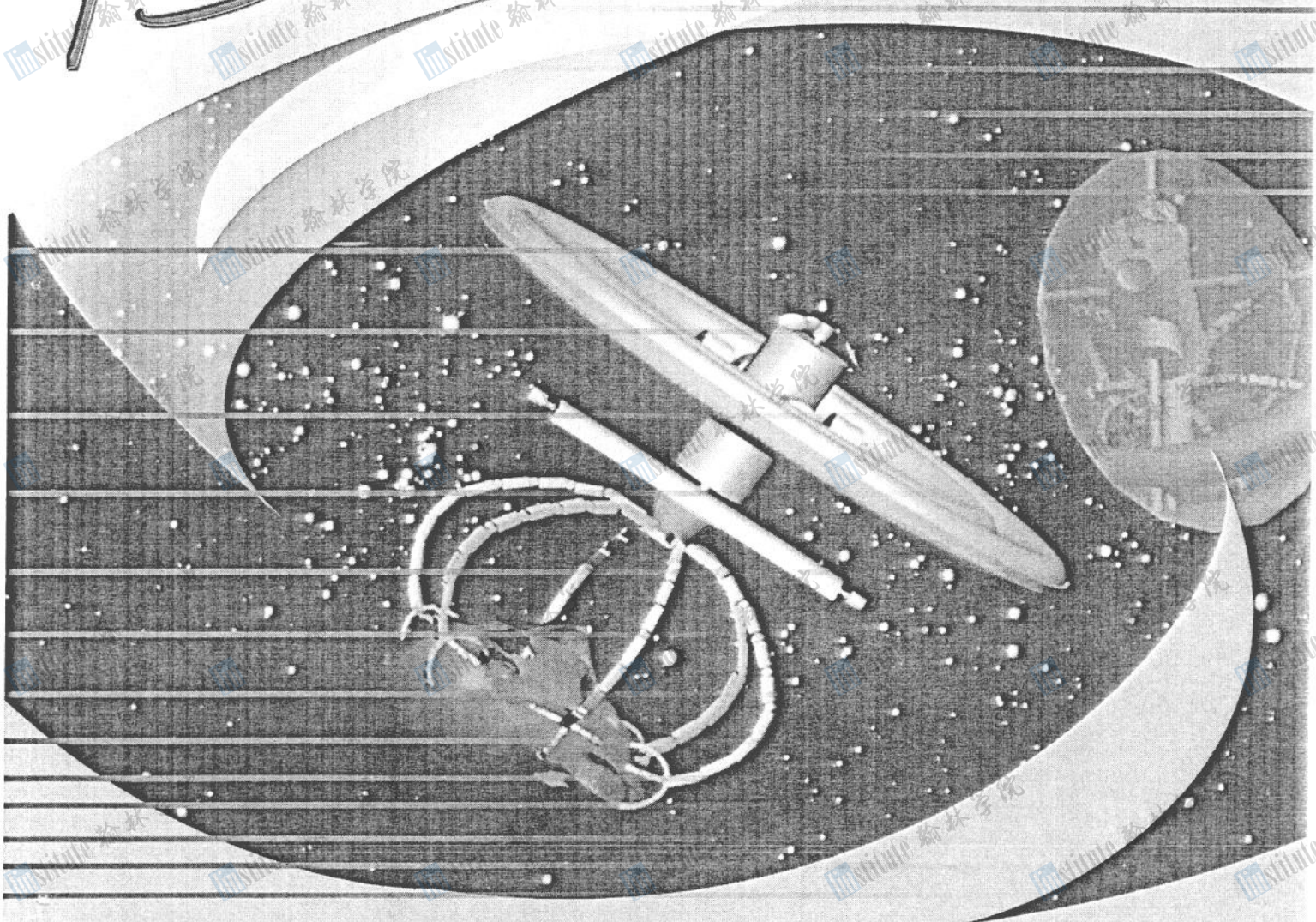
Bellevista



Submitted By:-

INDIVIDUAL REGISTRANTS TEAM - A

Executive Summary

In response to FOUNDATION SOCIETY Contractors' request for proposal for the second space settlement community in Earth Orbit, our company lays bare BELLEVISTAT. We present the design, development, construction & operations planning of the settlement, the name of which is loosely translated as "beautiful view".

This as envisioned by 'THE FOUNDATION SOCIETY' will serve as a centre for on-orbit refining of extra-terrestrial materials & zero-g heavy manufacturing. It has virtually been labeled as a 'rust belt of space'.

This proposal is basically divided into following sections dealing with different but integral components of any space venture viz. Structural Design, Operations & Infrastructure, Human Factors, Automation Design & services, Schedule & Cost and Compliance Matrix.

Structural Design deals with the basic outer & inner structure of the settlement. Artificial gravity will be generated in the settlement by the centrifugal force as a result of rotation of the settlement. The structure has been so designed keeping in mind the stability & security it offers given the fact that this is the most imperative pre-requisite for any construction in the frontier of space. Alongside the structure lends protection from radiation & a great living experience as it is spacious.

Innovative community plans & residential designs boast of proper allocation of areas based on scientific studies according to their utility & human comfort. Systems have been so chosen that they are hassle free, efficient & require minimum of resources. Maximum care has been taken to decide the food products- their production, storage, distribution & consumption. In all BELLEVISTAT has all those attributes which will make it a cherished dream for its residents.

Automation Design & Services assumes significance as the society is going to be a highly automated one. All the processes right from construction to maintenance, repair etc will be managed by robots controlled by the Control Centre. Contingency plans are well planned out in case of any system failure. Efficient, fast & reliable networking is planned for effective functioning of systems. The distinguishing feature of this section is the proper nomenclature that has been provided for the automation robots.

Schedule & Costs lay out the entire schedule for the construction & the total costs that have been reached after taking into account the minutest of detail. We are proud that we have been able to strike the fundamental balance between expenditure & quality.

Business Development deals with the commercial aspect of the settlement. Stress has been laid, understandably, on the dynamic nature of the various commercial & industrial ventures and hence due cognizance has been attained on the flexibility to add compatible business types with little configuration change.

Compliance Matrix includes the requirements of BELLEVISTAT & the part of the proposal that deals with it.

We would like to conclude by thanking 'THE FOUNDATION SOCIETY' for making us a part of this highly esteemed & coveted project. We sincerely hope that our proposal will satisfy the demanding requirements of 'THE FOUNDATION SOCIETY' & we'll be deemed competitive enough to be a permanent part of this historical endeavor.

2.0 STRUCTURAL DESIGN

Rationale for selection of Structure:

Torus- Maximum utilization of minimum area provides a constant value of **artificial gravity** and **long line of sight** all along the down surface.

Cylinder- Provides easy sub-divisions for various industrial and other purposes.

Semi- Cylinder- Provides a **flat (horizontal) surface** for mounting shock absorbers and robotic arms required for capturing and holding the asteroid.

Cylindrical Hubs- Provide easy **sub-division** and down surfaces for **variable gravity.**

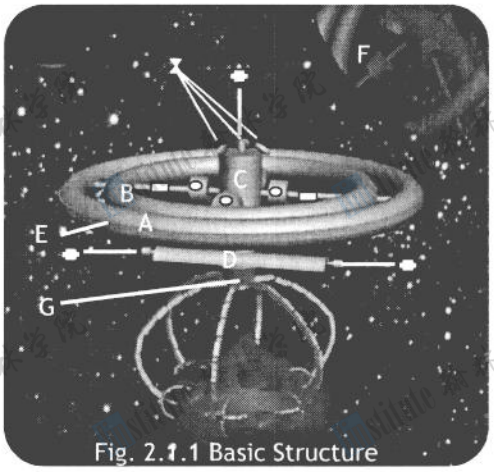


Fig. 2.1.1 Basic Structure

DESIGN FEATURES:

1. **Variable** magnitudes of **gravity** are provided for various purposes.

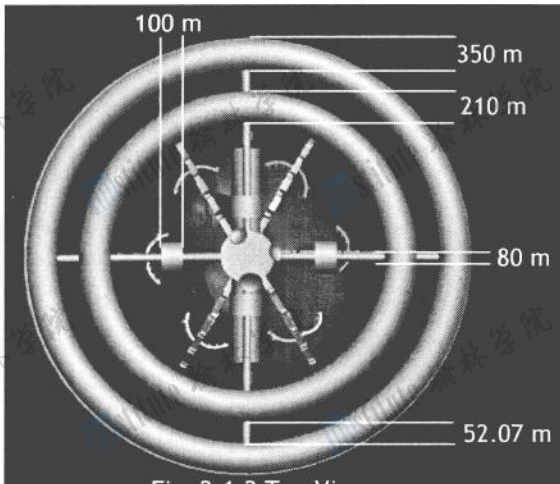


Fig. 2.1.2 Top View

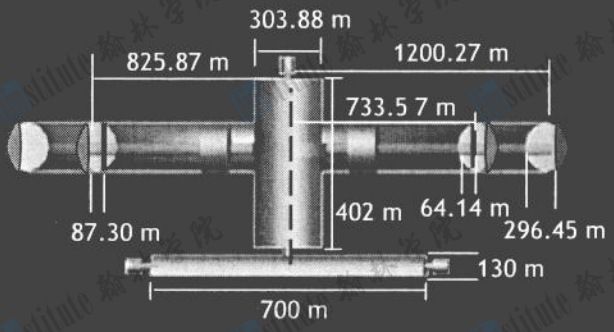


Fig. 2.1.3 Cross- Section View

2. **Industrial and mining regions** have been set up quite **away from residential area** to prevent harm to the residents in case of an accident.
3. For storage and asteroid related tasks, separate **semi cylinder** has been provided.
4. Efficient automated **robotic arms** have been incorporated for asteroid holding.

2.1.1 BASIC STRUCTURE

Table 2.1.1

	COMPONENT	DIMENSIONS(m)	Available Area (m^2)	Available Volume (m^3)	UTILIZATION
A	Residential Torus *	Major radius =1078.79 Minor radius =175	1900000	687750700.80	Provides resident's accommodation
B	Agricultural Torus *	Major Radius =774.43 Minor Radius =105	1330000	190817590.10	Area for growing Food and fodder
C	Central Cylinder **	Radius=151.94 Height=402	540000	26662500.00	Focal point of all activities
D	Semi Cylinder	Radius=65 Length=700	91000	4645630.14	Industrial storage, mining & refining

E	Solar Panel Strip	Length=7877.79 Width=70	551445.64	----	For absorbing solar energy for power generation
F	Mylar reflector	Inclination=45^0 Radius = 1400	6157521.60	----	For reflecting sunlight for day night cycle
G	Shock Absorber Frustum	Lower Radius =50 Upper Radius =25 Height= 60	Lower area =7853.98 Upper area=1963.50	274889.34	For absorbing vibrations caused during asteroid holding
●	Hubs (4)*	Radius=76.44 Length=100	26600.02 & 39900.03	2639341.75& 2612148.53	For recreation and research work
▬	Spokes (4)	Radius=40 Length=1048.06	263406.21	5268124.15	Connect torii to the central cylinder
▬	Docking Ports (3)	Radius=25 Height=30	7853.98	98174.77	Provide safe docking to spacecrafts.
⧗	Antennas (3)	Height= 34, 34 and 70	----	----	Help in communication

* Pressurized ** Pressurized (Control centre, emergency zone & port facilities)
Airlocks (Length=5 m, Volume= **50 m^3**) **at the interface of pressurized and unpressurized** volumes prevent air loss.

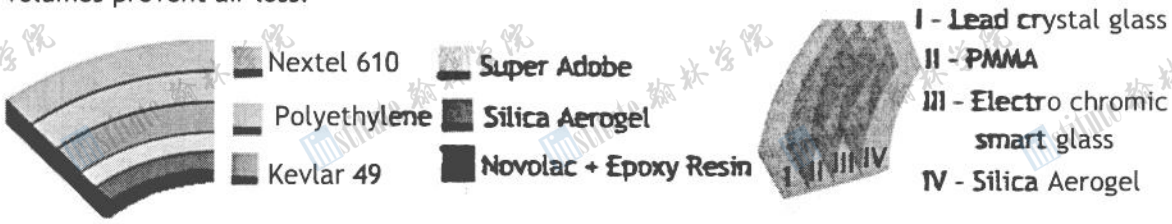


Fig. 2.1.4 Layers of Wall and Window

2.1.2 CONSTRUCTION MATERIALS

Table 2.1.2

Utilization	Material	Composition	Properties	Thickness (cm)
Framework	**Titanium**	Ti	High tensile strength and thermal stability	--------
For Outer Wall of torii, spokes, hubs and cylinders (2.5 m thick)				
Outermost Layer	**Nextel 610**	Al & O_2	Debris protection due to high tensile strength	35
Second Layer	**Ultrahigh Molecular weight Polyethylene**	C & H_2	Extremely high resistance to abrasion, extremely strong and provides efficient protection against radiation	40
Third Layer	**Kevlar 49**	C, N, O_2 & H_2	High tensile strength, shock absorption and debris protection	45
Fourth Layer	**Super Adobe**	Lunar regolith	Shock, fire , radiation resistance & sound insulation	35
Innermost Layer	**Silica Aerogel**	Si,O_2 & H_2	Acts as padded surface, provides thermal insulation and radiation protection	35
Intermediate Layers	**Mixture of Novolac and Epoxy Resin**	C, H_2 & O_2, and traces of other materials	Acts as contact adhesive to bind the layers; provides electrical, chemical resistance and automatically fills the cracks in the structure	4 x15

For glass panes and tourism elevator				
Outermost Layer	**Lead Crystal Glass**	Si, O_2, Pb, Na & K	Thermally resistant, debris and radiation protection	55
Second Layer	**PMMA**	C, H_2 & O_2	High mechanical strength, scratch resistance, good dimensional stability and does not shatter on rupture	50
Third Layer(expect tourism elevator)	**Electrochromic smart glass**	Si & O_2	Controls intensity of light	45
Innermost Layer	**Alumino silicate glass**	Al, Si & O_2	Electrical insulation and thermal shock resistance	40
For other constructions				
Robotic Arms	**AlNiCo**	Al, Ni & Co	High tensile strength and elasticity	-
Solar panels	**Silica**	S &O_2	Absorbs maximum sunlight per unit area	-
Mylar Reflector	**Mylar**	C, Si, P, Ca &Fe	Provides efficient reflection	-

2.1.3 ARTIFICIAL GRAVITY

- Initially, rotation of spokes connected to torii provides artificial gravity in torii and hubs by propellers operated on SPS (Solar Power Satellite) that will be taken on lease.
- Since settlement is in vacuum, the rotation will be continuous after it is initiated once.
- However, debris impacts may alter the momentum of rotating components. Thus, rotational velocity will be regularly monitored by RVS (**Rotational Velocity Sensors**) and corrected by providing thrust (by propellers operated on electricity stored in lithium polymer batteries) again if any major change is detected.
- **Rotation Rate**- The rotation rate supplied will be **0.8633 rpm** (rotations per minute).
- **Rationale for selection**- To avoid harmful psychological and physiological effects on human body due to high rotation and to avoid coriolis forces.

