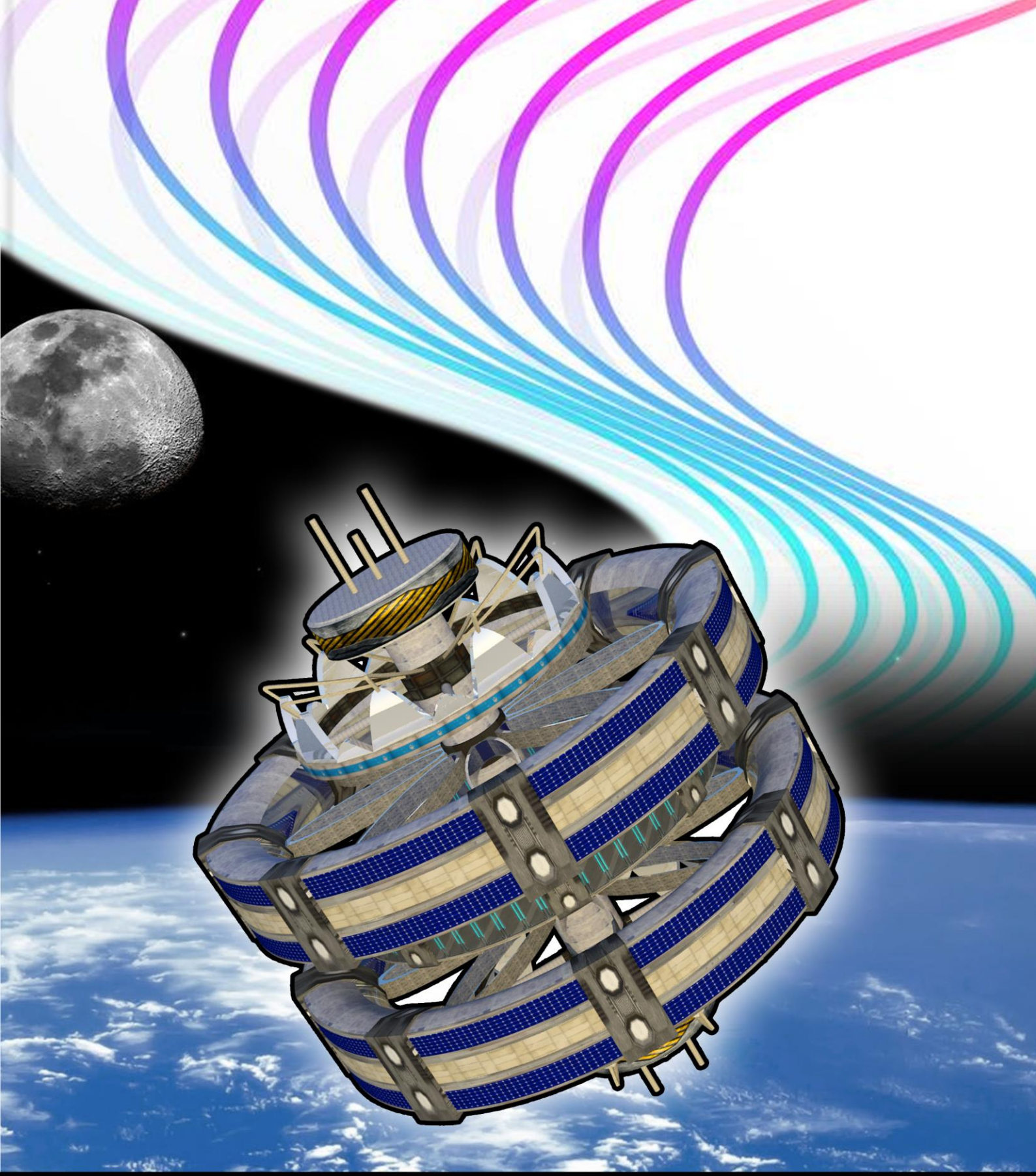


ELPIS

NSS Space Settlement Contest 2019

ELPIS

By

Medhovarsh Bayyapureddy

SRI CHAITANYA TECHNO SCHOOL,
VIJAYAWADA, ANDHRA PRADESH,
INDIA.

CONTENTS

ACKNOWLEDGEMENT

In the accomplishment of this project successfully, many people have bestowed upon me with their blessings and the heart pledged support.

On the outset of this report, I would like to extend my sincere and heartfelt obligation towards all the personages who have helped us in this endeavour. Without their active guidance, help, cooperation and encouragement, I would not have made headway in the project. I am ineffably indebted to the people for conscientious guidance and encouragement to accomplish this assignment.

I also acknowledge with a deep sense of reverence, my gratitude towards my parents, who have always supported me morally as well as economically. Any omission in this brief acknowledgement does not mean lack of gratitude.

My special thanks to our school Principal **Mrs. Sailaja** madam for her encouragement.

Finally, we would like to thank our parents for supporting and cheering us during the project. I have learnt so many interesting things during the completion of project.

EXECUTIVE SUMMARY

Earth has provided a stable platform for the evolution of life over 4 billion years. But that lease is limited; we know for sure that it will expire after a few billion more..... If we are wise, we will have furnished our apartments long before that time. -Robert Shapiro

Planetary dreams 1999 Earth has been becoming hot, deforestation; pollution has created a lot of CO2 and global warming. This year the maximum temperature recorded is nearly 57 0c. This may increase in next 10 yrs. The solution to this problem is forestation. However, this is not at all happening in our Earth. After 100yrs, the earth will not be suitable to humans. So it is better to choose an alternate way.

Space colonization is permanent human habitation off the planet Earth. Many arguments have been made for and against space colonization. The factors in favour of colonization are survival of human civilization and the biosphere in case of a planetary scale disaster, natural and man-made, and the vast resources in space for expansion of human society.

Building the settlement is the best way. ELPIS settlement can help the people in earth after 100 yrs.

INTRODUCTION

INTRODUCTION

1.1 WHAT IS THE NEED OF SPACE SETTLEMENT?

Imagine our world may be after 50 years or 100 or 200 if we go on increasing the number one may find very difficult to reside on earth. Existence of life may not possible because of numerous reasons like asteroid collision, global warming issues or depletion of ozone layer.

Human being the most intelligent creature on the earth can design his life in any other planets like Mars but what if it doesn't support by the time earth get destructs. Here, we come out with a solution called ELPIS a space settlement program. A space settlement can be treated as permanent home or habitation of human beings in a pre-set location of space.

1.2 SALIENT FEATURES OF THE SETTLEMENT

- ELPIS provides earth like atmosphere to the people.
- The atmosphere in the ELPIS provide peaceful and passive environment to the people.
- ELPIS has efficient life support system suitable for sustaining of life.
- Transportation will be easy to the people of ELPIS .
- Many recreational facilities are there for the people of ELPIS .
- This settlement provides excellent comfort to the people.

The settlement construction will be started at 2022 and will be completed at 2045. Our settlement proposal is surely going to be the modified form of the earth.

1.3 NAMING OF THE ELPIS

"Hope lies in dreams, in imagination, and in the courage of those who dare to make dreams into reality." – Jonas Salk

One of man's wildest dreams, a hope against hope is settling in vast and endless space. With a hope that leads to wildest imagination and with courage to turn dreams to reality, I present my project "ELPIS" (The Greek spirit of hope). To make space as an inspiration to mankind we have made the planning of ELPIS, which holds the key to mankind's future. I just HOPE, that my project ELPIS will succeed and secure mankind's future.

ELPIS can accommodate 22,000 People and has the ability to provide excellent comfort to the people. We are confident that ELPIS is the perfect human suitable orbital space settlement.

1.4 LOCATION OF THE SPACE SETTLEMENT

Location is the main aspect of the space settlement. Positioning at the correct location will make our space settlement as successful mission. We looked at possible locations for space settlement.

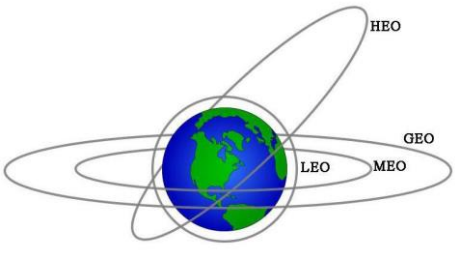
Mars Orbit

Mars is too far from Earth. It takes few months from Mars to reach Earth. So the transportation and communication will be difficult between Mars and Earth. So it is not a good choice. Choosing the location far behind the Mars is also not a good location.

Orbits of Earth

Low Earth orbit [LEO]: It is unstable and has orbital decay. So it is not a good choice. Geo stationary orbit [GEO]: GEO is crowded with telecommunication satellites. So it is not a good choice.

