated in orbits like L4 or L5.

Producing pants and vegetables in space for consumption and oxygen:

Plants are one of the most important living species for humans as they release the right gases for human survival and maintain the optimum temperature for the sustenance of *homo-sapiens* but the question how we are going to solve this problem in absence of the basic commodity that is soil in space. Scientist and engineers and botanist and the field experts at NASA have figured some of the ways for growth of plants without the application of soil that is through **Aerponics, Hydroponics and Aquaponics**. By further examination I conclude that Aerponics is the way we can adopt for growth plants (here the other two can also grow

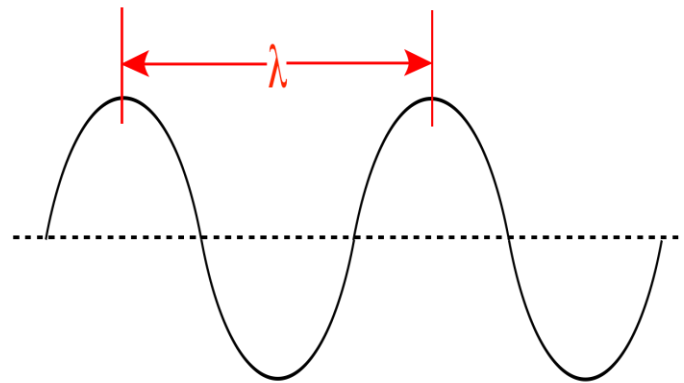
plants), the advantage of the Aeroponics is that we can grow any sort of plants that is of any species in minimum resources ensuring the maximum outcome. There is one of the research papers which was published by me which is regarding doing a experiment on the ISS with improvised shape and new idea of nutrient water for plant growth [2]. However, I will explain the basic principle of the Aeroponics.

Aeroponics: it is a method in which plants are grown by eliminating soil as the source of all necessary nutrients, but rather nutrient water is used for supplying the nutrients to the plants. This water is sprinkled on to the roots of the plants in atomized size, the root part is given for the absorption of nutrient water and the leaves are exposed to sunlight and to essential gases such as oxygen and carbon di oxide to carry out photosynthesis. Now these project can be carried out artificially and there is no requirement of natural resource this project of growing plants can be done on both of the ideas, the space-settlement projects and the inter-planetary bases.

Having good defence system against spatial rocks and asteroids:

When it comes to space there is always a lethal threat waiting for us at every curve and ensuring the maximum security is necessary for people. But how is the defence system for our projects is going to be? Once we reach the orbits of the space-settlement projects which are situated near the asteroid belt due to reasons for extracting minerals and necessary metals of the asteroids. However, there is always a threat of asteroid bouncing off its trajectory and heading towards the space settlement projects. For overcoming this problem there might be either a team who will be observing the asteroids like how we have here at the earth or else we might use powerful lasers for breaking down the asteroids and using them for extracting minerals, this is the only possible way for current day tech to compromise and make such damage without having any internal damage. However, we won't necessarily have this problem on the planets, if we consider to establish a base on either mars which is the only possible way for us if earth and moon are destroyed because most of the asteroids even heading towards the planet would be diverted by Jupiter's gravitational field thus taking the asteroid off its course which was set to be colliding, however actual asteroid crash into the planet is one out of the millions thus making the base much more safe for the human civilisation from the celestial rocks!

But taking the laser option would make us to discover some of the rays of light with higher frequency thus having less wavelengths



The lower the wavelength of a wave is the stronger the frequency is going to be and if the frequency of wave is more then more destructive the light ray can be. The frequency which will be used should be altered along the way depending on the asteroid hence breaking them into appropriate pieces which would help in extracting of minerals and metals.

$$\lambda = 4580 * \frac{y * y}{\sqrt{l * l + y * y}}$$

y=distance between light source and grating spectacles

l=length between light source and nearest light neighbour

λ=wavelength

$$U = \frac{3000,000}{\lambda}$$

U=frequency

λ=wavelength

Acquiring minerals and metals:

The above section might have given some idea of how we are supposed to acquire the minerals and metals for day-to-day life in our space-settlement projects. The main source would be asteroid mining and we have also discussed that the location of the space-settlement project would also be around these sources which will never let us run out of minerals and metals. The appropriate location would be around L4 and L5 orbits and near Mars so that there is safe distance between asteroid belt. Now one might consider this is again a non-renewable source of energy, it surely is a non-renewable but here it is renewable and non-renewable source at the same time. This is because most of the asteroids which are projected to different parts of solar system which are meant to be passed by the Jupiter are drawn towards Jupiter thus along the total revolution of Jupiter around sun there are a lot of asteroids effected by Jupiter's gravity form as a ring which we call it to be asteroid belt. Now as we are speaking there are a lot of asteroids being accumulated on the asteroid belt so for us it won't be a problem to acquire the minerals and metals.

But using the appropriate technology for mining these asteroids is necessary. For overcoming this we can classify asteroids based upon their size, availability, constituents, and many other features and then we can just have the appropriate tools and the appropriate technology for mining this asteroid worth of thousands of natural resources.

Distribution of work among people:

Having small bases on planets or large space-settlements projects without distribution of work among people it would be difficult to manage with the multiple tasks that have to be carried out. At first, we can have a survey asking people about their qualifications and interests this would give a better understanding of people to the representatives and take initiatives for the public good, it would depend upon the current situations in the space and making decisions. We can always programme robots and assign them works just like we do on the earth. But these would be just manufactured on a very large scale that would meet the ends for us human beings, now depending on the type of work we would be doing there might be many jobs such as defence minister, doctors, programmers, robot factory workers, software engineers, physicists, astronomers and people with good knowledge in physics and math which would guide us and pave path for our future.

Sanitization and disposal of dead bodies:

The sanitization of the bases and settlement projects is a important job now because we now no more have soil which would decompose the bio-degradable stuff. Having separate department and separate force is needed the robots can be used for sanitization and maintaining a clean and safe atmosphere for the people making it more difficult. Now having a large force for settlement projects is a tough job to govern the working and cleanliness but not impossible which would lead us for adopting bases due to their small structures and proper functionality and easy working departments, we also have to figure out ways for using this material to change them into useful stuff and make the complete use of resources in such times. But the disposal of the dead bodies is again a problem, even if we escape an asteroid which would have made us a extinct species still then we as living creatures would have to encounter death, no treating the dead bodies is again a problem, different religious and cultural communities have different ways of disposing their dead bodies but considering the situations it would be more favourable to burn the bodies and dispose their ashes into the void, just letting the bodies into the void would make space a more congested place and would create mess. Burning the bodies and disposing ashes is just an idea not an conclusion the actual disposal might be different.

3. CONCLUSIONS

Thus, by having a brief thought and answering some of the expected problems which are yet to happen we can conclude that both the ideas of space settlement that is through building massive bodies or establishing bases on

planets are equally effective in their places but in the end it would be totally dependent on the human race to opt for the better option considering the current day scenario and the problems which are being faced. The idea of building massive bodies seems to be quite impractical for this current day but not impossible, however if we can just nuke the nearby planets and create a thick and dense atmosphere for the human survival, we can expect to see humans to establish further space colonies and become inter-planetary species. With constant efforts being made in STEM and in aerospace engineering humans can and might become interplanetary species and understand our universe in detail. It has been our human capability to explore and understand and accommodate to our surroundings which makes us more powerful and solving some of the major problems of humanity and overcoming the failures and making advancements was always our motto. Therefore space colonization now might be a thought but in future we will experience this moment

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BIOGRAPHIES

SHEIKH KOLIMI ABDUL AHAD is a junior high school student, he has this unimaginable love for space and technology, he is also self-taught python programmer he has done many jobs till now and have been trained under world's second youngest astronaut trainee Akshat mohite. He has also been invited to NASA-AMES space settlement contest in 2019 and was awarded top 50 award in whole world. He aims on creating a better world for human beings with appropriate use of technology and bring ease in day-to-day life. He is also the person who made the first machine which has the potential to grow plants and vegetables on the ISS with application of Aeroponics.