The magnitude of gravity has been calculated using formula

$g = rw^2$ where, **g**= value of artificial gravity **r**= distance from axis of rotation (major radius of down surface); **w**= angular velocity {$2\pi/T$ (**T**= time of rotation)}

Table 2.1.3

COMPONENTS	GRAVITY (ms^{-2})	RATIONALE	Surface width(m)
Residential Torus (R)	9.81	Best suited for human living	251.94
Agricultural Torus (R)	Down surface 1= 6.75 Down surface 2= 6.00	Best suited for plant and fodder growth	183.08 and 82.44
Hubs 1 and 3 (R)	1.47 – 2.29	low g recreation & research environment	72.88
Hubs 2 and 4 (R)	3.18 – 4.00	low g recreation & research environment	72.88
Central cylinder and semi cylinder (NR)	Micro	Suitable for heavy manufacturing and other industrial processes	----------

(R) - ROTATING (NR) - NON ROTATING

2.1.4 Natural Views:

- Natural views are provided through **17.5 m** wide glass panes (supported by titanium framework) which are at a distance of **10 m** above the down surface, towards the ceiling.
- This window runs on the lower and upper

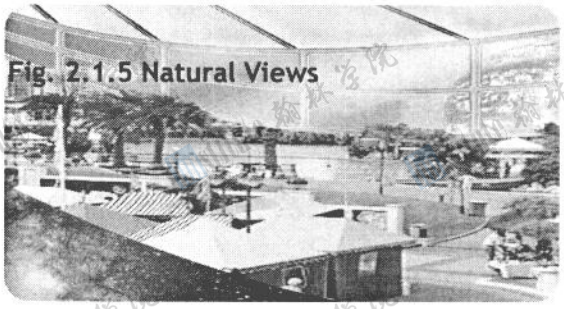


Fig. 2.1.5 Natural Views

circumference of the torus (left and right side of the down surface).

➢ **Electro chromic smart glass** layers sandwiched between the glass panes control the intensity of light. It changes the colour of the glass when **14 volt** electrical charge is passed across a microscopically thin coating on the glass surface.

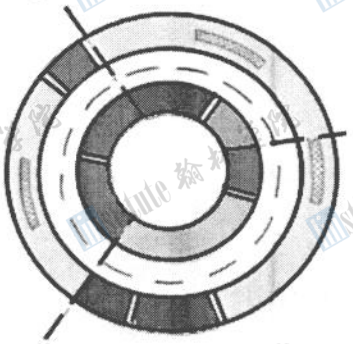
2.1.5 RADIATION AND DEBRIS DETECTION - PROTECTION

Table 2.1.4

DETECTION	PROTECTION
Radiation: Doped Glass Sheet containing **Manganese is used.** **Principle**- Manganese glass changes from **clear to purple when** Gamma rays strike it. This process is reversible. **Any colour** change due to radiations is restored to original **position by the** effect of heat.	Layers of Silica Aerogel, Polyethylene foams and lead crystal glass absorbs harmful solar, gamma and cosmic radiations.
Debris: Two **LIDAR (Light Detection and Ranging) systems on** the periphery of central cylinder is used. **Principle- Laser scanner** emits high frequency infrared laser beams. Scanner records the time difference **between the** emission of the laser pulses and the reception **of the** reflected signal giving information about **the position and** velocity of the upcoming debris.	Layers of Kevlar-49, Nextel-610 and lead crystal glass shield the settlement against small debris. For larger debris, **a probe** will be launched which will gently attach itself with it. The probe's mass driver engine will provide a low yet constant thrust required to deflect the debris from its path and will also drill the debris surface to obtain useful products.

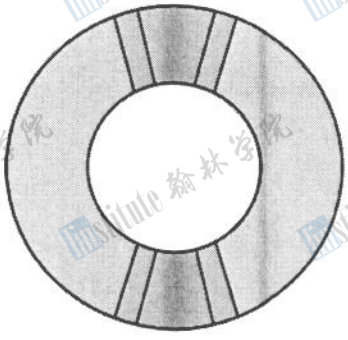
2.2 INTERNAL ARRANGEMENT

Fig. 2.2.1 Residential Torus (Vertical clearance= 296.45 m, Line of sight= 126 m)

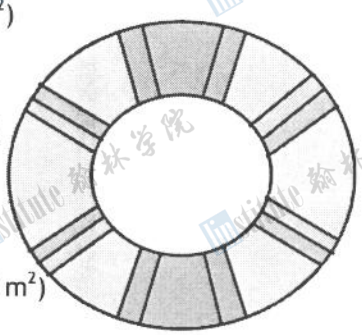


- **Residential area** (454799.96 m^2)
- **Parks** (291357.76 m^2)
- **Commercial area** (270287.36 m^2)
- **Recreation zone** (237255.02 m^2)
- **Utility area** (203620.27 m^2)
- **Research and education** zone (77357.45 m^2)
- **Hospital** (126697.20 m^2)
- **Road** (180996.48 m^2)

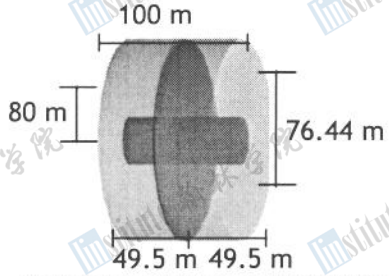
Fig. 2.2.2 Agricultural Torus



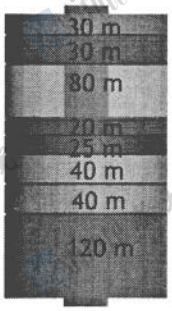
- **Crop growing area** (877913.67 m^2)
- **Water treatment** (76000.00 m^2)
- **Water distribution** (21236.75 m^2)
- **Dairies** (35000.00 m^2)
- **Animal Sheds** (60000.00 m^2)
- **Fodder growing area** (249796.55 m^2)



Down surface 1 (Vertical clearance= 87.30 m) **Down surface 2**(Vertical clearance= 64.14 m)



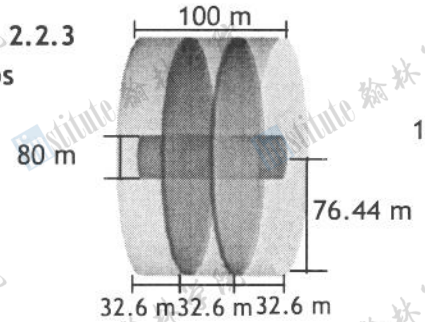
Hubs 1 and 3 (each 1319670.87 m^3)
(One as Amusement park & other as research lab)



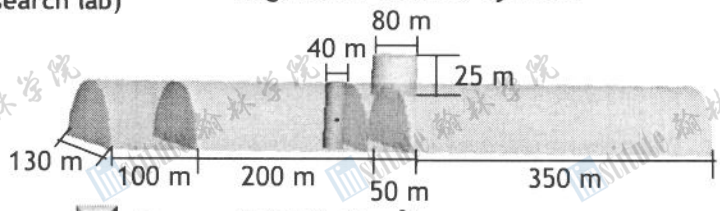
- Port facilities (2025000 m^3)
- Emergency Zone (472500 m^3)
- Transportation Corridor (5400000 m^3)
- Control Centre (1350000 m^3)
- Robotic repair Unit (1687500 m^3)
- Water Storage (2700000 m^3)
- Solid Waste Recycling (2700000 m^3)
- Industry (8100000 m^3)
- Isolation (472500 m^3)

Fig. 2.2.4 Central Cylinder

Fig. 2.2.3 Hubs



Hubs 2 and 4 (each 1306074.26m^3)
(One as Museum, science city & other as research lab)



- Hangar (663661.45 m^3)
- Mining and refining (1327322.90 m^3)
- Control Centre (2322815.10 m^3)
- Industrial & asteroidal storage (1327322.90 m^3)
- Tourism Elevator (81681.41 m^3)
- Separating rod (125663.71 m^3)

Fig. 2.2.5 Semi Cylinder

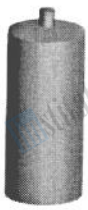
2.3 CONSTRUCTION SEQUENCE

INITIAL PHASE

- Solar Power Satellites taken on lease For initial construction.
- Robots sent to moon for mining.
- Construction of mass driver on moon at Shackleton Crater.
- Establishment of mass catcher at L5.
- Processing of materials take place at moon.

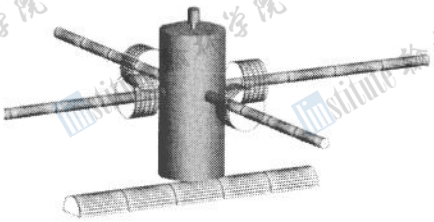
Duration: 3089 days

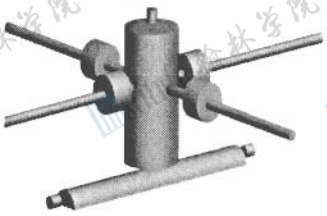
Assembly Phase:



Phase 1:

Construction of Central Cylinder and main docking port.
Duration: 1478 days





Phase 2:

Construction of Linkage Spokes, Hubs, Semi cylinder and two docking ports.
Duration: 865 days

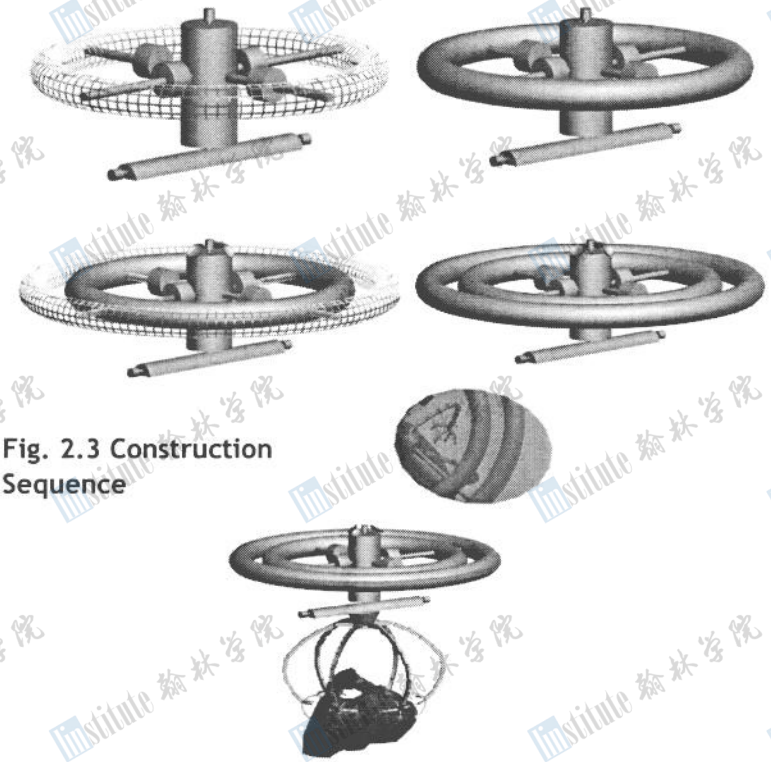


Fig. 2.3 Construction Sequence

Phase 3:

Construction of Agricultural torus.
Duration: 1630 days

Phase 4:

Construction of Residential torus and antennas.
Duration: 1765 days

Phase 5:

Establishment of shock absorbers, robotic arms and mylar reflector.
Duration: 1350 days

2.4 STRUCTURAL ATTACHMENT TO AN ASTEROID

- Asteroid capturing will be accomplished by six robotic arms, each of which further has four fingers.
- Two of the fingers (Anchor fingers) have anchors which will dig into the asteroid surface, while other two (Firming fingers) will tighten & firm the grip by virtue of their flexible junctions.
- The junctions of Firm fingers will tighten and firm the grip One by one so that every junction aids to the grip of previous one .
- Shock absorbers will absorb vibrations caused by asteroid capturing.

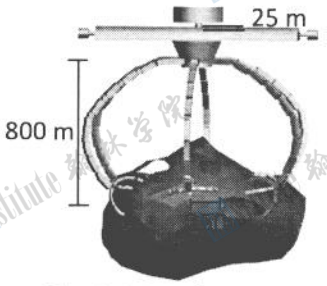


Fig. 2.4.1 Robotic arms

Dimension of a Robotic arm:

Table 2.4

Junction	No. of junctions	Length(m)	Breath (m)	Height (m)
Major arm	20	5	5	40
Finger	20	5	11	12.5

Dust Removable Systems-

System 1:

- **Centrifugal Multiple Cyclone Separators** are used Which consist of a number of small- diameter cyclones?
- The dust stream enters at an angle and is spun rapidly.
- The centrifugal force created by a circular flow throws the dust particles toward the wall of the cyclone where these particles, after striking the wall fall into a hopper located underneath from where these are removed.

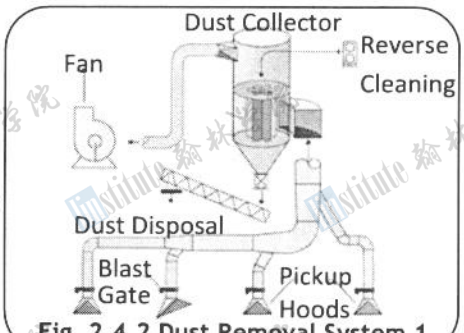


Fig. 2.4.2 Dust Removal System 1

System 2:

- **Electrostatic Precipitators** are used which use electrostatic forces to remove dust particles.
- Dust flows through passage formed by high-voltage, direct-current discharge & collecting electrodes.
- Dust particles receive a negative charge as they pass through ionized field between the electrodes.
- These charged particles are attracted to a positively charged electrode and adhere to it.
- The collected dust on the electrodes is removed by rapping or vibrating the collecting electrodes at a predetermined interval.