Highly elliptical orbit [HEO]: Placing the settlement in HEO may cause accidents. So it is not a good choice. Placing the settlement in orbits of Earth does not have resources other than Earth. So it is not a good choice.



Courtesy By: Google

LAGRANGIAN POINTS

In 1772, A French Mathematician Joseph Louis Lagrange discovered five points in the rotating three body system where gravitational forces balance each other. In the Earth-Moon system, these five points are continuously exposed to sunlight. So these points are useful for our location. In the first point of Lagrange [L_1] the object falls between Earth and Moon but a little closer to Earth.

L1

Even though all the forces balance there, it is hazardous equilibrium. If the settlement drifts sideward, the mixed effect of three forces will bring it to normal position. But if the settlement drifts forward or backward will make the settlement to fall either on Earth or Moon. So it is not a good location for settlement. Coming to next point L_2 and L_3 , they both are almost same but different positions. In L_2 the settlement will lie beyond the backside of the Moon whereas L_3 lie at back side of the Earth.

L2, L3

The locations L_2 and L_3 are not good choice because it consumes more fuel to stay at that location. Low investing on fuel will make the settlement fall on Earth or Moon. The points L_1, L_2 and L_3 are unstable locations for space settlement like a cart balance on sharp hilltop. A slight tilt will make the cart fall on Earth. The points L_4 and L_5 are quite different from other three points. These points are equidistant from Earth and Moon and forms equilateral.

L4, L5

In the points L_4 and L_5 there is no matter where the settlement drift or lean. But the force will prevent the settlement moving farther. Placing the settlement in L_4 and L_5 will be like the cart placed in flat plains. So we opt to place our settlement in either L_4 or L_5 . Placing in L_4 or L_5 also has an advantage of exploiting resources on Moon as well as Earth.

So, the final location of ELPIS is L_4 as it has some good conditions for settlement when compared with L_5.

STRUCTURAL

ENGINEERING

2.1 BASIC SHAPES

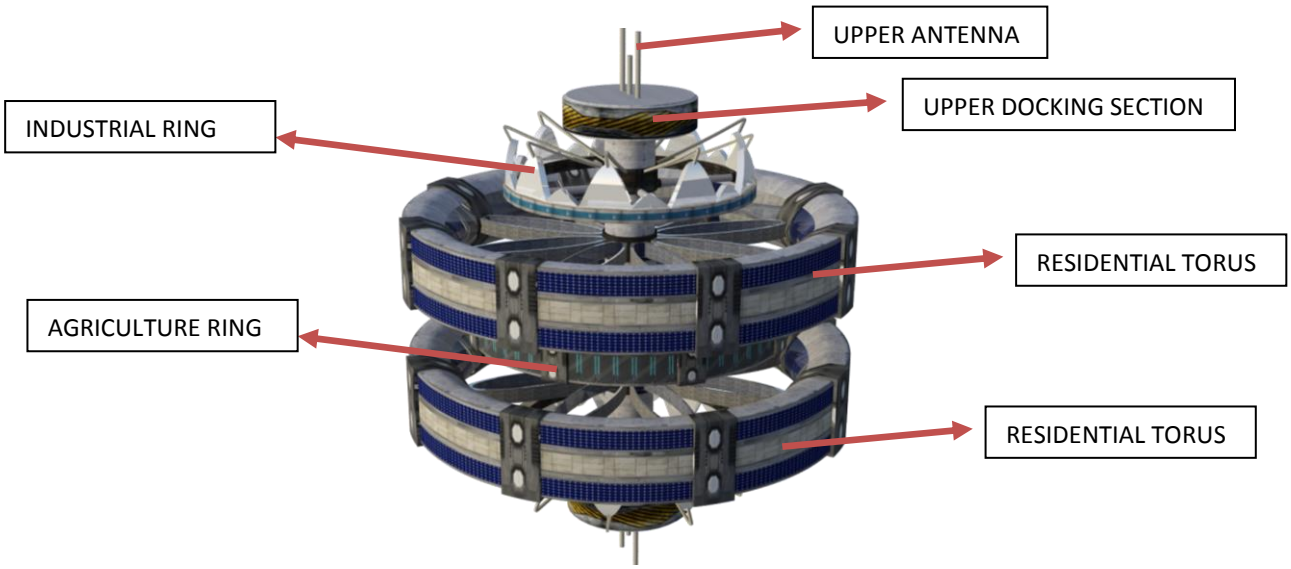
Basic form of the space settlement, Torus was chosen as the basic of our space settlement, due to its advantages when compared with sphere and cylinder.

Advantages of Torus:

- It has more rotational stability
- The earth's environmental conditions can be easily created in Torus.
- No need of creating huge atmosphere
- Perfect mass to area ratio.
- Can be easily illuminated by using mirrors.
- Residents cannot see the opposite side of Torus.
- In terms of mass, all other shape has 4 times more weight when compared to torus

Due to its more advantages we use Torus as a primary shape of our space settlement.

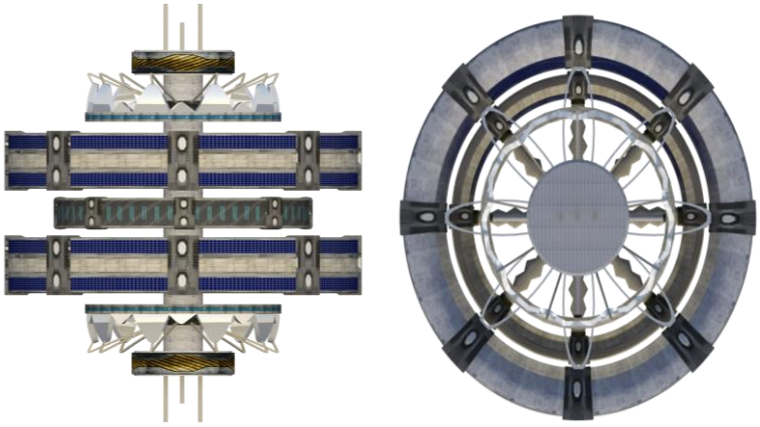
2.2 FINAL STRUCTURE OF ELPIS



2.3 JUSTIFICATION FOR THE STRUCTURE OF ELPIS

In this structure, the agriculture and industrial rings are situated separately because they both play a vital role in the economy of the settlement. The industrial pollution does not have any effect on people if the industries are far from residential colonies. It is preferable to locate industries in low gravity area than residential colonies.

In our structure, we can observe that the agricultural Torus lies between the habitations Torus. This is because, to provide safe and fast transportation of food and daily requirements for human. As we see in the diagram, habitation Torus consists of spokes that are coming from top to bottom which connects to the central hub. These spokes provide a lot of stability and support as they are directly connected to the central hub. Connecting the spokes through agricultural Torus may cause disturbance and lack of stability as well.



Views and Symmetry

2.4 HULL COMPONENTS OF SPACE SETTLEMENT

HABITATION TORUS: All the residents of ELPIS will live in this Torus. Habitation Torus is made up of truncated Torus because, when using simple Torus most of the volume will be wasted for flooring to prevent gravity fluctuations.

Structural parameters of Habitation torus

For proper stability, the external radius of habitation Torus is 1/8 of internal radius of cross section.

Internal Radius=1/8*1200

=150 m

We can say that the cross section of the habitation Torus is semicircle because of its height(300m) and cross section radius (150m).which is again an advantage of truncated Torus to save money, material and time.

Major Radius=1200 m

Width [height] =300 m

Minor Radius=150 m

There is no need to calculate Surface area as it was only used for residential colonies. As truncated Torus has flat external surface like cylinder

(a) Surface area

Lateral surface area of truncated Torus =Lateral surface area of cylinder

$2\pi rh$

$=2*3.14*1200*300$

$=2260800\ m^2$

We find the surface area in order to find the population of the Torus.

According to the NASA summer study, a person requires an area of $100m^2$ to live excluding agriculture.

So population=total area/required area (per person)

$= 2260800\ m^2/100$

=22608

Therefore, the population of ELPIS is 22608 in which 18000 are permanent residents and 600 are the visitors of the earth. We have to find out the volume of the Torus to know how much air need to be created

(b) Volume

Volume of the habitation Torus=Area of cross section*perimeter of the circle

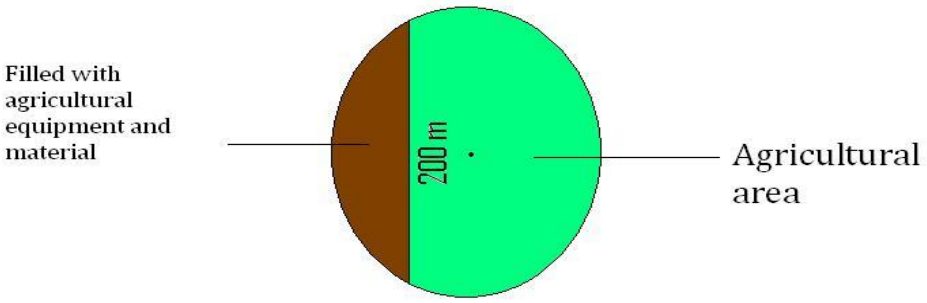
$=\pi r^2/2*2\pi R$

$=3.14*(150)^2/2*3.14*1200$

$=266209200\ m^3$

Therefore, we need to create a volume of 266209200 m^3 of air to live.

AGRICULTURAL RING: In this Ring, all the Agricultural and Agricultural industries will be located as it has large radius. The exterior layer is transparent to pass the sunlight easily. To prevent the gravity



Fluctuations we prefer simple torus filled with soil.

Structural parameters of Agricultural torus as it is simple torus, it has both major and minor radius. Major radius should be 1/8th of minor radius for good stability. Therefore, minor radius=1/8th*960=120(major radius=960)

Determination of surface area and volume

Given diagram refers the cross section of the agricultural torus. Where AC is the base used for agriculture and r is the internal radius. Suppose AC=200m and

OB is the perpendicular bisector of AC.As ΔAOC is isosceles OB also bisects ∟AOC such that ∟AOB=∟COB

ΔAOB is right angled triangle. So,

$AB^2+OB^2=r^2$

$OB^2=r^2-AB^2$

$OB^2= (120)^2-(100)^2$ [where OB is ⊥r bisector.

So, AB = AC

OB=66.33m

Therefore, OB=h=height from base to centre.

Surface area: The major radius of the agricultural torus is 960m[R].this is the distance from the axis to the centre of the cross section. So the total radius from the axis to the base of the torus is

960+66.33=1026.33 m [Ro]

Therefore, lateral surface area=2πRo*AC

=2*3.14*1026.33*200

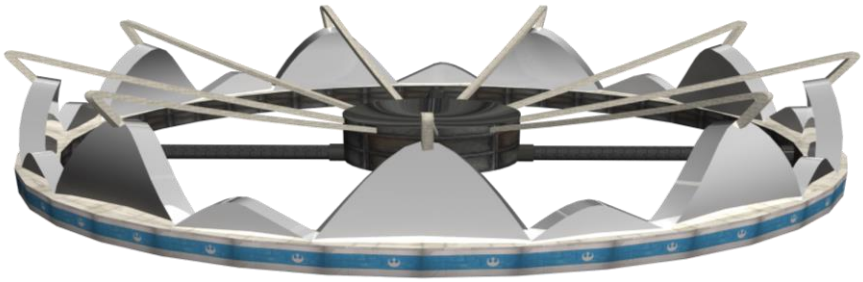
$=1289070.48\ m^2$

Agriculture requires 50 m^2 to feed one person. So, number of persons= lateral surface area/50=1289070.48/50=25781.

The area in agricultural torus provides more food than population in ELPIS. So, there is no problem for food in ELPIS and life sustained is possible for extra 4000 people and visitors also. Agricultural based industries can also be established here.

Industrial Ring

In this torus, all the heavy industries are located. Industries play a vital role in ELPIS because; all the human needs are fulfilled by manufacturing. So that one torus is mainly allotted for industries



Lateral surface area

The major radius of the industrial torus is 304m, which is the distance between the axis and the centre of the cross section. To determine the lateral surface area, the distance from the axis to the centre of the base is used.

$R_0=R+h$

$=304+23.32$

$=327.32m$

Lateral surface area$=2\pi R_0$*base (AC)

$=2*3.14*327.32*60$

$=123334.176m^2$

Zero gravity centres

There are two zero gravity centres in our settlement. One is located near to industrial torus. So it is known as industrial torus zero gravity centre in which all the heavy goods required for industrial torus will be stored. Next one is located near recreational torus so it is known as recreation zero gravity centre. This is used for recreational purposes like zero gravity hotel and other purposes. These zero gravity centres are cylindrical in shape.

DOCKING STATION

Docking station is the place where the space crafts' land. There are two docking stations in our settlement. Upper docking station is used for landing of space craft's whereas lower docking section is used for paring and storing extra vehicles for future references.

Central hub

Central hub is the axis of rotation of our space settlement. The surface of the central industry hub is used for storage purpose. And in it centre lifts are used for transportation. All the spokes of tore are connected to central hub only.

COMMUNICATION CENTRE

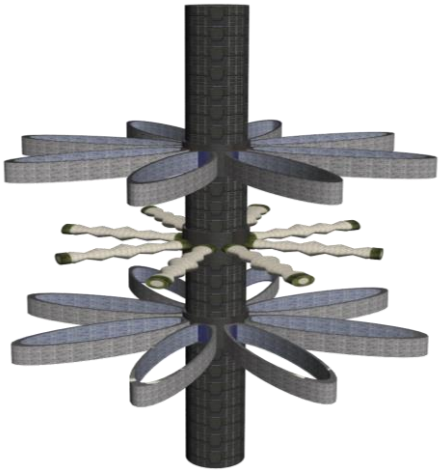
Communication centre is the main controller of communication in ELPIS . It acts as a satellite for ELPIS. If a person is communicating with the person in earth the signals should pass through this communication centre only.

Spokes: Spokes play a major role in transportation. It helps in transportation between the torus.

2.5 CONSTRUCTION PHASE

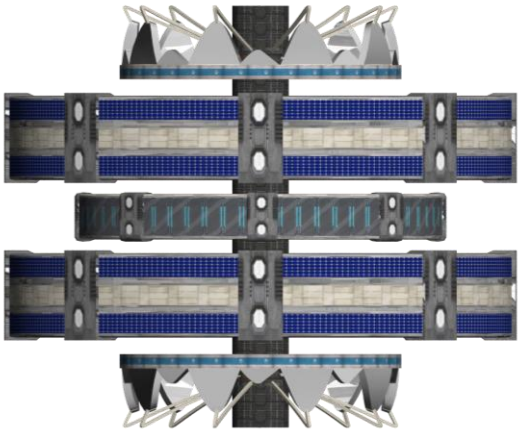
Step 1:- Central hub needs to be constructed as it is the axis of rotation of our space settlement.

Step 2:- constructing the spokes of all the tori.

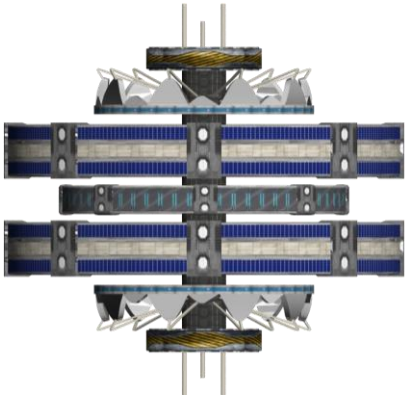


Step 3:- Constructing the Residential Torus and agricultural ring. Constructing the habitation and agricultural tori will take long time.

Step4:- So, industrial and recreational tori should be constructed first. Therefore, workers can stay there.



Step 5:- Docking station will be constructed so that space crafts have space to land and construction can be done faster.



Step 8:- The construction will be completed by placing mirrors at the top and bottom of settlement. The construction of ELPIS will be started in the year 2022 and will be completed in the year 2045.

2.6 MATERIALS REQUIRED

We have used some materials for constructions of our planet .Those are as follows:

KEVLAR: Kevlar is a synthetic fibre. It source is earth. It will protect our planet for getting rid of damages. It protects from solar radiations.

REGOLITH: Regolith is a layer of loose, heterogeneous and superficial material covering solid rock. It includes dust soil, broken rock and other related materials. It is used as affective radiation shield.

LEAD GLASS: It makes the structures transparent. We are using this material in construction of our planet.

CARBON NANO TUBE: Carbon Nano tubes play a vital role on both sides of thermal insulation. We are using this carbon Nano tubes in the third layer in our structure.

TITANIUM: It is used for sealing walls for extra protection for our planet. Titanium is used as a second layer in our construction structure.

POLYTHELENE: Polyethylene is a complex materials that can serve as both effective shielding materials against cosmic rays and solar rays which are coming from the sun. We are using these materials in the construction of our planet.

MINERALS FROM MOON

Moon is the major resource for our space settlement. There are many resources on moon required for our space settlement. All the mineral extraction and asteroid mining is done here. There will be a base to extract the minerals.