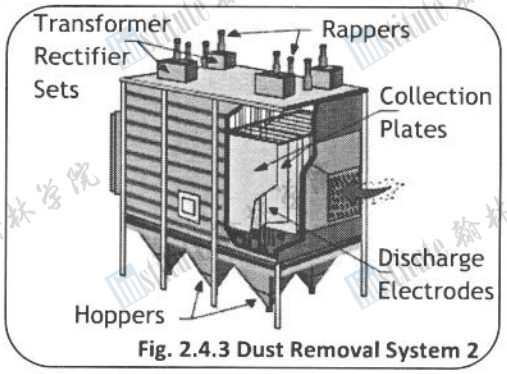


Fig. 2.4.3 Dust Removal System 2

2.5 DOCKING FACILITIES

- Bellevistat consists of **three widely separated docking ports-** one on the vacant side of the central cylinder and other two on either side of the semi cylinder.
- Distance between main docking port and the residential down surface is **1370 m** which will be covered in **4.6 min.**
- The extremely sensitive task of docking is carried out through **Androgynous Peripheral Attach System (APAS).**
- A structural ring, a movable ring, alignment guides, latches, hooks, dampers and fixers are integrated to form APAS.
- During docking, the active half's capture ring extends outward from the structural ring towards the passive half. Upon contact, system dampens out any relative motion between the docking Vehicles. Once that is accomplished, the capture ring aligns the two vehicles. It is then retracted with the passive ring still attached. Twenty- four structural hooks snug the connection down to form an airtight seal.
- Shuttle's external airlock is connected to Settlement's Pressurized Mating Adapter (PMA-2) using an interlocking System. Crew also control PMA-2's docking from cockpit.
- Two PMAs provide passageways for crew and equipment.
- Because they are pressurized, heated and supplied with hand grips, **8-ft-long**, tunnel-like PMAs permit the passage for passing.
- Nanobots in **dust removal zone** remove dust from surface of docked spacecraft. **(Ref.5.2)**
- **Warehouse Facilities:** These include storage of incoming and outgoing materials, provision for fuel storage and cold storage for perishable goods.
- **Movement from non-rotating to rotating part:** The crew members are transported from docking ports to transportation corridor via elevators. Hence, the crew are seated in a **rotating capsule** is rotate at an acceleration of 1 ms^{-2} and within 10 s the relative velocity between capsule and spoke will becomes zero. Now the crew shifts inside the airlock which will closes itself and thus prevents loss of atmosphere. The crew is seated in the elevator which takes them to their desired location.

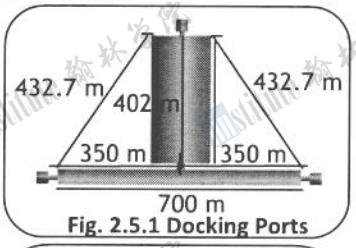


Fig. 2.5.1 Docking Ports

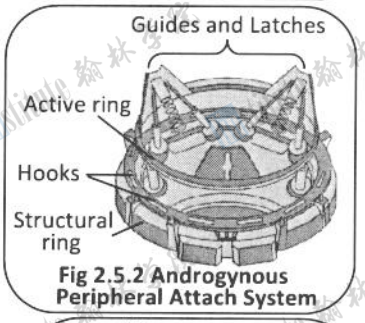


Fig 2.5.2 Androgynous Peripheral Attach System

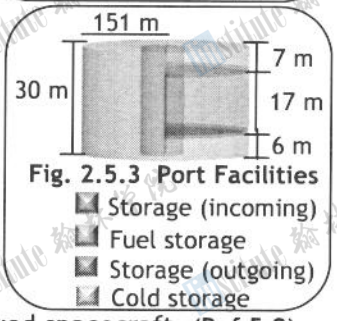


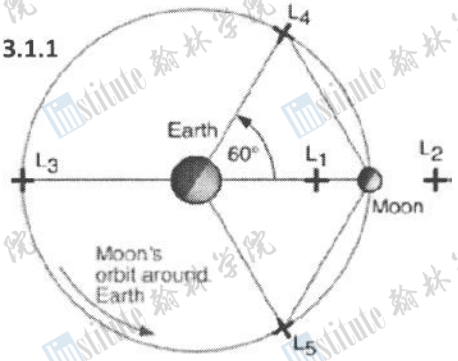
Fig. 2.5.3 Port Facilities

3.0 OPERATIONS AND INFRASTRUCTURE

To build a community is, to start with, building its physique...its operations & infrastructure. Bellevistat will provide all necessary operations to sustain life as well as to meet manufacturing and mechanical needs.

3.1.1 ORBITAL LOCATION

Fig. 3.1.1



Earth -Moon lagrangian point **L5** located at a distance of **23900miles (384663km)** has been chosen as a base for Bellevistat. Its features include a semi-major axis of **3843900 km** and perigee and apogee of **363104km** and **405696km** respectively. It completes its one revolution around earth in **27.32 days** at a mean orbital velocity of 1.023km/s. L5 is at the advantage of more stable equilibrium than L1, L2 and L3 and it scores over L4 as it can fetch assistance from Alexandriat for construction and assembling purposes. Less orbital velocity as compared to other orbital systems is another plus factor. And finally it is endowed with 24 hours sunlight which is **6-15 times** more intense than earth.

TABLE 3.1.1

CONSTRUCTION MATERIAL	COMPOSITION	USE	MAJOR SOURCE	TRANSPORT-ATION	STORAGE
Titanium	Ti	For making framework	Moon	Brutus	Alexandriat
Nextel 610	Al & O_2	Outermost layer	Moon	Brutus	Alexandriat
Ultrahigh Molecular weight Polyethylene	C & H_2	Second layer	C from 3554 Amun & H_2 from moon	Miranda, Brutus	Alexandriat
Kevlar 49	O_2,C,H_2,N	Third layer	C from 3554 Amun,H_2 & N_2 from Moon	Brutus , Miranda	Alexandriat
Super Adobe	Regolith	Fourth layer	Moon	Brutus	Alexandriat
Silica aerogel	Si , O_2 & H_2	Innermost layer	Moon	Brutus	Alexandriat
Mixture of novolac and Epoxy resin	C , H_2 & O_2 and traces of other materials	Intermediate layers	Moon	Brutus	Alexandriat
Lead crystal glass	Pb, Si, O_2, K, Na	Outermost layer	Moon	Brutus	Alexandriat
PMMA	C,O_2,H_2	Second layer of glass pane	C from 3554 Amun,H_2 & N_2 from Moon	Miranda, Brutus	Semi-cylinder
Electro chromic smart glass	Si,O_2	Third layer of glass pane	Moon	Brutus	Semi-cylinder
Alumino silicate glass	Al,Si,O_2	Innermost glass pane layer	Moon	Brutus	Semi-cylinder

TABLE 3.1.2

EQUIPMENT	MAJOR SOURCE	TRANSPORTATION	STORAGE
O_2 & N_2	Moon	Brutus	Alexandriat
Water	Moon	Brutus	Alexandriat
Agricultural biomass	Alexandriat	Olivia	Alexandriat
Robots	Earth	Augustus	Directly used
Mining equipments	Earth	Augustus	Directly used
Mass driver & mass catcher	Alexandriat	Olivia	Moon / Asteroid
Space vehicles	Earth	Augustus	----------
Automated system	Alexandriat	Olivia	Directly used

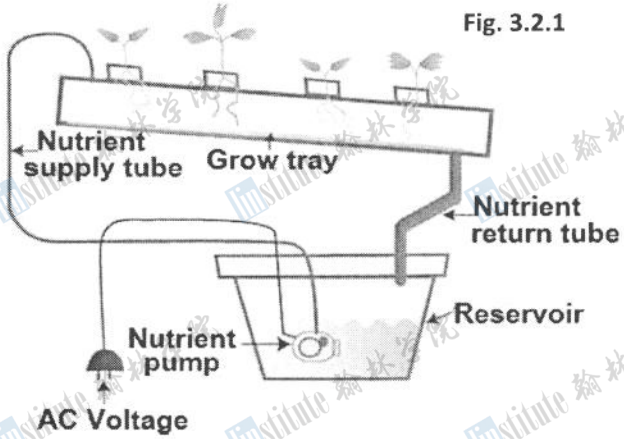
3.2 Basic operations

We eye at building an infrastructure that doesn't alienate the residents from one another, rather creates economic development, enhances safety and improves local communities as well as grows with the growing economy.

3.2.1 Food production

Food will be initially acquired from Alexandriat for 5 months. Then it will be grown in agricultural torus using **Nutrient Film Technique (N.F.T).**

Fig. 3.2.1



N.F.T is a *hydroponics* technique in which plants are grown in a thin film of nutrient solution that flows down a channel by gravity and is collected in a reservoir from where it can be pumped back to the top of the channel for reuse. The roots absorb the essential nutrients from the solution which is repeatedly neutralized as per the requirement.

TABLE 3.2.1

FOOD ITEMS	VARIETY	REQUIREMENTS (g/person/day)	AREA/PEROSN (m^2)	TOTAL AREA (m^2)
Cereal products	1.Wheat	225	8.5	161500
	2.Rice	120	5.6	106400
	3.Maize	50	5	95000
Legumes & Grains	1.Soyabeans	45	5.4	102600
	2.Pulses	150	5.5	104500
Vegetables & Fruits	1.Green vegetables	130	7.6	144400
	2.Fuits	125	8.1	153900

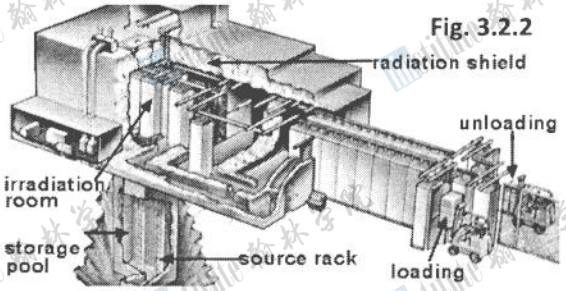
3.2.1.1 GROWING- A total of **1330000 m^2** area is to be employed to agricultural purposes including **95,000m^2** of plantation area for animals. The crop yield would be raised to the maximum using sunlight as well as different color OLED's depending on the needs of the respective crops. Constant flow of nutrient solution saves the timer requirement for the

submersible pump. The nutrient solution is pumped into the growing tray and flows over the roots of the plants, and is then drained back into the reservoir. The use of air as the prime growing medium saves the expense of replacing the growing medium after every crop. Normally the plant is supported in a small plastic basket with roots dangling into the nutrient solution. Fodder will be grown separately on upper down surface of the agricultural torus.

3.2.1.2 Harvesting- Harvesting would be conducted by Quaradz (ref Table 5.2.1).

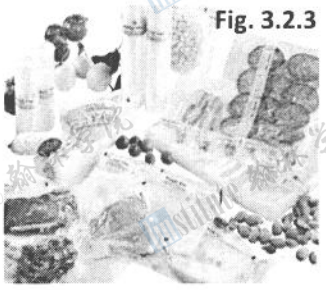
3.2.1.3 Storing- Food will be stored in storage area of 95,000m^2 in the agricultural torus preserved by ***Food Irradiation Technique***, a process in which food is exposed to high levels of **X-rays** that disturb the DNA of damaging microorganisms including bacteria and parasites to restrict their ability to reproduce, thus extending the shelf life of the food products. To produce X-rays, an electron beam with Kinetic Energy ranging from **5-10MeV**, which hardly amounts to 100kW, is projected at a thin plate of sodium (available on moon). The technique will be ideal as it amounts to less energy consumption, does not alter the nutritive value of food products nor makes it radioactive, is environmentally clean, reliable and sans any use of chemical additives.

Fig. 3.2.2



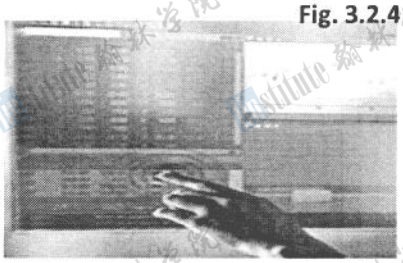
3.2.1.4 PACKAGING- *Hypobaric Vacuum* ***Packaging*** (HVP) technique would be employed for food packaging in which the food product is packed in a gas-impermeable bag (fig.3.2.3). The air within the bag is then vacuumed out and the bag is sealed hereby reducing the pressure inside the bag. Then low pressure and low humidity is maintained using ventilation. This atmospheric state reduces the oxygen concentration hence preventing the growth of micro-organisms and preserving the food.

Fig. 3.2.3



3.2.1.5 DELIVERING AND SELLING- Elevators would be engaged for delivering food products from agricultural torus to residential torus.Food products will firstly reach the administrative zone from where they will be sent to their respective selling places via underground pipelines(ref.3.2.4). Selling of food products will be done through various distribution centres equipped with touch sensitive voice responding plasma screens displaying prerecorded information of the products.

Fig. 3.2.4



3.2.2 ELECTRIC POWER GENERATION

The electric power generation at Bellevistat will be a declaration of human superiority against all challenges. Solar pannels will be brought into play to generate electric power.

- Each panel will be 196.92 m long and 70 m wide.
- Panel circumference of 7877.9 m to support 183960 cells.

- With one cell producing 103.5 W of electricity,each panel outsources 19039860W.
- A total of 40 panels employing 7352609cells produce prolific 760.99 MW
- Estimated requirement of 662 MW leaves surplus of 98.99 MW to be stored in lithium polymer batteries.
- Solar cell blanket weighing 0.3 Kg/m^2 amounts the mass of solar lining to be 165433.69 kg.

TABLE 3.2.2

Per person requirement per day	5 kW
Residential torus	95×10^3 KW
Agricultural torus	57×10^3 KW
Central cylinder	183×10^3 KW
Semi-cylinder	247×10^3 KW
Hubs	80×10^3 KW
Total power consumption	**662×10^3 KW**

3.2.3.1 INTERNAL COMMUNICATION-

Life must pass into communicaiton for its fulfilment. Internal communication in the settlement will be carried out through FSP(Free Space Photonics)in which there is transmission of infrared rays that carry out communication.The rays are invisible and eye safe whose transmission cannot be interrupted within the line of sight i.e.125.97m.Two FSONA beam transmitting anntenas will be placed in the residential torrus each having bandwith of 20Gb/s and can cover a distance of 10 km, so that in case of any failure in one, the second one can cover the whole residential torus.The primary advantage of FSP is that no spectrum licencing or frequency coordination with other users is required that ensures very low error rates and almost no practical limits to the no. of FSP links that can be installed in a given location.