HUMAN LIFE SUPPORT

3.1 ARTIFICIAL GRAVITY

Adverse effects of 0 g on humans

- Exposing our body to zero gravity can make the bone to lose calcium through urine.
- Zero gravity environment makes our muscles to lose weight and become weak.
- The size and functioning of heart will be reduced by zero gravity.
- Zero gravity makes our immune system weak.
- Digestion is impossible in zero gravity.
- In zero gravity human body becomes a little taller which causes human spine problems
- Red blood cell content in our body will be reduced.
- All the fluid content in our body will move from legs to head, which causes health problems. Different problems like vomit, nausea and other temporary health effects.

Therefore, it is essential to overcome these effects by creating Pseudo gravity.

Pseudo gravity

Pseudo can be generated by the following methods.

They are

1. Linear acceleration
2. Magnetism
3. Tidal forces
4. Mass
5. Rotation

The best way to produce Pseudo gravity in space settlement is by rotation.

Spinning of the settlement

Spinning of ELPIS will be done by using the technique of couple of forces with the help of thrusters. In this one rope is surrounded the settlement and the thrusters are connected at the edges of the ropes. In order to prevent damage to the settlement, the velocities of the thrusters will be increases gradual.

Value of g in both industrial and agricultural torus is 2.4824 ms-2

Habitation torus Major radius[R] = 1200 m

Acceleration due to gravity[g] = 9.8 m-2

Angular velocity =?

g = R * 2

9.8 = 1200 * 2

2 = 9.8/1200

W= 0.008166

= 0.0903696 rad.sec-1 Time period [for one rotation] = 2π/

= 2*3.14/0.0903696

=69.492 sec

Rotations per minute = 60/2π * 0.0903696 = 0.86340 rpm

TORUS name	Acceleration due to gravity
Habitation torus	1 g
Agricultural torus	0.8g
Recreational and Industrial torus	0.25g

3.2 ATMOSPHERE

Atmosphere is very essential component in our life. It is very precious. So, we have to create atmosphere in ELPIS as it is on earth. It will contain partial pressure of oxygen (PO2) sufficient to provide high enough pressure within the alveoli of lungs for good respiration. It contains enough pressure to respire, preventing the loss of blood cell mass.

Atmosphere components

- Nitrogen percentage in the atmosphere should be 78% and 2.2*106 m3. Source to obtain nitrogen is earth.
- Oxygen percentage in the atmosphere should be 21% and 10.16*105 m3. Source to obtain oxygen is moon.
- Carbon dioxide percentage in the atmosphere should be 0.03 % and 11.12*102 m3. Source to obtain CO2 is earth.
- Argon percentage is 0.09% and 2.2*104m3. Source to obtain argon is earth.
- Hydrogen percentage in the atmosphere should be 0.00005% and 2.44m3 to obtain H2 is moon.
- Other gases percentage is 0.0026% and 63.17m3. Source to obtain is earth.

Creation of artificial atmosphere and its components

Basically, most space colony proposes large, thin walled pressure vessels obtained from the earth and also should be recycled perfectly. Nitrogen in the form of ammonia can be obtained from asteroids and moon.

3.3 OXYGEN PRODUCTION

Photosynthesis

$CO_2+H_2O+sunlight \rightarrow O_2+$ organic compounds

This is produced by cyano bacteria and eventually higher plants- the rest of O2 is supplied to the atmosphere.

Oxygen gas factory

Oxygen gas factory is designed and developed under the BOSCHI technology. Oxygen gas is released from this factory.

Oxygen gas cylinder filling plant

We supply comprehensive range of gas cylinders which are known for its effectual functioning with the incorporation of latest technology in our gas cylinders, we have earned the acclamation of a number of valued clients. In addition, the products are designed according to the client's requirements and are delivered within stipulated time frame.

Oxygen plant

Oxygen plants are industrial systems designed to generate oxygen. They typically use air as a feed stock and separate it from other components of air using pressure swing adsorption (or) membrane separation techniques such plants are distinct from cryogenic separation plants which separate and capture all the components of air. A mature leafy tree produce as much as oxygen in a season that 10 people in hale in 1 year "A 100 feet tree ,18 " diameter at its base produces 6,000 pounds of oxygen for each year. Two mature trees can provide enough oxygen each year for a family of four.

Oxygen consumers

- Chemical weathering through oxidation of surface materials.
- Animal respiration.
- burning of fossil fuels

Oxygen from moon

SiO_2 is most available on moon. By separating Si and O_2 we can get oxygen from moon.

$$SiO_2 \rightarrow Si + O_2$$

Carbon dioxide production

Procedure

- Measure approximately 3 grams of baking soda and place it in a flask.
- Use the pipet; add a few drops of vinegar to the sodium carbonate. Yes bubble will form.
- Light a wooden splint (or) tooth pick with a candle.

- Carefully tip the flask, insert the following splint in to the neck of the flask and observe the effect of gas (CO_2) on the flame.
- Using the candle, re-light the splint and test the gas again.
- The equation for this reaction is

$$CO_3+HC_2H_3O_2 \rightarrow NaC_2H_3O_2+CO_2+H_2O$$

It is simple to operate and maintain ASCO high performance CO_2 generators run from low sulphur content diesel, kerosene (or) natural gas .they are fully automatic and use a low concentration aqueous monoethanolamine solution too efficiently and safely procedure high quality CO_2. The result is lowest possible CO 2 production costs, external plant life and maximum environmental effect.

What happens if CO_2 is increased?

Ten time"s current CO_2 levels are more than 3 doublings, which means definitely more than 6 degrees, temperature increase...

Ways to reduce CO_2 emissions

There are 3 primary methods for reducing the amount of CO_2 in the atmosphere.

- Efficiency and conservation.
- Carbon free and reduced carbon energy sources.
- Carbon capture and sequestration.

Production of N_2

Mahler AGS is the leading manufacturer and supplier of cost effective, safe and reliable gas generation and purification plants for H_2, O_2, N_2, biogas and protective gas.

Chemical generation of nitrogen

Industrial N_2 gas can be produced by either cryogenic fractional distillation of liquefied air (or) separation of gaseous air using permeation. Carlvon Linke devolved the first method the oldest one in 1895. The two most important factors to consider when choosing among nitrogen supply options are the required nitrogen purity and the required N_2 flow rate.

Weather controlling machine

This weather controlling machine plays a major role in controlling weather. It will take the carbon dioxide (CO_2) from habitation torus and it released in agricultural torus. From agricultural torus oxygen will be taken and released in habitation torus. And it also creates seasons. By this it can maintain ecological balance.

3.4 AGRICULTURE

"I don't see future space crews leaving the Earth for long durations without having the ability to grow their own food" -Topham

Agriculture is a very important and essential sector. It provides food to the inhabitants and animals of ELPIS. Apart from food agriculture field also provides some products for industrial use such as cotton, rubber etc. Medicines can be prepared from medicated plants; they also provide oxygen for respiration.

In the absence of food the total space settlement will stop working. Hence a continuous food production and food supply is essential. Cultivation of crops should be fast and production should be high.

Growing of plants:

On Earth plants are grown in soil. But it is difficult to carry soil to our space settlement either from Earth or other planets. So, some techniques are used on ELPIS for growing plants without soil.

Hydro culture system:

It is the process of growing plants in an inert medium with water and odourless fertilizer, other than soil.

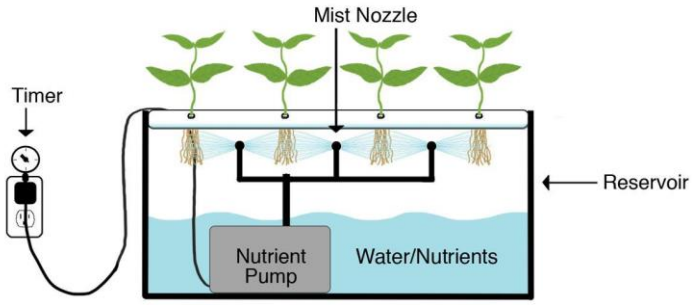
Advantages of Hydro culture system:

- It is clean and easy for growing plants.
- No over-watering or under-watering.
- Only fewer plants lose.
- Special clay particles are used as they are light in weight and easy to handle.
- Repotting is not necessary because special clay particles remain efficient for a long time.
- Daily watering is not required. Once or twice a week.
- Special odorless liquid fertilizer is used instead of traditional fertilizers so that we can enjoy odor-free environment.

In this method of organic hydroponics, organic fertilizer is degraded into inorganic nutrients by microorganisms in the hydroponic solution via ammonification and nitrification. The microorganisms are cultured with a method of multiple parallel mineralizations. The cultured solution can be used as the hydroponic solution.

Aeroponics

The word "Aeroponics" is derived from the Greek meaning of aero (air) and ponos-(labor). Actually, the plants only need: water, nutrients and the sun (for photosynthesis). Soil is just the media that helps hold these elements to the roots of the plants.



Aeroponics is a type of hydroponic system where the roots are not submerged in water, as they are with hydroponics, but rather they are sprayed or misted continually with filled with nutrients. This allows the roots to receive maximum aeration and water at the same time. As far as the plant roots are concerned this is the best way.

Requirements for plant growth:

Hydroponic systems will not compensate for poor growing conditions such as improper temperature, inadequate light, or pest problems. Hydroponically grown plants have the same general requirements for good growth as field grown plants. The major difference is the method by which the plants are supported and the inorganic elements necessary for growth and development are supplied.

Temperature: Temperature is a primary factor affecting the rate of plant development. Plants grow well only within a limited temperature range. Temperatures that are too high or too low will result in a abnormal development and reduced production. Warm-season vegetables and most flowers grow best between 60⁰ and 75⁰ or 80⁰ F. Cool season vegetables such as lettuce and spinach should be grown between 50⁰ and 70⁰ F.

Light: All vegetable plants and many flowers require large amounts of sunlight. Hydroponically grown vegetables like those in a garden, need at least 8 to 10 hours of direct sunlight each day. Special plant-growth lamps are used where sufficient sunlight is not available. The fixtures and lamps however are very expensive and thus used in some areas.

Weather: A vegetable needs either warm or cool weather; crops were sort into two distinct categories: cool season (for spring and fall) and warm season (for summer). Planting in the proper season is the first step to a bountiful garden.

Food storage

Food is stored in huge containers which are dry and provided with ventilation. Required temperatures are maintained for storing fruits, vegetables and grains. Later these will be sent to markets for sale.

Nutrition and food supply

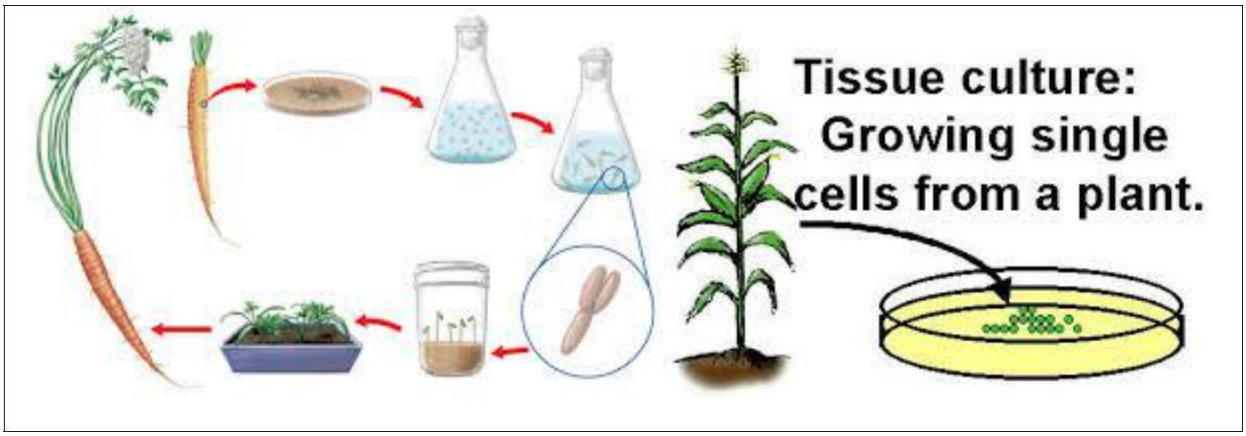
Nutrition is the mode of intake of food by the organism and its utilization by the body. All organisms on ELPIS are provided the best quality and nutritious food. Food comprises of different nutrients which include carbohydrates, proteins, fats, vitamins and minerals. Food provides energy to grow, repair the damaged parts in the body etc. On average an adult consumes about 1 kg of food

per day and burns almost 3000 calories/day. So to feed entire space settlement we need of food per day.

Cloning is the process of producing genetically identical animals or plants. Cloning process prevents the species to extinct up to 5 thousand years. Cloning process will be used in ELPIS to maintain ecological balance. Cloning of different animals or plants in ELPIS makes no necessity to bring the animals from earth. By cloning, new plant species can be created.

Tissue Culture

Plant Tissue culture is yet another technique used in agriculture. By this technique, the cells of good flowering mature plant will be maintained. So the exact copies of good flowering plants can be prepared which helps in more yield of the crop. By this technique matured plants can also be grown faster.



3.5 WASTE MANAGEMENT

WASTE GENERATION:-

Waste generation refers to activities involved in identifying materials which are no longer usable and are either gathered for systematic disposal.

WASTE COLLECTION:-

The waste is collected by means of Nano trucks (which are driven by robots). This waste is dumped at the place which is far away from the living area. There we will separate organic waste and inorganic waste. Organic waste is recycled by means of Eco-digesters and other recycling machines. Inorganic waste is recycled by plastic recycling machines and non-useable waste is converted into useable fuels. We have estimated that each family in ELPIS will give waste up to 5kg and these two machines will clear the waste in3to24hours. For the population of 18,000people we need only 200 eco-digesters", other recycling machines and plastic recycling machines. These recycling machines will keep our settlement neat and clean.

RECYCLABLE METHODS OF ORGANIC WASTE The recyclable methods of organic waste are:-

1. Eco-digesters
2. Other recycling machine.

CONVERTING OF WASTE INTO USABLE FUELS:-

Non-recyclable waste is converted into usable fuels through a variety process. This type of source of fuel is renewable fuel source as non-recyclable waste can be used over and over again to create fuel. The easier method of waste management is to reuse the old materials like jugs, bags, repairing broken items rather than buying new ones, avoiding use of disposable products like plastic bags, reusing second hand items and buying items that are made up of less designing, recycling and composting a couple of the best methods of waste management.

3.6 WATER MANAGEMENT

There must be enough water to sustain life and to maintain proper sanitation so; there should not be any water scarcity. Water is one of the basic and most essential requirements for the human life and also for the living life. Water helps us in many ways:

1. It helps in the digestion of food. It helps in transporting all the nutrients to the body. It also removes the waste materials from our body. It helps in maintaining the temperature of our body. It helps the food to move easily in the digestive tract. So, water is an essential component in our life. Not only for the human survival, has it also helped for the survival of plants and animals.
2. We should not waste the unwanted water obtained from plants etc…, and should manage them.

SABATIER PROCESS:

In the Sabatier and the Bosch processes water will be produced. Let us see the Sabatier process:-

$$CH_4+4H_2 \rightarrow CH_2+2H_2O$$

When 0.222kg of hydrogen react with 1.222kg of carbon dioxide gas it gives out methane which is used as a fuel in air craft‟s and in other purposes.(industrial etc...,) Initially, water will be taken from the moon in the form of ice. We will melt ice by using solar energy. In the settlement water will be constantly recycled. Plants and animals eliminate water by breathing and excretion.

$$C_6H_{12}O_6 \rightarrow 6CO_2 + 6H_2O$$

Starch is decomposed in to carbon dioxide and water Excess humidity in the air need to be condensed and the water will be recycled.

Aboard the shuttle orbiter water is generated using a hydrogen-Oxygen fuel cell which produces both electricity and very pure water. Water can also be produced by reduction of CO_2 by hydrogen over a suitable catalyst. The Sabatier and Bosch processes are two Carbon Dioxide reduction systems which have been studied extensively. Production of water by the Hydrogen Fuel cell

$$2H_2 + O_2 \rightarrow 2H_2O$$

Production of water by the Sabatier reaction.

Current technology for the reduction of Carbon Dioxide to produce water aboard the ISS is embodied in the Sabatier reaction.

$CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$

For each mole of CO_2 reduced in this system to produce two moles of Hydrogen and one mole of Methane and Methane is taken to the container.

For this reason only, half of the hydrogen is consumed in this reaction and can be recovered by the Electrolysis. The Sabatier reaction utilizes an alumina supported ruthenium catalyst in comparison to the Bosch reaction has the advantage of greater thermodynamic favourability and higher reaction rates.

Production of water by the Bosch reaction

The Bosch reaction produces water and element carbon allowing all of the hydrogen to be recovered by electrolysis. This makes closer of the oxygen-CO_2-water loop possible.

$CO_2 + 2H_2 \rightarrow C + 2H_2O$

The net reaction produces heat 2.3×103 joule/gram of carbon produced at 6500C and it is the result of two successive reactions one fast,

$CO + H_2 \rightarrow H_2O + CO$

And a second rate controlling slow reaction.

$CO + H_2 \rightarrow C + H_2O$

Water storage

For storing this large amount of water, we need large space. We will store this water in the central hub. Through strong metallic pipes, we will supply this water to tanks in habitation torus and agricultural torus.