3.2.3.2 EXTERNAL COMMUNICATION-

The external communication will be supported through DSN Array Antennas (two 34m and one 70m) set up on periphery of central cylinder with circumference of 769.69 metres. Antennas are installed 256.56 metre apart at an angle of 120^0 to each other. 70 m and 34 m antennas are dual shaped reflector antennas employing Ka and Ku bands corresponding frequencies ranging 12-18GHz and 18-35GHz respectively, providing an around-the-clock communication freedom. It scores above other systems in providing improved multi-spectral imaging instead of single images. It facilitates increased wavelengths and geographical coverage alongwith longer celestial comunication upto 35 AU. Furthermore,it will track many spacecrafts simultaneously as its sub-arrays are capable of providing optimal aperature size of each of the several spacecrafts.

3.2.4 INTERNAL TRANSPORTATION

Personal- A 1.5 m wide walkway will be pedestrians' territory to enjoy the pleasure of walking. With the total torus circumference of 7541.52m, a person has to cover a maximum of 3770.76m without a mode of Public transport for travelling. Such a small distance can be easily facilitated with our specially designed'Flight bike'

Fig. 3.2.5

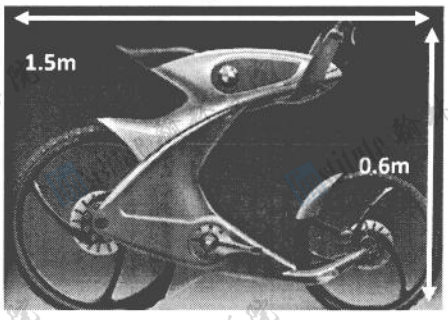
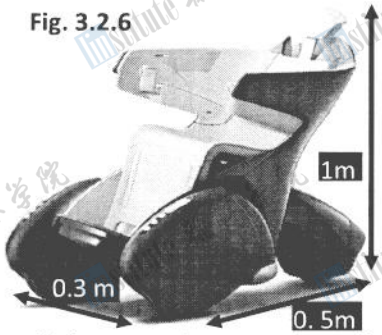
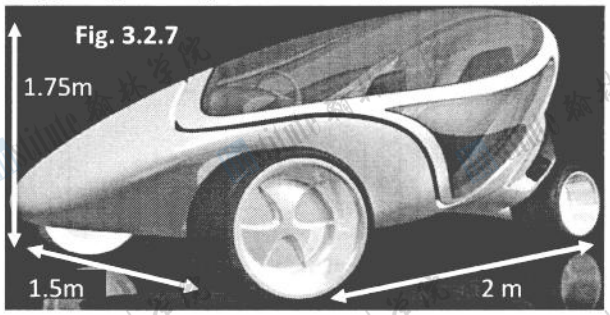


Fig. 3.2.6



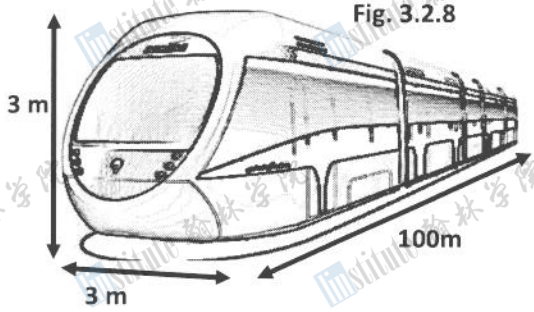
bicycle(fig3.2.5), which will also aid to the fitness of the residents. **'Joey chair'**(fig.3.2.6), a boon for physically challenged will assist them to reach their destinations. It will move at maximum speed of 10 km/hr and will be supportted by a 30 hrs battery . It will also be euipped with an attacthed music system and the chair willl be easily manageable with an inbuilt remote control. Our **'Pulse car'** (fig. 3.2.7) will fufill the desire of the family exucursions. It will be based on ultra capacitor technology, employing barium titanate hybrid engine, which runs using compressed air(300 bars).A staggering mileage of 6500 km per one complete refueling will be the highlight of 10 litre capacity V6 engine, hence giving the owner the bliss of just buying the car and fuelling it once to drive on and on completing nearly 1500 rounds of maximum distance . Pulse car features double wishbone front suspension with an anti-drive geometry, air springs and gas charged shock absorbers.

Fig. 3.2.7



PUBLIC- The two trams (fig3.2.8) comprising the public transport system will travel in opposite directions encircling the city in total of 12 stops. The trams travelling at speed of 60 km/hr will take 41.03 sec to travel between two consecutive stops, stopping for 30 sec. A complete trip encircling the whole residential area will take 13.71 min and the farthest destination will be just 7.10 min away.

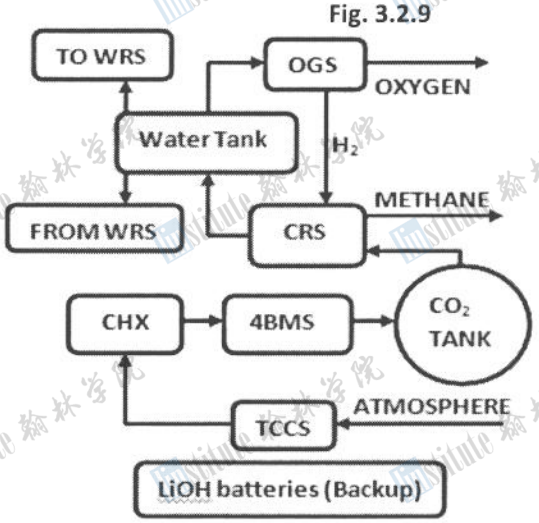
Fig. 3.2.8



3.2.5 AIR REVITALIZATION SYSTEM

The air revitalization system with one back up as lithium ion batteries is installed in administrative department in the residential sector. It consists of four sub-systems installed in 3 communities of the settlement.

Fig. 3.2.9



The Trace Contaminant Control System (TCCS)-Gas purifier system containing a Preconditioned ultra-low emission (P-ULE) carbon for reducing trace impurities from a reactive fluid to sub-ppb levels without concurrently emitting other impurities such as moisture or carbon dioxide into the purified reactive fluid. The P-ULE carbon is prepared by heating a carbon material to temperatures between about 300° C to 800° C in an ultra-dry,

inert gas stream, to produce an ultra-low emission (ULE) carbon material, subjecting the ULE carbon to a second activation process under a reactive gas atmosphere to produce a P-ULE carbon and storing the P-ULE carbon in an environment that minimizes contamination of the P-ULE prior to its use in a gas purifier system. TCCS removes trace contaminants from air.

Climate and temperature control

Table 3.2.3

SEASON	TEMPERATURE (C^0)	HUMIDITY (%)	BREEZE (km/hr)
Winter	13/-2	80/65	10
Summer	30/15	86/55	8
Spring	23/11	86/60	11
Autumn	18/10	82/60	7

The climate of Bellevistat will be maintained in a four season cycle similar to that of earth. Four seasons i.e. spring, summer, autumn, winter will be maintained through **Condensed Heat Exchangers (CHX)** that control humidity and temperature limits according to the season. Precipitation generators will be placed on the ceiling of the settlement that provide rain in between seasons. Projectors will line the floor of the settlement that projects sky into the ceiling. A total of 20572 projectors will be used of intensity of 5000 lumens, with each projector covering an area of 300 m^2 each. In addition to sky, storms and clouds will also be projected matching the intensity of rain and wind speed respectively. The RHC (Relative Humidity Controller) is used for total humidity control. The **RHC** has a built- in onboard sensor which humidifies and dehumidifies accurately within +/- 15% with a set differential of 15%. Such two humidifiers are installed in each community. After CHX, the air goes to **Four Bed Molecular Sieve (4BMS)** which removes carbon dioxide and concentrates it.

Carbon Reducing System (CRS)

Carbon dioxide from the CO_2 tank is reacted with hydrogen to form a mixture of methane and water. The methane produced is then passed over a high temperature to about 1000°C-1200°C to produce hydrogen gas and a high density carbon. This results in lessening of the storage problem for the carbon material because of its high density. The hydrogen gas produced is also recycled back to the incoming carbon dioxide for reaction.

$CO_2 + H_2 \rightarrow CH_4 + H_2O$

Oxygen Generation System (OGS)

The H_2O produced in CRS would undergo electrolysis in the OGS. A water processor is installed to reclaim water from urine as a feed to the electrolysis cells. 20000 such electrolysis cells are used.

AIR COMPOSITION

Table 3.2.4

GAS	PERCENTAGE	PRESSURE
Nitrogen	78.1%	26.6 kPa
Oxygen	21.9%	22.7 kPa
Other Gases	1%	.78 kPa
Total	100%	50.08 kPa

The composition of atmosphere will be kept similar to proportion of earth's atmosphere. The atmosphere will be comprised of Nitrogen, Oxygen with addition of traces of Carbon dioxide, Argon, Hydrogen, Water vapours etc. The pressure will also be same as that of earth's atmosphere.

3.2.6 HOUSE HOLD AND INDUSTRIAL SOLID WASTE MANAGEMENT

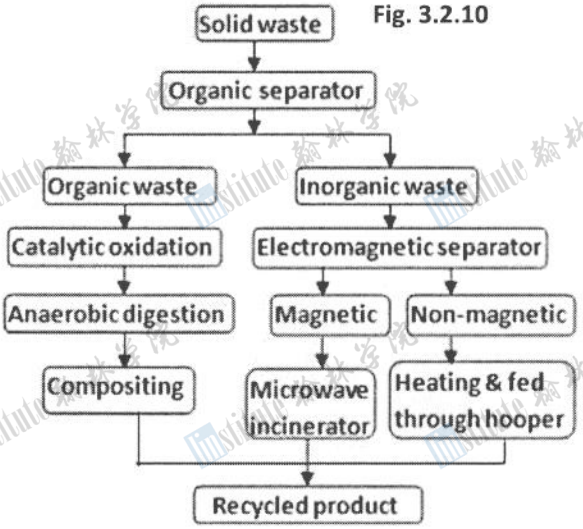


Fig. 3.2.10

"To pollute is to perish." To keep our Bellevistat pollution free, solid waste management systems will be installed. The expected total waste is **12650kg** and our system will recover **10120kg to 10750kg** of it with its effeciency ranging from **80-85%.** The residue will be stored in the semi-cylinder until it is dumped on the asteroid to be mined for its resources. For waste management, firstly the solid waste will be treated in organic separator to separate out organic and inorganic wastes. Organic waste will undergo catalytic wet oxidation,anaerobic digestor and compositing respectively. Parallel to it, the inorganic waste is first treated with electro-magnetic separator, which segregates the non-magnetic waste undergoes heating before being fed to hopper while the magnetic waste is sent to microwave incinerator. Recyled products are at the disposal of the residents promissing a pollution free Bellevistat.

3.2.7 WATER MANAGEMENT

3.2.7.1 PROCUTION: Frozen water would be procured from moon & treated at the water treatment plant in industry located in Agriculture Torus. The water would be liquefied & processed to meet the daily requirement of **25693m^3**.

3.2.7.2 STORAGE: The water storage plant in the residential torus would hold **9377945m^3** of water which caters to the needs of the settlement for a period of 1 year even without any recycling. The NASA studies predict the recycled water requirement per day per person to be **29.33 kg**. Thus , the requirement of the whole settlement of **557270 kg** per day woul be met by two recycling zones working with **100 %** efficiency.

3.2.7.3 DISTRIBUTION: The residential & agricultural areas each will have two water purification centres which further will run two units each that operate in opposite direction . The two purification plants will ensure the supply of purified water . The one end of the underground pipes will be connected to the houses while the other to the water distribution plant.

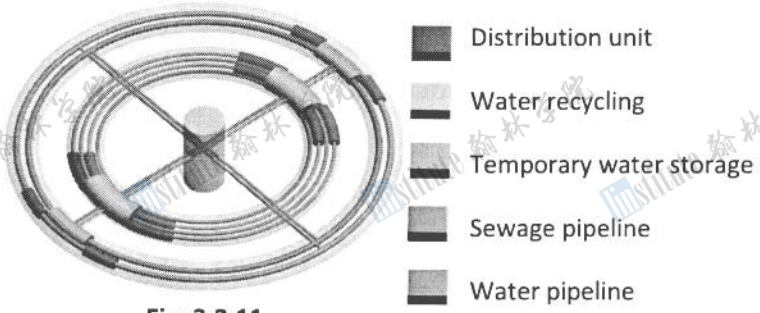
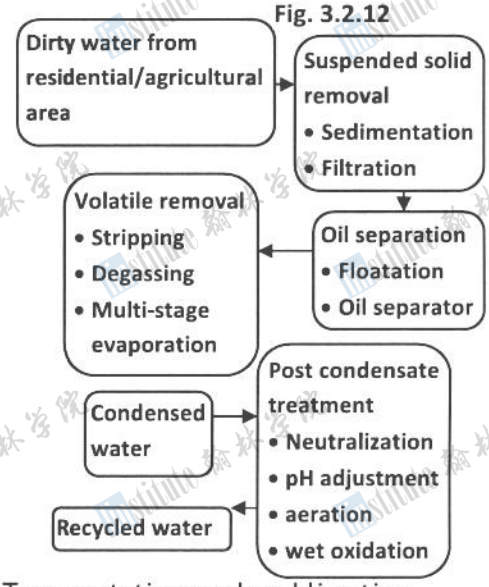


Fig. 3.2.11

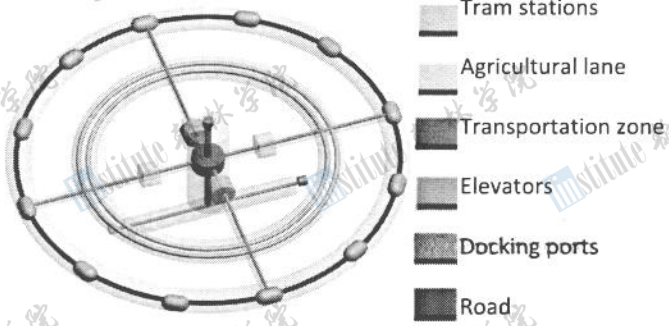
3.2.7.4 RECYCLING: The maxim -**"Conserve & cherish "** will be followed. Every single drop of dirty water from residential & agricultural area will be recycled. First, suspended solids will be removed by sedimentation & filteration. Then oil will be seperated employing the process of floatation & using oil seperator. Gases & volatile materials will be removed using the technique of stripping , degassing & multistage evaporation . The vapour will be condensed &readied for post-condensate treatment that includes neutralization , pH adjustment , aeration & wet oxidation. Recycled water wil lbe now ready to be provided to residential area for re-use.

Fig. 3.2.12



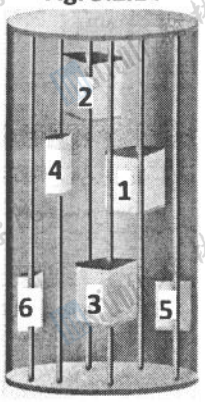
3.2.8 Transportation corridors-

Fig. 3.2.13



Transportation made sublimation literal; it's the story of "how world became small."Our transportation system (fig.3.2.13) comprises cylinder corridor of diameter 80m which supports 6 elevators (fig3.2.14) each of height 5m moving with a velocity of 15km/hr. Elevators 2 & 3 diametrically opposite to each other will be reserved for robots, cargo & other non - human elements. They will cater to a maximum weight of 20 tones. Elevators 1, 4, 5 & 6 will be used for humans. Elevator 1 has a capacity of 30 passengers while elevators 4, 5 & 6 have a capacity of 80 each. These elevators will be used as per the number of people to commute in order to save power.

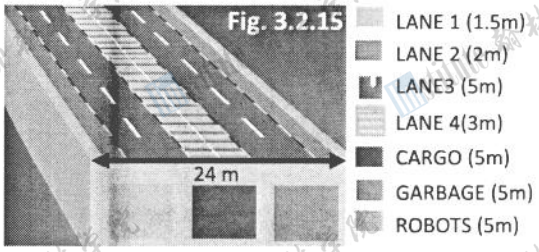
Fig. 3.2.14



3.2.9 RIGHTS OF WAY

The life-lines of Bellevistat-the roads will be four laned. From the left, Lane 1 will be reserved for the pedestrians. Lane 2 will be used by Flight bikes and Joey chairs. Lane 3 will pulsate with Pulse car while trams will glide on Lane 4.

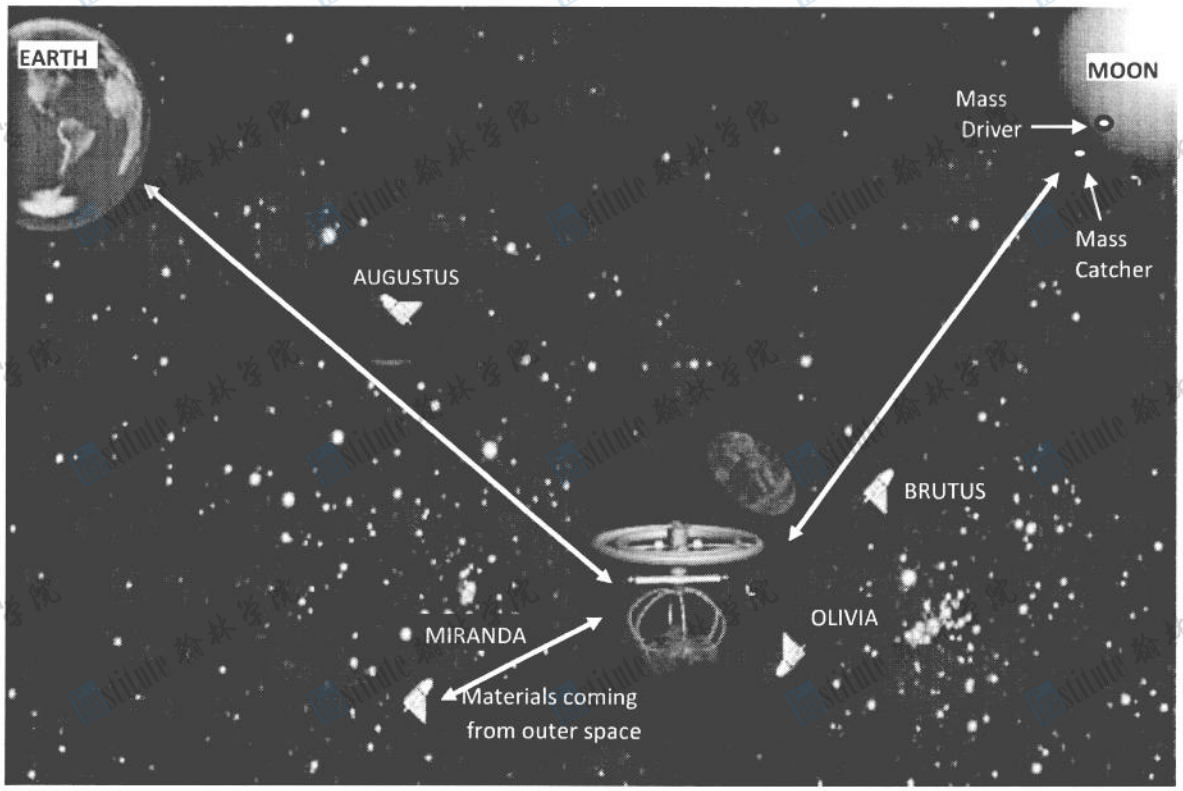
Fig. 3.2.15



3.2.10 MOVEMENT OF EXPORT FROM SOURCES TO PORT FACILITIES

For movement of export from sources to port facilities space vehicles (ref.3.3.2) have been used. Mass driver along with mass catcher have been introduced to transport heavy materials to moons orbit which are further moved by the respective space vehicle.

FIG.3.2.16 SHOWING MOVEMENT OF EXPORT FROM SOURCES TO PORT FACILITIES



3.2.11 DAY/NIGHT CYCLE PROVISION

Since the intensity of sunlight is 6-15 times more than that on earth so there will be abundance of sunlight available there which will be reflected to the settlement using a reflector.

- The reflector will be inclined at an angle of 45°
- Intensity of light will be lowered during the night using electro chromic smart glass.
- A 14 hours day light and 12 hours day- night will be provided keeping in mind the optimum growth of body and mind.

3.3.1 ON ORBIT INFRASTRUCTURE

TABLE 3.3.1 SHOWING ON ORBIT INFRASTRUCTURE BEING USED BY BELLEVISTAT

On orbit infrastructure	Quantity	Use
Alexandriat	1	For initial construction
SPS (on lease)	1	For initial power
DSN antennas	3	For external communication
Reflector / Mirror	1	For Day-Night Cycle provision
Space vehicles	22	For external transportation
Mass drivers / catcher	1/1	For transportation of materials
Solar cells	7352609	For electric power generation

3.3.2 Space Manufacturing

To accommodate and develop space manufacturing for business pursuits and to satisfy its application needs, a total volume of 1,984,500 m^3 has been reserved in the industrial region of central cylinder. In addition, solar cells will be regularly manufactured on the surface of the moon due to abundance presence of silica there. These solar cells will be utilized to replace malfunctioning or damaged solar cells in Bellevistat. Rest of the produce will be utilized to acquire economical profit by selling these to various contractors.

Table 3.3.2 SHOWING EQUIPMENTS TO BE PRODUCED IN BELLEVISTAT

Product	Volume (m^3)	Production Cost (US $)	Selling Cost (US $)	Profit (US $)
SPS	162,000	10,257,682,810	12,011,125,425	1,753,442,615
Antennas	121,500	10,192,865	11,927,500	1,734,635
Automated vehicles	243,000	40,762,325	45,211,111	4,448,786
Mining equipments	324,000	23,768,770	30,225,325	6,456,555
Components of future space settlements	810,000	3,000,000,000	3,927,416,400	927,416,400
Manufacturing and assembly of space crafts	486,000	1,750,266	2,105,620	355,354

3.3.3 EXTRA TERRESTRIAL MATERIAL HARVESTING AND REFINING

Asteroids are broadly divided into four categories:

1. Main Belt asteroids-These are a band of asteroids located between Mars and Jupiter. None of these are economically attractive as they are too far away from earth.
2. Amor asteroids- These include those whose orbits approach the earth's orbit but do not intersect it. Even these are not economically attractive.
3. Apollo asteroids- These include those asteroids whose orbits intersect the earth's orbit but they spend most the time beyond earth's orbit. Many of these are economically attractive.
4. Aten Asteroids- These include those asteroids whose orbit crosses earth's orbit. These spend their most of the time inside the earth's orbit. A large number of known Aten asteroids are economically attractive.

Since Bellevistat will harvest ores from the captured asteroids of approximately 1 km in diameter and as per the data mentioned above many near earth asteroids are very promising targets as future ore bodies in space, for reasons of accessibility, ease of return, variety of source materials and ease of extraction of both metals and volatiles, both of which are likely to be in heavy demand during the development of large scale space infrastructure. A list of such metals and volatiles on a 1 km diameter earth crossing asteroid with its estimated market value is given below:

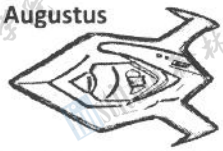
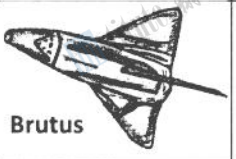
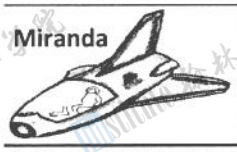
Table 3.3.3

Element	Symbol	ppm	Price (US $)/kg
Iron	Fe	592	1.64
Nickel	Ni	83	14.96
Magnesium	Mg	29	2.75
Gallium	Ga	60	300
Germanium	Ge	210	745
Selenium	Se	36	10.47
Oxygen	O	30	115
Ruthenium	Ru	13	365

Element	Symbol	ppm	Price (US $)/kg
Rhenium	Re	3.7	1560
Osmium	Os	9.0	12862
Iridium	Ir	33	960
Platinum	Pt	35	12390
Aluminium	Al	125	2.76
Calcium	Ca	20	110
Gold	Au	0.5	12,345
Silver	Ag	0.46	160

3.3.4 SPACE VEHICLES

TABLE 3.3.2 SHOWING SPACE VEHICLES TO BE USED BY BELLEVISTAT

Vehicles	Purpose	No.	Capacity	Dimensions (in meters)	Turn around time/ max. flights per year	Status of contract
Augustus 	Earth –L5	10	Pay load- 100 tones Persons - 600	28 x 10 x 12	5 days 60 flights per year	To be commercially developed
 Olivia	To –fro liberation	4	Pay load- 60 tones Persons -100	20 x 11 x 10	3 days 120 flights per year	Included in the contract
 Brutus	L5-Moon	6	Pay load- 70 tones Persons - 100	25 x 12 x 14	3 days 120 flights per year	To be commercially developed
Miranda 	Deep space research/ tourism	2	Pay load- 45 tones Persons - 250	18 x 8 x 10	4 days 90 flights per year	Included in the contract

*** EDDY WILL BE USED AS ONE WAY RE-ENTRY VEHICLE TO EARTH (ref. 4.3.4)**

3.4 PLANTATION IN RESIDENTIAL AREA AND ANIMAL HUSBANDRY

In concurrence with some corrections suggested by the Foundation society in Alexandriat's design to be incorporated in Bellevistat special care has been taken for efficient land use; plants for human consumption have also been grown in landscaping of residential and commercial areas. However, growing of animal feed has been conducted in separate areas.

3.4.1 ANIMAL HUSBANDRY

TABLE 3.4.1 SHOWING FODDER TO BE GROWN FOR ANIMALS

Name	Crude protein	Crude fibre	Other constituents	USES
Barley grass	18.5 %	15.2 %	Vitamins, Minerals, Enzymes	Optimum animal growth
Oat grain	12.3 %	10.1 %	Carbohydrates, vitamin, minerals, fats	Maintenance of glucose level
Cottonseed	44 %	12.8 %	Car bohydrates ,minerals, fats	Increases milk production
Rye grass	10.4 %	23.2 %	Carbohydrates, vitamins, minerals	Proper digestion, increases immunity
Lucerne hay	18 %	23 %	Carbohydrates, vitamin, minerals	Increases bone strength
Pigeon pea	23.7 %	8.1 %	Carbohydrates, minerals, vitamins, fats	More egg-yielding capacity
Sunflower meal	19.8 %	37 %	Vitamins, mineral, antioxidant	Clears digestive tracts hence enhancing digestion

The total area for animal husbandry comes out to be 3, 80,000 m^2

Table 3.4.2 showing facilities provided for animals

Facilities	Features
Mobile veterinary facilities	Render treatment of animals at the door steps hence improving their health
Livestock rearing facilities	For better quality animal breed growth
Animal sheds	Provide better quality homes for optimum growth
DNA replication facility	For controlled replication of DNA ensuring population control
Disease surveillance facility	Provides vaccination and other medical facilities

The total area for animal husbandry comes out to be 3, 80,000 m^2

3.4.2 PLANTATION IN RESIDENTIAL AREA

For efficient land use, plantation in residential areas has been introduced in the form of kitchen gardens where growing of crops will be carried out through hydroponics. For growing trees on road side lunar soil will be used whose fertility will be increased using fertilizers produced in fertilizing industry by the remains left in the recycling process.

TABLE 3.4.3 SHOWING VARIOUS TYPES OF PLANTS TO BE GROWN IN RESIDENTIAL AREA

NAME	SCIENTIFIC NAME	USES	GROWTH PLACE
Ficus bonsai	*Ficus pumila*	Noise & Air pollution reduction	Tree lining
Pine bonsai	*Pinus monticola*	Noise & Air pollution reduction	Tree lining
Tomato	*Lycopersicon esculentum*	Easy growing home food	Kitchen garden
Basil	*Ocimum basilicum*	Air purification, Medicinal purposes	Kitchen garden
Rose	*Rosa indica*	Bring down fever, enhances immunity	Parks
Hibiscus	*Hibiscus rosasinensis*	Wound dressing, remedy for various diseases	Parks

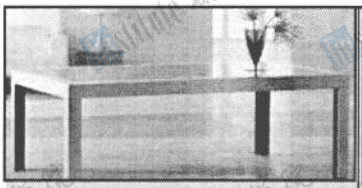
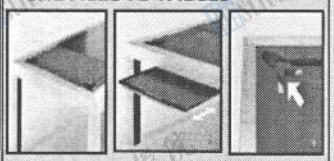
3.5 INNOVATIVE APPROACHES

Out of the box innovative approaches have been adopted in designs and materials of furniture, interior finishing of residences, plumbing and kitchen equipments. This will help to conserve both resources and time.