Recycling of water

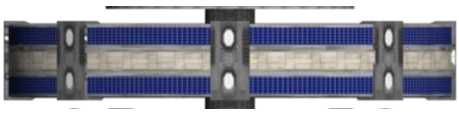
The drainages of houses are connected to some purification plants. There the drainage water will purify and again send for desalinization for better purification. The purified water will send to houses and the wastewater will send to agricultural torus to get more fertility to plants.

3.7 ELECTRICITY

Electricity plays an important role for completing our work in an easy and faster way. Electricity can also fulfil the human daily needs. Electricity production will be high on ELPIS to fulfil all the needs of people. Solar photovoltaic cells are used as a primary producer of electricity in our space settlement as it has many advantages. The advantages are listed below:

- It provides abundant energy.
- It provides clean and green energy.
- Sunlight will be directly converted into electrical energy through photoelectric effect.
- Energy production, distribution can be done in an easier way. Photo voltaic cells are more durable and efficient. They are less expensive when compared to other solar cells.
- As the settlement is located near moon which has high silica helps in easier manufacturing of solar cells.

By observing the following advantages photo voltaic cells has the ability to fulfil the electrical needs of ELPIS.



Sun produces an average power of 3.86*1020 Mega watts in second. So we can get sufficient energy from the sun. The PV solar cells can produce electricity of 120 watts m-2 and the total surface area of our space settlement which produces electricity is

2260800 + 123334.176 + 123334.176 = 2507468.352 m2

The total electricity produced in our settlement is

=120 * 2507468.352

=300896202.24 watts.

This power is more than we required. Therefore, this extra energy needs to be stored.

Storage and Distribution

There are four spokes in every torus that divides the torus into four sectors. In each sector, there will be one huge battery, which can store 10-mega watt power. These batteries are connected with underground pipes. The electricity produced by the solar cells will be transported to batteries through these pipes.

The energy in the batteries is transported to transformers, which are present in all streets of ELPIS. These transformers will distribute electricity to every house at that particular street. These transformers supply adequate power, remaining power will be stored in the huge batteries. This process will be same in both recreation and industrial torus. Solar panels will be located inside the agricultural torus, covering the exterior of torus may cause disturbance to plants for sunlight. The solar cells to produce electricity will use the light reflected by the reflectors.

3.8 RADIATION PROTECTION

In space there are many harmful radiations which are precarious to human beings. So it is essential to protect the residents from space radiations.

The harmful radiations are as follows:

1. Cosmic rays
2. Gamma rays
3. X-rays
4. Neutron particles
5. Beta particles.

People of the ELPIS should be protected from these radiations. The solution to this problem is covering the settlement with different layers. Cosmic rays can be stopped by using high hydrogen content a material Polyethylene has high hydrogen content. Gamma rays can be reflected by using Lead. It is also used to protect from X-rays and other radiations. Aluminum and Lunar regolith can stop the neutron and beta particles.

Electro Magnetic Shield

Earth has no radiation shielding as it has atmosphere and also it has magnetic field which reflects the radiations and other particles. Inspired by this idea, the electromagnetic insulated coils will be used in our settlement. When the current passes through the coil, the electrical energy changes into magnetic energy and reflects all the harmful radiations. As our settlement is mostly made of metal electricity will be easily passed. So insulators will be used at the place where insulated coils are used. So our settlement is completely protected from radiation.

Thermal stress

In space, sun continuously releases heat and light. Along with radiations heat was also hazardous to the people. So people need protection from thermal stress. Thermal stress can be overcome by covering the settlement with thermal insulators. The main thermal insulator is Aerogel. There are different types of Aerogel in which silica Aerogel is used as thermal insulator in the form of layers. It has melting point 1200°c and density 1000 gm-3. It has Guinness record for the best thermal insulator. This material is included in the layer of radiation shielding materials.

Therefore Aerogel can protect the ELPIS from harmful thermal stress

OPERATIONS AUTOMATIONS

4.1 TRANSPORTATION

Transportation is important for any space settlement coming to the transportation in ELPIS ; the vehicles used in our space settlement are same as earth but modified and modernized.

There are three kinds of transportation in our space settlement

- Transportation inside the torus
- Transportation between the tori
- Transportation between the settlement and outer Space.

Transportation inside the torus

a) Eco-Tech cycles

These cycles are the main source of transportation in habitation torus. These cycles have a special feature that it will purify the polluted air and make it into fresh air. It also has a LED screen for route map and GPS.

Courtesy By: Google

These all features run with electric batteries which can be recharged. We promote cycles in our space settlement as they provide excellent exercise to our body. It ELPIS , almost all the people will use these cycles.

Electric cars: Electric cars are suitable for family members. It doesn't cause any pollution to the environment. It is also suitable for travelling long distances.

Local trains

Local train is used by all the people in the habitation torus. This train takes 21 min to cover the habitation torus. It is also used for transporting goods and it is also weight less. It can accommodate 54 persons per car. Depending on the time and situation cars will be added or removed.

Transport between tori

Transportation between the tori is possible through spokes only. Using vehicles in spokes is not a good idea. The better idea is using elevators (lifts).

Commuter's lift

These elevators are used by the daily residents between tori. These lifts are extremely large so that passengers can keep their luggage also. This lift's special feature is, it is gravity adjustable. So passengers may not feel gravity fluctuations while moving in elevators. Its speed is just 2.5m/s.

Merchandise lift

These lifts are used to transport the goods between the tori. Its maximum speed is 4m/s. ELPIS has fast transportation due to its numerous spokes. If a person in residential torus wants to go to industrial torus, he will go through upper spoke lift. If he wants to go to recreation torus, he will go through lower spoke lift.

Transportation between settlement and outer space Swift:-

It is the super-fast passenger space ship which helps in transportation between ELPIS to earth. It moves with velocity of 14.74 km/s. It can accommodate nearly 500 people. It brings visitors from earth and also ELPIS residents to earth.

4.2 COMMUNICATION

Space craft has a transmitter and a receiver for radio waves. As we all know that sound cannot travel through space (vacuum). But visible light and electromagnetic radiation can travel.

External communication

The upper communication wheel is used as external communication wheel. As DSN (deep space network) is best communication method, we are using this communication between earth and ELPIS . Totally three antennas will be there around the earth to communicate with ELPIS . These are large dishes which are steerable, parabolic reflectors.

Steps for how DSN works

- ❖ It receives telemetry data from ELPIS .
- ❖ It tracks the position and speed of ELPIS .
- ❖ It receives science data from ELPIS .
- ❖ It monitors and it controls the performance of DSN.

Laser communication

AS light travels much faster than sound laser communication has now become as backbone for communication in ELPIS . In laser communication the voice is converted into electric pulses and then it converts into a light beam. This light beam is received by the receivers on the ground. This process goes on and then reversed. Laser communication systems are wireless connections through atmosphere. They work similarly to the fiber optic links; encept in laser beam is transmitted in free space. Parts needed for Laser communication components needed for one channel are Laser dioxide, photo resistor, 2 op-amp, transistor, 12reistors, 3 capacitors, 2 nine volt batteries. For lab equipment or forecasting multi meter, Function-generator (optimal), oscilloscope (11).

Internal communication

For ELPIS we are using different types of communication. Internal communication is very important because without communication we can"t tell

anything to anyone. So we are using fast and best network. We are using high-tech mobiles for fastest communication.

We are distributing free mobile phones to everyone in ELPIS. There are some telephones to communicate with earth.

INTERNAL REFLECTOR OF LIGHT

Along with mirrors, Prisms are also good reflectors of light. Mirrors reflect at only one place. But prisms reflect all the area around itself. So prisms were used. These prisms are present in central hub. These prisms surface is "hammered style" texture which is excellent reflector of light [nearly 98%].So the problem of light in ELPIS is completely solved. Along with this artificial interior lightening is also required.

Day and night occurrence: It is important to create day and night cycle to create earth like environment. There are two reflectors at the top and bottom of the settlement which are inclined with an angle of 450.

4.3 EDUCATION

Excellent foundation of the society is possible through quality education. Schools in the ELPIS provide good basement to future of children. The education system in the ELPIS is central and integrated.

All schools will be run by ELPIS government and provides many facilities to the students. It is not better to use automated robots for teaching, as the robots cannot teach human values effectively like normal humans. Therefore, the teaching staff will be normal humans.

Courtesy By: Google

Education system

Parents can join their children in school at the age of 5 yrs in first standard. There are three types of schools in our settlement

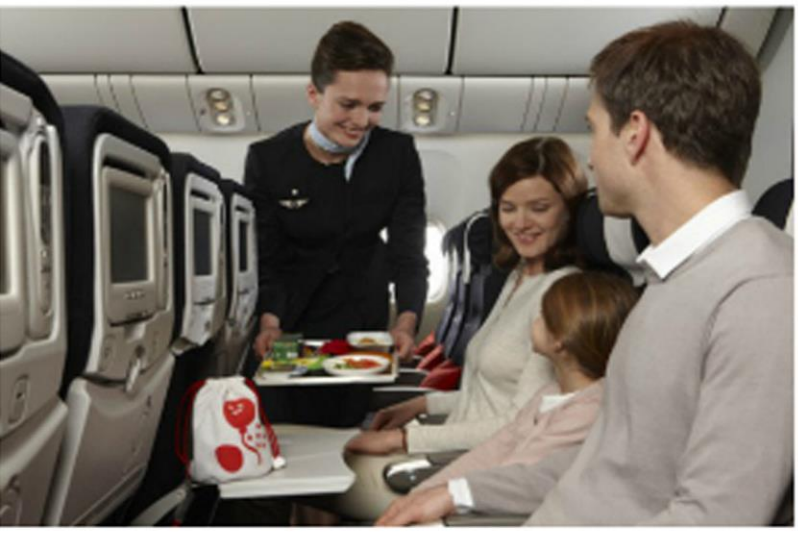
- Primary school [5 to 10 yrs]
- High school [11 to 16 yrs]
- Intermediate school [17 to 18 yrs]

After completing the education in these three schools, Students can join in the particular universities in which category they are interested. All the facilities will be provided by the ELPIS schools for students to complete their education and settle in their jobs.

Facilities

Specially trained, top-class Teachers will explain to the students by using modern technologies. This will raise interest in students to learn new things. Every day two hours will be allotted for playing games to provide excellent exercise to the students. Digital education system will be implemented. In other words paperless, strain less and modernized education. All the content will reach directly into the children‟s brain.

Lunch, Books, laptops will be provided by the school itself. During the student‟s education, teachers will observe their behavior, interest and suggest students to choose right career. Government will pay fee for students who have passed high school education. In this way the schools in our settlement will mould the student‟s future in a bright way.



HUMAN LIFE DESIGN

5.1 RECREATION

As humans need relaxation, entertainment facilities, restaurants etc. If recreation is not there for humans it leads to serious behaviour disorders. For this we have a solution. In ELPIS we have constructed parks, restaurants, water parks etc.

PARKS

In ELPIS we have 5 main parks in recreation torus with many trees, beautiful flowers, lakes etc. These parks will refresh our mind. Artificial sky is also available in these parks. Each park is about 100m to 200m of length and 30m of width.

GAMES

We know that games are two types.

- Indoor games
- Outdoor games

INDOOR GAMES

For playing indoor games like chess, caroms, pool master etc. We have a big games hall. In that all games are situated.

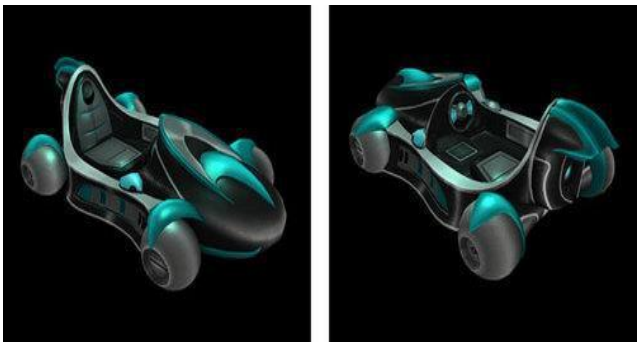
Courtesy By: Google

OUTDOOR GAMES

In ELPIS so many people show more love towards games like Cricket, Golf, and Tennis etc. So we have constructed „multipurpose grounds". These multipurpose grounds are used to play games like Baseball, Tennis and Cricket according to the schedule.

MOVIE THEATRES: - In our recreation torus we are interested to put movie theatres because in future generation many people want to see movies in theatres only rather than seeing movies in CD"s. So we have constructed movie theatres. In one movie theatre 150 members can see the film at a time. There are 5 theatres in this recreation torus.

The tourists who will come to ELPIS will definitely come to recreation torus. And they usually like racing games. So we have constructed galactic racing. Half of the torus will be the track for this galactic racing. The track will be very smooth for the racing purpose.



Racing bikes used in racing purpose.

RESTAURANTS

Restaurants are mainly automated in this torus. When we enter into the restaurants they will scan our body and then only they will give permission to enter in to the restaurant. After entering they will give one pass. When we want to go out we need to show the pass to the security system. Otherwise we can"t go out. Here robots will serve the food and all.

PLANETARIUM: - The tourists who come to recreation torus want to see planets stars etc. So we have constructed this planetarium. Here we can see all stars, planets etc.

ELPIS planetarium

RECREATION IN RESIDENTIAL TORUS

Recreation torus is a fully equipped one. All the people cannot go there regularly. So, we have constructed recreation in residential torus. Small recreation facilities are present in this torus.

Health Care

Maintaining Proper health is very essential to complete our daily works. So ELPIS has fully equipped and modernized hospitals.

There are 19 hospitals located in ELPIS in which eight are located in habitation torus, 3 hospitals are located in both recreational mad industrial torus and 5 hospitals are located in agricultural torus. All hospitals are multi-specialized hospital with 24 X 7 ambulance service. These hospitals have many facilities.

depend on cow for milk, curd, ghee etc. If any cow was unhealthy, all these products will be stopped. Therefore, veterinary hospitals are very important. There are five veterinary hospitals in our settlement in which three are located in agricultural torus and two are located in habitation torus.

5.2 MAINTENANCE

Maintenance of the settlement is very important to provide comfort, safety to the residents and to protect the settlement from failure. ELPIS employs many people and use robots in maintaining the settlement.

Maintenance in the tori

1. Cleaning group: This group cleans and maintains the habitation torus. They collect the waste from every house and send this waste to waste- treatment group. They clean the floors of houses, hospitals, publics place etc to maintain hygiene. They also help in proper sanitation. They maintain the surroundings of settlement very cleanly.
2. Edifice group: This group constructs the buildings and repairs the houses, shops etc. They use modern technology in construction so the construction of any building will be completed in just few days.
3. Machinery and Automobile group: This group repairs all machinery in industries, equipments in recreational torus and other daily technologies of the people. This group also repairs vehicles, local trains and lifts.
4. Automated structural group: This group consists of robots, which maintains the exterior of the settlement. This group also maintains the zero gravity centers of the settlement.
5. Outer space group: This group takes care of all the tasks, which are out of the settlement. Examples: Asteroid mining, extraction of minerals on moon etc.
6. Transportation group: This group helps in transportation of the people. Example: Cab drivers, lift operators, local train operators etc. They do not take fare from the people and the government of ELPIS will pay them salary.

Group Name	Name of the employed
Cleaning group	200
Edifice group	500
Machinery and Automobile group	300
Automated structural group	100 [robots]
Outer space group	150
Transportation group	100
Checking group	25
Human rights protection group	35
Public protection group	55
Health protection group	25
Safety Protection group	45

5.3 GOVERNMENT

CONSTITUTION:-

The constitution of our settlement will follow the democracy, equality and fraternity (brother hood). Every single person on ELPIS shall be given the equal right and also serve every person"s self respect. We promise no mistakes will be happened in the government such as corruption etc. We will arrange sufficient number of police officers for controlling the fights etc.

PREAMBLE:- We the people of ELPIS want to build a social and democratic government but not a monarchy one. We will protect the dignity of humans of our settlement. We never encourage the activities that may harm the beautiful

and lovely environment of ELPIS . Not only harming the environment but also harming each other.

LEGISLATIVE:-

Every colony of our settlement will be divided into some constituencies and residents of each constituency will elect one member. The members of this government will have 5year tenure in the government .So; these people who are elected will be used to control the people and their activities.

EXECUTIVE:-

It will have police forces in it and also high post official. Any person who does the crime will be arrested by the police officers. With some of the population we have to create police officers and high post officials.

JUDICIARY:-

There will be only one court in our settlement. Any one 40years of age can write exams for being a judge. This judge can be in the government up to 50years. Then any other will be a judge. For lawyer minimum age is 35years.

Residential Facilities

ELPIS has the population of 18600. Therefore, in residential areas the houses should provide shelter to 18600 people and another 2000 people. Coming to the residential facilities, the facilities should be in such a way to provide comfort to the residents.