3.5.1 FURNITURE

TABLE 3.5.1 SHOWING VARIOUS FURNITURE TO BE USED IN BELLEVISTAT

CELESTIAL FURNITURE	USE	MATERIAL	SOURCE	INNOVATIVE APPROACH
	**EROS BED** ➢ Automated lighting & music systems in snuggling comfort. ➢ Automated night adjusting system on a cozy corona	Silicon, aluminium and required mattress.	Moon	Both present in abundance on moon and silica is also obtained as slag in blast furnace in the form of Ca_2SiO_3
	**DAISY LOUNGER** ➢ Multidimensional lounger with inbuilt music system, T.V, telephone, computer ➢ Light weight and portable	OLED's, polyveen	H_2 from Moon, C from 3554 Amun	OLED's can be easily recycled and polyveen used is recyclable, fire resistant, easy to clean and scratch free

 Convertible normal table	**CHEVILLOTE TABLES**  Converted pool table	Ceramics	Moon	Can be used both as a regular table and a pool table
	**OFFICE CHAIR** ➢ Will be used in offices and business areas ➢ Provides proper relaxation to spinal cord	Natural materials	Moon	Cushion material melts to give cooling effect but regenerate automatically when stored in cool place

3.5.2 INTERIOR FINISHING EQUIPMENTS

TABLE 3.5.2 SHOWING VARIOUS INTERIOR FINISHING EQUIPMENTS TO BE USED IN BELLEVISTAT

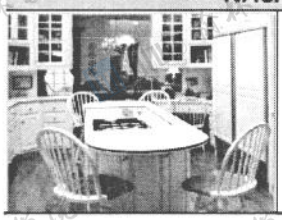
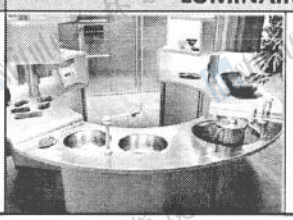
EQUIPMENT	MATERIALS(COMPOSITION)	SOURCES	INNOVATIVE APPROACH
PAINTS	N-butyl acrylate & methylmetahacrylate	MOON	Embedded with non toxic antimicrobial nano particles
CURTAINS	Synthetic Fabrics (polyamide)	H_2, N_2 from Moon, C from 3544 Amun	Panels with liquid crystal molecules renders the screen from transparent to opaque upon activation
Packaging material	Polystyrene	H_2 from Moon, C from 3554 Amun	On recycling it forms a dense block which can be used as a fuel for garden docking
Construction of walls	Ceramics, CaO	Moon	Tilt up construction
Integrated circuit	Si, Ge and compound semiconductors	Moon	Incorporated DC to DC converter making it ten times more energy sufficient

3.5.3 KITCHEN AND PLUMBING EQUIPMENTS

TABLE 3.5.3 SHOWING VARIOUS KITCHEN AND PLUMBING EQUIPMENTS

EQUIPMENTS	MATERIALS	SOURCES	INNOVATIVE APPROACH
Taps			Will be manufactured by new environment friendly anti-corrosive technology that cuts water in automotive paint shops by half and decreases use a production of sludge by 90%
Fittings, filters, valves, pipes etc.	Plastic, Fe, Al, PVC	H_2 from Moon, C from 3554 Amun	
Floor tiles & Bath tubs	Ceramics	MOON	

Table 3.5.4

NACRE KITCHEN		LUMINAIRE KITCHEN	
	These kitchen–cum-dining halls are intended for reflecting cordial atmosphere in houses. The kitchen will be invitingly illuminate to echo warmth		A central computer will control all the electronic devices & locate the kitchenware. The circular setup gives the provision of maximum storage.

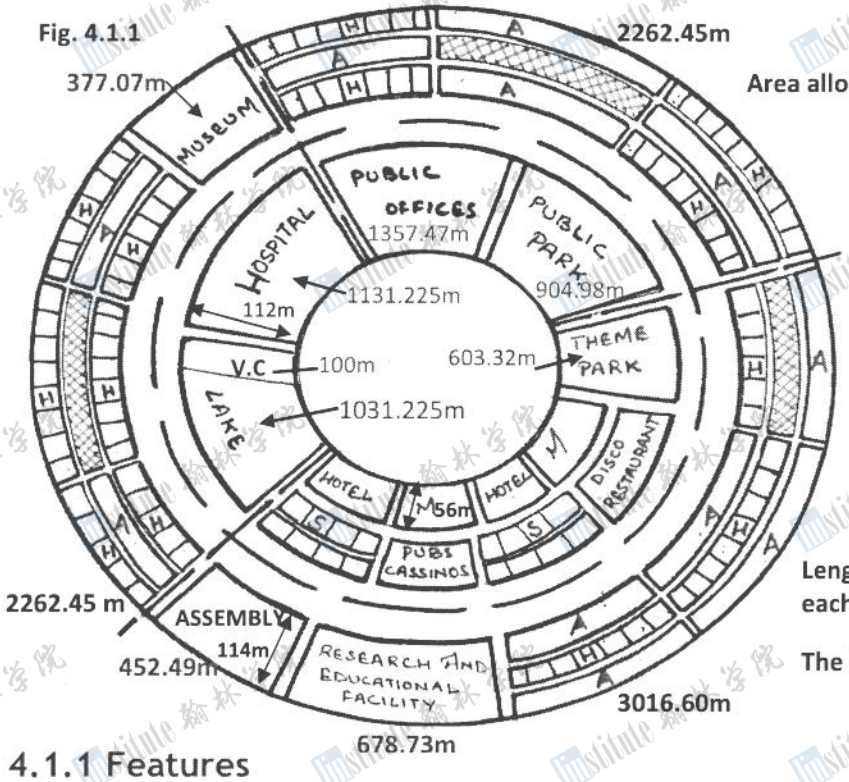
4.0 HUMAN FACTORS

Any plan for humans aboard Bellevistat keeps in mind the traditional comforts of earth while incorporating the concept of automated living. We have come up with a design which is **innovative** while being **realistic, cost effective** and highly **enjoyable**. The views of space outside and natural sunlight are readily available to the residents. Some of the notable provisions in the community plan are the presence of plant based foods in residential area & differentiation between neighborhoods based upon different lifestyle choices.

4.1 Community Design

The length of the whole down surface of torus is **7541.52 m**. The whole residential area is divided into three communities i.e. **Commercial** Neighborhood, **Restive** Neighborhood and **Economic** Neighborhood.

Fig. 4.1.1



4.1.1 Features

4.1.1.1 Housing

The housing scheme for Bellevistat will lay equal emphasis on traditional comforts of homes as well as modern amenities, techniques & gadgets. It will be mainly divided into houses and apartments. Houses will be for families or couples and apartments for singles. There will be a total of **12060 apartments** and **2700 houses**.

4.1.1.2. Education

Education on Bellevistat will be divided into **3 levels**: kindergarten (3-6 years), school (7-15 years) and university (16 or above).

Imparting education on Bellevistat will lay equal stress on practical experimenting and theoretical part. For the clear understanding of concepts educational simulation will be used

which will allow students to become immersed in learning, transforming them from active passive observers to active participants. Classroom will accommodate high-tech furniture like multi-touch board used by teachers and innovative-desk that will fold at the times of examination and independent learning, and unfold at the time of teacher's lectures **(fig 4.1.2).** This desk will enable students to imagine without any stumbling-block, will provide privacy and allow students to concentrate.

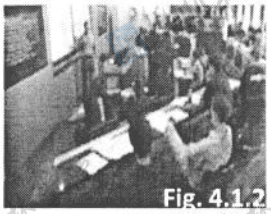
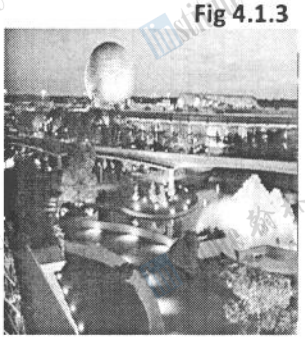


Fig. 4.1.2

Fig 4.1.3



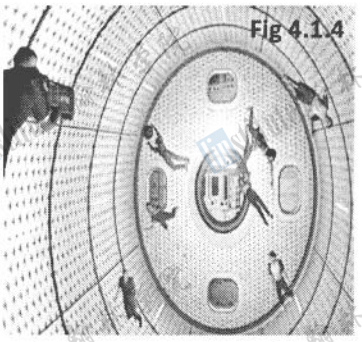
4.1.1.3 ENTERTAINMENT

Theme Parks- Theme parks will accommodate several interesting regions making people cherish and fright by virtuality and simulation. **(Fig 4.1.3)**
Museums- Earth, Planet and Space based museums will be present.
Multiplexes- Multiplexes will have dome-shaped 3-D theatres.
Restaurants- Fully automated restaurants will have glass-flooring to provide a refreshing view of water. Here customers will order their meals through touch-screen on each table.

4.1.1.4 LOW-GRAVITY ENTERTAINMENT

Pseudo pool- A room with water blobs floating and humans will pass through them giving a pseudo experience of water in the water blob.
Foolish maze-In this a long complicated tubule maze will actually have one exit but there will be many false changeable exits giving the outside view.
Other modes - Sports have been introduced to enhance the competitive, intellectual and emotional quotient of the inhabitants and to provide a holistic environment. Razzle-Dazzle sports meet will be held annually.
Annual carnival event will be held in which different floats will display the ethnic diversities of the inhabitants of Bellevistat.

Fig 4.1.4



4.1.1.5 Medical

The hospitals will use sophisticated technology and instruments. The medical Personnel will be trained in use of the highest advancements in Nanotechnology, Neurotechnology and Cytotechnology. Hospital will be equipped with **1500 beds.** The community will also have health centers which will ensure routine check-ups. The features of the hi-tech bed are:-

- It provides recent test results, heart beat, body temp., pulse rate, etc. of the patient.
- It keeps the patient in required posture and can be automatically adjusted.
- It alerts alarm in case stress is applied by the patient.

4.1.1.6 Research:

Research would take place in research labs in hubs. Research would be carried out on the topics like protein crystals, micro encapsulation, bacteria growth research, latex spheres, nanotechnology, tele-surgery, ceramic bones and effect of micro gravity on combustion.

4.1.1.7 Public Areas:

Bellevistat promises the residents for providing public areas endowed with open spaces for the encouragement of community interaction. Hotels, Pubs and Casinos, Assembly, Lake, Theme Park, Public Park, Residential Park, etc are some of the illustrations.

4.1.1.2 Variety of Consumables

TABLE 4.1.1

FOOD PRODUCTS	QUANTITY (in grams/person/year)
Cereals	113900
Grams	71400
Fruits and vegetables	93365
Beverages	629490
Meat products	32790

TABLE 4.1.2

General Daily Requirements	
Water	2000ml
Proteins	80g
Carbohydrates	500g
Fats	50g
Minerals	100mg
Vitamin	Traces

Quantity of Consumables

Table 4.1.3

Age-Group	Proteins(g)	Calories	Iron(g)	Calcium(g)
Men	58	2800	20	0.4-0.5
Women	48	2200	30	0.4-0.5
Children (2-3 yrs)	22	1200	15	0.4
Children (4-9 yrs)	29	1800	15-20	0.4-0.5
Children(10-13 yrs)	43	2100	20	0.5
Adolescents (girls)	53	2200	25	0.6-0.7
Adolescents (boys)	63	3000	35	0.6-0.7

4.1.1.3 Psychological factors

Table 4.1.4

Psychological Factors	Effects	Mitigation
Gravity gradient	Errant movement, nausea, headache	Proper rate of rotation
Vertigo and Spatial disorientation	Arbitrary changes in sense of verticality	Adequate sleep, Regular exercise, Periodic training
Boredom, depression & home sickness	Depression	Various recreational and entertainment facilities
Home earth sickness	Stress, fear of isolation, depression	Provides same day and night, wind as earth
Insomnia	Sleeplessness	Sleeping pills, Warm bath & heavy exercise
Solipsism Syndrome	Feeling of dreams/ living in a virtual life.	Providing Macro geometry in the settlement by means of space viewing, space walking, virtual space theatres, etc
Claustrophobia	An anxiety disorder wherein a person fears enclosed or confined spaces	

4.1.1.4 Distribution of Consumables

Underground passage will connect spokes to various communities. All goods will be transported till the doorsteps of various houses hence reducing the traffic. The surplus can also be stored in the underground stores or sent back to the cylinder for storage and packaging. Refer(**Fig 4.1.5**)

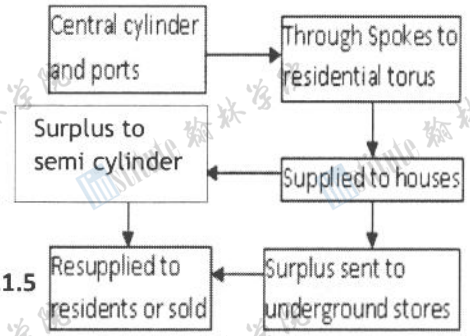


Fig 4.1.5

4.2 House Plans

Table 4.2

POPULATION TYPE	NO. OF PEOPLE	TYPE OF RESIDENCE	NO. OF RESIDENCE(in units)	Dimension (in feet)	Area (in feet^2)
Married adults	5400	Sovereign houses	2700	42 X 47	1974
Single men	6660	Apartments	6660	30 X 32	960
Single women	5400	Apartments	5400	30 X 32	960
Children	540	Sovereign houses	Along with married adults		

Fig 4.2.1 Floor Plan House

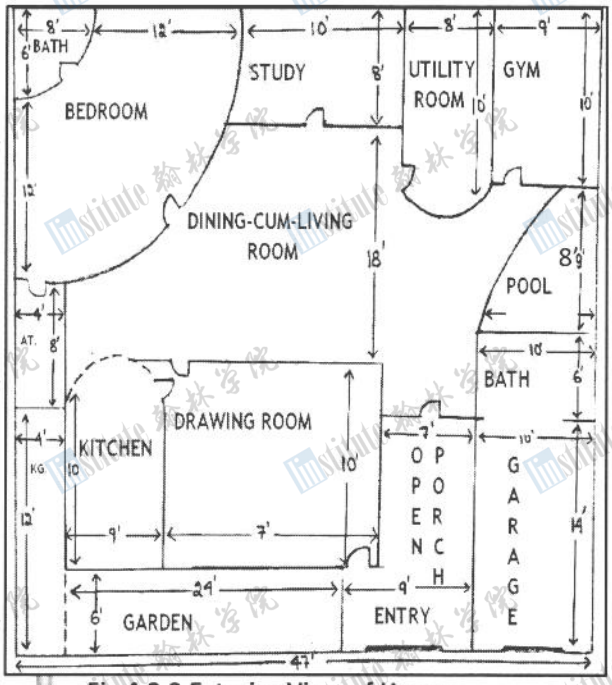


Fig 4.2.2 Floor Plan Apartment

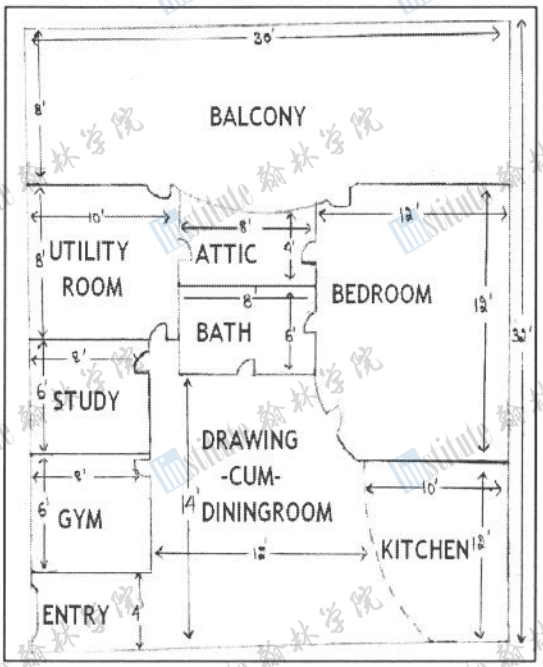


Fig 4.2.3 Exterior View of House

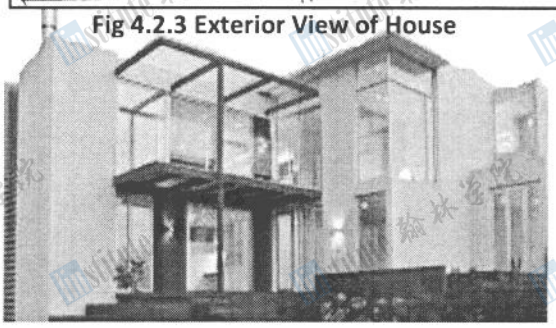


Fig 4.2.4 Exterior View of Apartments

4.3 Work Environment

Bellevistat recognizes the importance of safe and efficient working environment, and strives to maintain a high level of security through orderly systems of transportation, ergonomically designed work spaces, safety crews, and high-quality tools. The presence of human factors psychologist will continually improve the work environment for maximum efficacy.

4.3.1 Design of systems

Administrative system:

The administration will have a **democratic structure**. Bellevistat Administrative Council (BAC) will be the control body which will be further divided into Public & System Security Unit, Economic Unit, Resources Dept., Mining Dept., Robotic unit and Communication Unit.

Monetary System:

Bellevistat will use **electronic money**. In this system, smart cards will be provided to every citizen (above 14 years). The exchange of money will take place through computer networks. This allows transfer of funds from one account to other or to main Bellevistat Money Bank.

Security System

Bellevistat will host a two tier security system which can scrutinise any threat either by a personnel or technology. It is a two phase process:

Hazard Tracker

- It couples a uniquely structured copper material and terahertz radiation (T-rays) and leads to the development of sensors that revolutionize security screening for dangerous materials.
- T-rays, electromagnetic waves in the far infrared part of the electromagnetic spectrum, have a wavelength 500 times longer than visible light.
- Many molecules in explosives and biological agents such as anthrax strongly absorb this radiation. If T-rays are tightly confined on surfaces in contact with such molecules, the detection sensitivity is greatly increased.
- A metamaterial surface draws T-rays close to it, creating a strong field less than a millimeter above the surface. This greatly enhances the absorption by molecules on the surface, making highly effective sensing techniques possible.
- A metamaterial is a man-made material with designed electromagnetic properties that are impossible for natural materials to possess.
- The T-rays are generated from small dipole antenna on semiconductor.The antenna is struck with a fast laser pulse to cause a spark between two electrodes in the semiconductor. Those electrodes cause a pulsed current in the antenna that emits terahertz radiation.
- If there is a security threat in a government building, hazardous material specialists would place the metamaterial surfaces in a room and aim T-rays on to it. If there are hazardous materials present, they would attach to the surface and absorb radiation from the rays. The materials would then be identified with a spectrometer.

Fraud Detection Software:

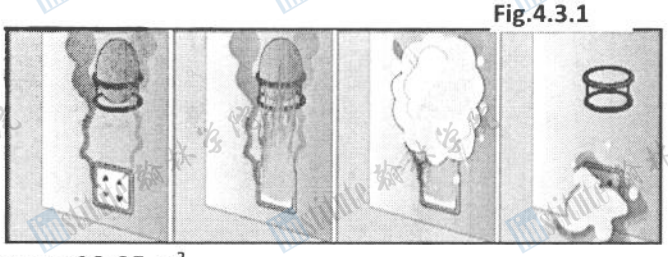
- Textual analysis technique - it will be used to identify language patterns in management communications inconsistent with either the company's financial performance or with the communications of other companies in the same industry which may indicate fraud.
- The model uses text-mining techniques to automatically identify word patterns that might be highly associated with financial fraud.
- The software will eventually serve as a decision-support tool that would improve the efficiency of the auditing process and, ultimately, enable the detection of financial fraud.

4.3.2 DESIGNS OF DEVICES

4.3.2.1 Fire Extinguishing Balls

- The ball will blast automatically when it comes in contact with fire.
- Built in alarm goes off simultaneously.
- The weight of the fire-extinguishing ball is 1.3 Kg, hence it is very mobile.
- When in contact with the flame of fire, in 3-5 seconds the fuse at the surface layer of the ball will automatically be activated through the fuse breaker at the center of the ball. The breaker will explode and the dry chemical will be dispersed covering fire area of 2.25 m^2.

Fig.4.3.1



- The outward circular force from the Fire Extinguishing Ball explosion will assist in removing the oxygen from the fire area, and the dry chemical will extinguish the fire.

4.3.2.2 Waterless & Detergentless Washing Machine

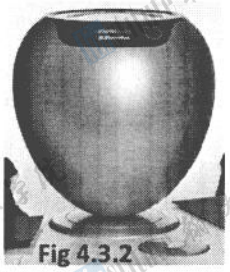


Fig 4.3.2

- This washing unit is waterless and does not use detergents.
- It utilizes negative ions, compressed air and deodorants to clean clothes.
- By using atmospheric air and negative ions, a natural cleansing agent it fights dirt and bacteria with nature's own weapon.
- It is also designed to be placed anywhere in the home.

4.3.2.3 Eye Catcher, the Videophone

- Eye Catcher, a videophone offers real-time eye contact with broadcast-quality pictures.
- It creates natural sensation of face-to-face conversation with meaningful eye contact. Hand gestures and non-verbal signals are a part of the videophone.
- The user looks at a mirror screen, which is positioned at an angle and shows a reflection of the main 18in display screen.
- A camera lies at eye-level directly behind the mirror, meaning the user is always looking directly at the person he is talking to. The near life-size image,high-quality sound and video combine to create a realistic experience.
- Gets rid of Grainy pictures, awkward time delays and bandwidth problems

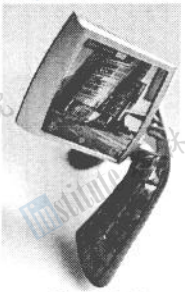


Fig 4.3.3

4.3.3 Designs of Vehicles:

Vehicles like Miranda, Augustus, Brutus, Olivia are used for external transportion. Refer (**Table 3.3.2** and **Article 3.2.4.**)

4.3.3.1 Re-entry vehicle (Eddy): Adjoining one way re-entry space vehicle has been designed which is made from asteroid materials and is recyclable.

TABLE 4.3.3.1

Material	Source	Use	Use after recycling
RCC	433 Eros	Outermost layer	Used in Iron industry to make steel, used as a part of cutting tools, space craft manufacturing
Duralumin	433 Eros	Second Layer	Used in Automation industry for vehicle manufacturing
Iridium	3554 Amun	Third Layer	For business
Silica	433 Eros	Innermost Layer	Indoor & outdoor furniture, electronic industries, porcelain, glass and glaze

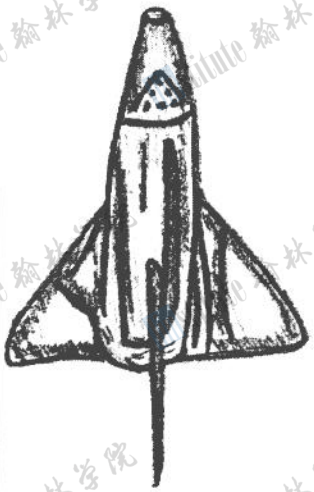


Fig 4.3.4 (Eddy)

4.3.3.2 Tourism

The desire for adventure makes man travel, thus fuelling the wheels of tourism .The insatiable desire of human for new vacation destination in space drives Bellevistat to provide unparagoned facilities to its tourists & visitors. A safe, cozy and beautiful stay would be their advantage. The tourism package offered to them to give them freedom to explore the various corners of Bellevistat. According to preference, the entertainment like discos, restaurants, bars, casino's, multiplexes, weather parks, micro-g recreation ,visual centers observatories, amusement parks and space rides will be their disposal to make their trip full of fun, thrill and unparalleled adventure. The breath-taking & mesmerizing view of outer space and earth below, as could be seen from observatories located in civic centre and equipped with special

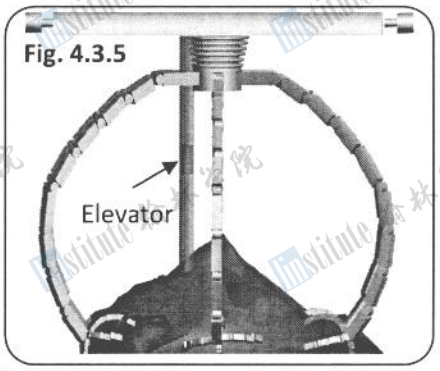


Fig. 4.3.5

equipments like optical telescopes, will be introduced to make the whole experience more enthralling and spicy. The tourists will be able to enjoy nearby space tours on the manned ship Miranda (Ref. 3.3.2). The rapture of observing closely the floating objects like asteroids, meteors and man-made satellites would be ethereal. Visitors can have firsthand experience of mining, refining & manufacturing operations. They will have access to enjoy amazing and knowledge 1 hour ventures. A tourist elevator (having accommodation capacity upto 80 persons) constructed from carbon nanotubes (source- 3554 Amun) and having transparent glass panes will run down from the mining and refining area in semi-cylinder towards mining sites on the captured asteroid surface where tourists will have a chance to explore and observe various aspects of mining science and technology. This elevator is self sufficient to provide water and oxygen supply as well as sewage disposal unit. Provision for food and water supply for upto 1 week will also be available in case of any emergency.

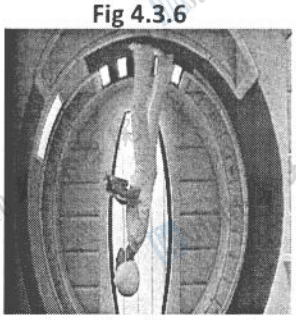
4.3.3 Designs of Vehicles:

Vehicles like Miranda, Augustus, Brutus, Olivia are used for external transport. Refer to **Table 3.3.2** and **Article 3.2.4.**

4.3.4 Normal movement in low gravity areas:

1. **Padded walls:** Walls in low gravity areas will be padded with soft materials so as to reduce the impact of collision in any such case.
2. **Elevated ceilings:** These will be followed in the entire settlement so as to make available spaces reducing chances of collision.
3. **Recessed Hand Holds:** Will be provided for movement within various regions of the central cylinder.
4. **Tethers:** Will be tied to tracks & hooked to a person's back so as to prevent errant movement.
5. **Safety Belts:** Will be provided in vehicles & elevators to be used for transportation in spokes & central cylinder
6. **Magnetic Boots**: These will keep people, working in low gravity, bound to the floor and would provide proficient movement in the micro gravity.
7. **Hook roving**: A lightweight hook attached to the back of a person and the other end to an electric grid ceiling which will firmly hold the person & prevent errant movement.

Fig 4.3.6



4.3.5 Categories of work and tools required

Table 4.3

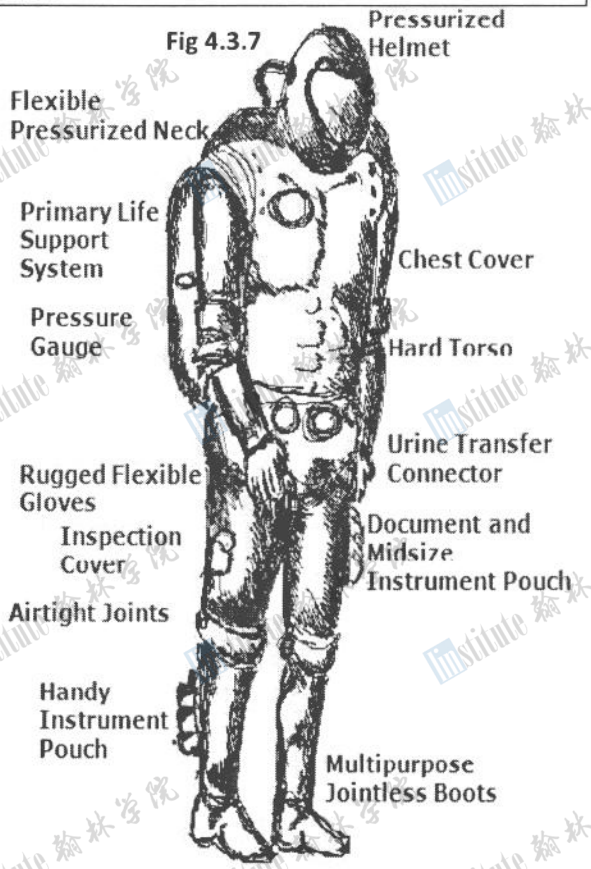
Category Of Work	No.	Tools Requires
Offices	1000	Desks, Chairs, Lamps, Stationary, Computers etc
Manual Household Chores	-----	Vacuum cleaners, Robotic arms Lift- Trolleys etc
Waste management	200	Robots, Pipeline System, Sewage treatment
Medicine (pharmacist, physician and chemist)	1500	Coronary apparatus, medicines, surgical equipment
Teaching	54	Desks, e-books, stationary
Cargo handling	300	Hand cart, Inclines, Loading/unloading Robots
Research	9000	Labs, Apparatus, Exhausts
Business Visiting Departments	750	PDA's, Walkie-Talkie's, Handy-Cams

Exterior Maintenance	1456	Space suit, Robotic arms, Canadian arm, Virtual reality system, Space vehicles, construction equipments
Food Production & Distribution	350	Water & Drip Sprinkler, Packaging Material, Slaughtering tools, Thresher, Reaper, Bio Monitors
Commercial/Industry	2000	Handholds, Tethers, Robotic Arms, 3D Virtual Reality Systems, Computers
Warehousing	150	Forklift, Cargo Handling Robots, Hardhats
Entertainment/Recreation	500	PDC's, Sports Equipment, Safety Equipment, Virtual Reality Infrastructure
Asteroid capturing & Mining	200	Robotic arms, free touch sensors, tac-tile sensors , super-computers

4.3.6 Spacesuit:

- Circulation of cooled and purified oxygen that will be controlled by the Primary Life Support Backpack(**fig 4.3.7**)
- Oxygen pressure of 32.4kPa, carbon dioxide pressure of 5.3 kPa and 6.3kPa water vapor pressure to avoid decompression sickness.
- Thirteen layers of Standard Body Suit Materials - Neoprene coated Nylon - 4 layers of aluminized Mylar film alternated with non-woven Dacron- 2 layers of aluminized Kapton film & Beta cloth marquisette laminate & a layer of Teflon coated Beta cloth. A layer of Demron will be sandwiched between the two Kapton films.
- The skintight body suits which supplies mechanical counter pressure to the body with elastic non-air tight fabric
- Flexible neck and gloves for more maneuverability.
- Touch screen controls.