5.4 RESEARCH AND LABORATORIES

A laboratory is a facility that provides controlled conditions in which scientific or technological research, experiments and measurement may be performed. Laboratories play a vital role in our settlement. They are very necessary to continue the existence of humans in space. They also help in improving the conditions of our space settlement. All researches and experiments will be held in laboratories. Hence they are very essential even for inventing new things. There are many kinds of labs located on our space settlement.

- Metallurgy labs
- Bio-physics and micro g-labs

- ❖ Agricultural and plant & biotechnology labs
- ❖ Radiation labs
- ❖ Astronomy labs
- ❖ Pharmaceutical labs

Laboratories on ELPIS are not restricted to a particular place.

They are present in many parts depending on their use.

For example, metallurgy labs are present in metallurgy tori. All the materials imported from asteroids, moons etc are tested in these labs and the report of metals will be sent for separation. All the labs are provided with sophisticated equipment. Even the required conditions like temperature, gravity are also maintained.

5.5 AGE DEMOGRAPHY:

AGE	NO. OF PERSONS
CHILDREN (0 - 12)	3000
TEENAGERS (13 –20)	4000
ADULTS (21 – 45)	9000
OLD PEOPLE (46 – 70)	2000
VISITORS	600
TOTAL	18,600 PEOPLE

Existence of industrial operations on the space settlement is very essential .The industries in ELPIS should include all kinds of industries. The Human life mainly depends upon the industries. The every object that we use is made in industries. Industries play a vital role in our life. Industries make our work easier. So, to facilitate the people of ELPIS we separately arranged an industrial torus.

5.6 TYPES OF INDUSTRIES:

1) Pharmaceutical industry

Among all the industries pharmaceutical industry is very important and plays a vital role. For everyone health is very precious and versatile. So, giving more priority to P.I (Pharmaceutical industry) gives us the best result. Being healthy is a foundation for economic development and essential to a good quality of life. We want to prepare medicines for general health problems like: fever, cold, cough etc…, and also for the complicated health problems such as, cancer, HIV, virus, etc…, In situations where the right to health is not being effectively fulfilled, due to the nature of its responsibility to contribute, in particular, to improving access core business, the pharmaceutical industry has a special to medicines.

Glass industry:

The importance of glass in our day to day life cannot be avoided or ignored. Without the manufacturing of glass, there could have no lights to switch, as they are used from bathroom to the living room and from theatres to the social venues. All the screens of T.Vs and entertainment systems like computers, laptops, tablets etc…, are made of glass. Our spectacles and lenses are also made of glass. Apart from these all glass manufacturing also plays an important role in our economy. In our homes glass is used as reflector of sunrays that makes us safe. Glass is also used in microscopes. Glass is obtained by melting sand at high temperatures with other materials and cooling it rapidly.

Textile industry:

Textile industry is nothing but production of clothes. Production of clothes artificially and naturally can be done by using raw materials like plants, chemicals, resins etc…., we

can prepare the clothes that can be used by farmers while applying pesticides and also used in covering the plants etc.., in building we can the textiles to insulate them from heat and cold. In preparing the artificial organs like heart, kidney etc.., and prevent the spread of bacteria. In the sports hockey sticks, fishing rods and more can be prepared. The textiles are also used in preparing tooth brushes, combs, book bindings, artificial flowers as such materials

Telecommunication industry:

Telecommunications provides a technological foundation for societal communications and the Telecommunications provides vital infrastructure for national security. The communication instruments like cell phones and telephones help us to interact with the people around us. These can be prepared by using some metals and materials. It can be widely used in our life and now-a- days communication between people became common and important. So, telecommunication is needed.

Mineral industry:

Mineral resources have a wide variety of uses and plays a huge role in our lives Minerals is important to our health. We need small amounts of a wide variety of minerals. Which include Calcium, Phosphorus, Sulphur, Copper, Fluoride, Iron, and Zinc. Minerals are ingredients in almost all of the products we use from fertilizer to plastics, from toothpaste to kitty litter, from knives to plates Minerals also play an important role in the processing of materials. Barite is important in oil drilling. Fluorite is important in making steel. Barite Used in oil drilling to weigh down the oil and prevent gushers (high specific gravity), filler in paint, glass, toothpaste. Chert Used to make stone tools. Used as fill to provide a stable base for roads (insolubility). Copper is used to make electrical wiring (electrical conductivity). Gypsum is primarily used to make wallboard. It is also an ingredient in cement. Phosphate is used as a fertilizer and to make phosphoric acid which is a major ingredient in food products such as cola drinks. Sandstone is used as a building material.

SCHEDULE

& COST

6.1 COST

Name of the component	Quantity	Cost per quantity	Total cost
CENTRAL HUB			
Cylinder	1	118million /unit	118million $
Docking section	2	48 million/ unit	96million $
Communication centre	2	2500000/ unit	50million $
Zero gravity centre"s	2	4200000/unit	84million $
Residential spokes	8	18millions/unit	144 million $
Agricultural spokes	4	12million/unit	48million $
Industrial spokes	4	7million/unit	28million $
Recreational spokes	4	7million/unit	28million $
Clamps connected to central hub	5	3.5million/unit	17.5million $

Light reflecting mirrors	2	1.5 million/unit	3 million $
HABITATION TORUS			
Construction[interior and exterior]	-	25689875 451 $	25689875 451 $
Radiation Shield	7	15million	105 million $
Solar panels	100	1.2million / unit	120million $
Transportation	1500 vehicles	20000$/vehicle	30000000 $
AGRICULTURAL TORUS			
Construction[interior and exterior]	-	17023945123 $	17023945123 $
Soil	1200000 kg	230 $ /kg	276000000 $
Resources and minerals	-	-	12million $
INDUSTRIAL AND RECREATIONAL TORUS			
Construction of torus	2	8125468964 $	16250937928 $
Interior Construction	2	1532489203 $	3064978406 $

Machinery in industrial torus	-	142 millions	142 millions
Equipment in recreational torus	-	175million	175million
SALARIES			
Engineers	500	100000/year	3500million $
Construction Workers	200000	30000 $/year	42000 million $
Other workers	-	-	3500 million $
Financial Advisors	1000	100000 $/year	250 million $

COST ESTIMATION

Cost of the settlement= 112,756,236,908 $

Additional Unknown cost = 120000000 $

TOTAL COST OF THE ELPIS = 112,876,236,908 $

CONCLUSION

- ELPIS will be located at the lagrangian point L4
- ELPIS construction will be started in the year 2034 and will be completed in the year 2107.
- The basic structure of the space settlement is torus. In terms of mass all the structures takes 4 times mass more than that of torus.
- The main sources for settlement are extracted from the two asteroids: (436724)2011 UW158, (308635) 2005 YU55, moon and most important elements from earth.
- There are two zero gravity centers which are used for storage purposes and two docking stations for proper landing of spacecrafts. There are two communication wheels in which one is used for internal and another one is used for external communication.
- The capacity of ELPIS is 22,000 in which 18000 are permanent residents 600 are visitors from earth and remaining is left for future reference.
- In human life support system, Atmosphere, agriculture, industries and recreation is essential in orbital space settlement. So a separate torus was allotted to fulfill those needs.
- Weather controlling machines play very important role to control the components of the atmosphere in all tori.
- Settlement will be fully protected from radiation and thermal stress by using protective layers and electromagnetic field.
- ELPIS has fastest and easiest transportation. Many Eco tech cycles are used to control the pollution.
- There are eight types of squads to maintain and protect the settlement.
- In agriculture, hydroponics, Aeroponics, organic hydroponics and soil are used and also maintained by using automated robots.
- In ELPIS government, Legislative, Executive and judiciary systems will be followed.

- ELPIS will be illuminated by strong and efficient plane mirrors and prisms are used and are controlled by sensors.
- Industrial torus has all types of industries which is back bone of settlement and its economy.
- There are many recreational facilities in recreational torus which for human relaxation.

BIBLIOGRAPHY

www.nss.org

www.nasa.gov

http://www.nss.org/settlement/nasa/75SummerStudy/Table_of _Contents1.html

http://settlement.arc.nasa.gov/designer/tables.html

http://www.physics.montana.edu/faculty/cornish/lagrange.pdf

http://www.nasatech.com/briefs/nov00/msc22957.html

www.rso.cornell.edu/scitech/archive/97sum/plants.html

http://lifesci3.arc.nasa.gov/SpaceSettlement/designer/sphere.ht ml

http://physics.bu.edu/~duffy/py105/Rotationalkin.html

http://en.wikipedia.org/

http://en.wikipedia.org/wiki/materials_science

http://en.wikipedia.org/wiki/moon

http://en.wikipedia.org/wiki/coriolis_forcehttp://www.spacefutu re.com/

http://lifesci3.arc.nasa.gov/SpaceSettlement/75SummerStudy/ Design.html.