Fig 4.3.7



4.4 Neighborhood plan

The community is divided on the basis of lifestyles of the people. It is divided into Commercial, Restive and Economic neighborhood.**fig 4.4**

Restive Neighborhood (R.N):-

- This part of the settlement is serene and a calm place.
- It is preferably for Aged or Married Couples.
- It is the main location of characteristic avenues such as Hospital, Lake and Museum.
- It covers a total of 30% of total residential area.

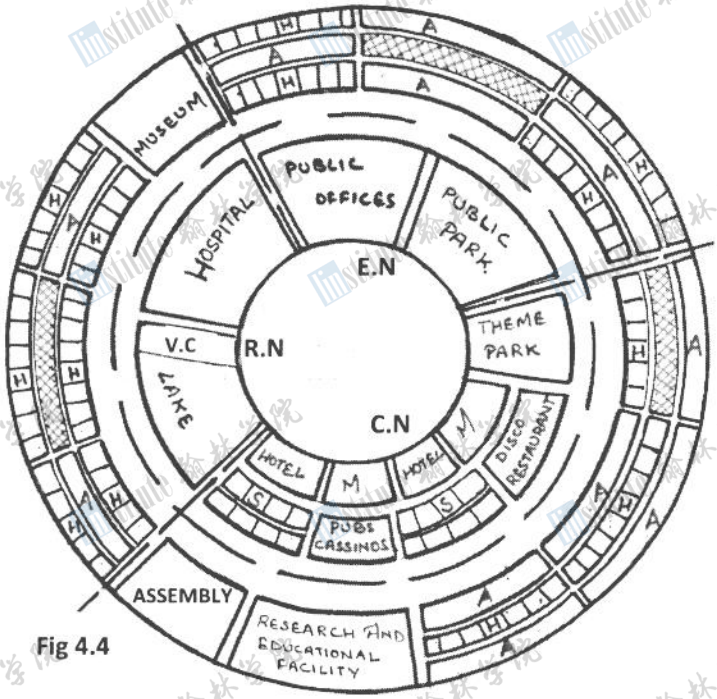


Fig 4.4

Economic Neighborhood (E.N)

- It has low real estate prices
- It is mainly dotted by less frequented high consequence areas like public offices and public parks
- It contains equal no. of apartments and houses
- It covers 30% of total residential area

Commercial Neighborhood (C.N)

- It contains the commercial area
- It is the downtown of the whole settlement
- This type of neighborhood is preferred for young unmarried adults

4.5 Varieties Of Activity, Entertainment and Recreation

Table 4.5

AREAS	ACTIVITY	DETAILS	BENEFIT
Parks	Walk	Dedicated areas in parks	Physical fitness
	Animal shows	Give an earth-like experience and a brush with nature	Mental stimulation
Sovereign houses	**Kitchen Gardens**	Outlet for recreation and relaxation	Mental stimulation
Lake	Swimming , rowing and fishing competitions, underwater diving	Weekend getaway and venue for friendly sports	Physical fitness and mental stimulation
Visual centre	Educational shows, documentaries, planetarium, simulation competitions	Knowledge with fun	Mental Stimulation
Hospital	**Voluntary health work**	Internal satisfaction	Mental stimulation
Theme parks	Rides & Water parks	Entertainment & Family fun for kids	Physical fitness & Mental Stimulation
Commercial area	Multi-cuisine restaurants, discos, pubs, casinos, multiplexes & bars	Unwinding at the end of the day for relaxation	Mental stimulation
	Fashion shows	Recreation	Mental stimulation
Research & educational facility	Olympiads	Talent searches & urge for improvement	Mental stimulation
	Library	Intellectual recreation	Mental stimulation
Sports centre	**Inter-settlement Olympics**	Building of relations with health	Mental stimulation &physical fitness
Central cylinder	Industrial tours	Familiarity with emergency systems and industrial processes	Mental stimulation
Out of the settlement	Research tours	Fun out of intellectual quest	Mental stimulation
	Deep space tourism	Recreational vacation tours	Mental stimulation

Above are the pastimes for residents, one has to acclimatize oneself to the new environment

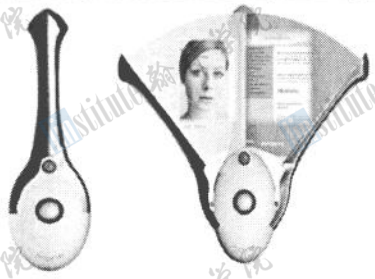
5.0 AUTOMATION DESIGNS AND SERVICES

Bellevistat will be highly modern and automated so as to sustain large population and its varied purposes. High speed computer system will be provided in each home and state of the art software's, operating systems etc. will be used.

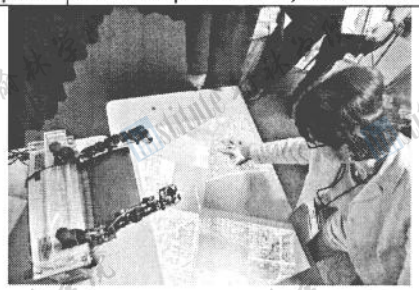
In order to function properly and avoid human errors, all the activities are automated and coordinated by super computers. There is one master computer controlling all the other computers. Each computer has its own database managed by a program. All computers have the same operation system, but are equipped with programs designed to manage the specific functions and are connected to Bellevistat network (provides the best speed and security against failure). Every person has an ID number which is associated with its retina. Each person has its own data (personal data, debit card information, health evidence etc.) stored in the residential computer's data base.

TABLE 5.0.1 TYPES OF COMPUTERS

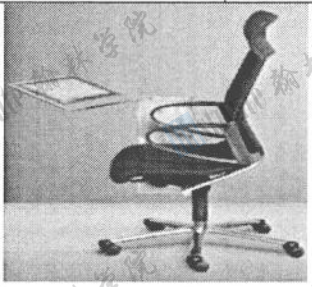
Name	Type	Specifications	No.
Personal Digital Gadget(PDG)	Personal use	8 GHz quad core processor, 32Gb RAM,1Tb hard disk	17460
Desktops PC's	Personal use	Xeon4.6 GHz processor, 64Gb RAM,2tb hard disk	18000
Supucomputer	Office purpose	5.0 GHz processor,128Gb RAM,4tb hard drive	1000



PDG (Fig. 5.0.1)



Desktop computer(Fig. 5.0.2)



Supucomputer(Fig 5.0.3)

TABLE 5.0.2 TYPES OF SERVERS

Servers	Processing Power	No. reqd.	Backups	Data storage media
Main Server	1.7 quadrillion calc/sec	1	1	512Tb hard disk,2Tb RAM
Mining	1 quadrillion calc/sec	2	1	250tb hard disk,1Tb RAM
Industrial	800 trillion calc/sec	5	2	250tb hard disk,1Tb RAM
Agricultural	576 trillion calc/sec	2	1	150tb hard disk,512Gb RAM
Residential	839 trillion calc/sec	3	1	300tb hard disk,786Gb RAM

TABLE 5.0.3 SOFTWARES

Name	Function
JOS*	Server operating system that is used in all servers
Securit	Will be used for security purposes(fingerprint etc.)
Hawkeye	Detects the debris and work along with laser beams
Protecton	Antivirus software providing data protection
Holdo	Used for control of robotic arms
Netconnect	Manages various network devices
Kermit	For safe data transfer between earth and Bellevistat
Backit	Provides backup of critical data

Tempair	For monitoring the temperature and air pressure inside settlement
Fraudy	Fraud detection software
Collectdis	For data distribution and collection
Robosoft	Monitors behavior of robots and their actions
Powus	Gives information on Power usage and backup

***JOS stands for Jauntus Operating System**

DATA STORAGE

Quantum optical technology will be used for data storage. The density of information of this memory is 192MB per square millimeter.

Work and administrators computer data will be stored on server hard drives.

DATA COLLECTION AND DISTRIBUTION

All the data regarding the various aspects of settlement will be stored in the main server. The distribution of Data and Collection from various sub-servers will be carried out through Collectdis. 5 Tbps connectivity between the various sub-servers and the main server will help in this regard.

USER ACCESS TO COMPUTER NETWORKS

Face Recognition, Retinal scanning and fingerprint recognition techniques will be used for providing safe and secure access to user networks. Only Administrators will have access to critical system data but only after verification.

5.1 AUTOMATION FOR CONSTRUCTION

Lithium polymer batteries will be the source of Robots' power. These are easily recharged by connecting the plug to power outlet.

Table 5.1.1 SHOWING LIST OF CONSTRUCTION ROBOTS

NAME	PURPOSE	NO.	MATERIALS	SIZE(L*B*H)(m)
Fructol	Construction of framework	250	Pb, Ti, silica oxide	1 x 1 x 2
Celeron	Construction of various layers of settlement	300	Pb, Tl, Nextel, SiO_2	1.5 x 2.5 x3
Lenovo	Construction of buildings	220	Nickel oxide,Fe	3 x 2 x 4.5
Newtek	Transportation of mined materials	30	Duralumin, Kevlar	0.5 x 0.5 x 0.5
Roady	Construction of roads	38	Al, carbon fibres	2 x 2 x 1

5.1.1 a CELERON(Fig.5.1.1):

- Moves with help of 6 thrusters that provide free & fare movement.
- Gripper places the materials and welding arms binds them using acetocholene flames
- Material handling, feeding of flexible parts and rendering of joints is done by two 360^0 rotating robotic arms capable of holding 5 tons of weight in a single shift.

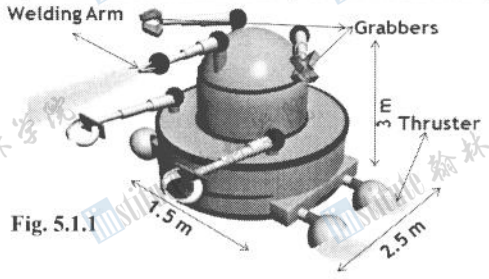


Fig. 5.1.1

5.1.1 b LENOVO(Fig.5.1.2):

- Moves with chained wheels that provide more stability as it carries heavy load.
- Strong robotic arm capable of carrying material weight of up to 1 ton.
- Length of robotic arm is 4 m when extended fully enabling it to reach high heights.
- 360^0 rotatable camera for proper viewing

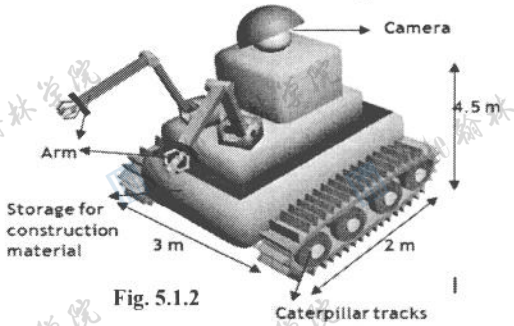


Fig. 5.1.2

5.2 AUTOMATION FOR MAINTAINANCE, REPAIR AND SAFETY FUNCTIONS

TABLE 5.2.1 AUTOMATION FOR MAINTAINANCE AND REPAIR

NAME	PURPOSE	LOCATIONS	SIZE(L*B*H)(m)	NO.
Grumb	Surveillance robot	All parts of residential torus	0.5 x 0.5 x 0.5	10000
Celer	Exterior repair & cleaning	Central cylinder	1.5 x 1.5 x 2.5	135
Medico	Medical robot	Hospital	1 x .5 x 4	120
Cleno	Interior cleaning	Central cylinder	1.5 x 1 x 1.75	450
Quartz	Agriculture	Central cylinder	2 x 2 x 3	250
Clan	Pipe maintenance & cleaning	Within all accessible plumbing	0.2 x0.1 x 0.5	100
Nanobot	Cleaning	Central & Semi Cylinder	3 X 5 X 8 mm	50000

5.2.1.a CLENO (Fig 5.2.1)

- **Cleno** will be used for interior cleaning applications.
- It has a suction rod in front used for cleaning sewage drains.
- A cutter in front will be used for cutting grass in parks
- It will also house a vacuum pump at its bottom for cleaning of roads.
- Fig 5.2.1.a shows Cleno indicating its various parts.

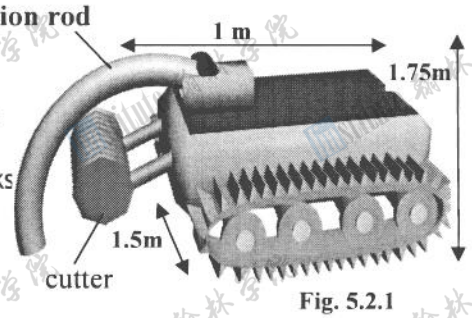


Fig. 5.2.1

AUTOMATION FOR SAFETY

5.2.2 BACKUP SYSTEMS

For the safety of Bellevistat residents,backup systems will be used. Lithium-polymer batteries will be used as a backup in case of power failure. They will continue to provide uninterrupted power for atmosphere control and other essential activities such as lighting, computers, transportation etc. for three days. A backup for Atmosphere Revitalization System will be located in administrative area. Three widely separated docking ports are provided so as in case of accident at one of the ports, other two ports are available.

TABLE 5.2.2 CONTIGENCY PLANS FOR FAILURES

Contingency	STEP I	STEP II	Steps/Time taken
Gas Leakage	Laser Gas detection system detects leakage	Lock area; Depressurisation followed by Repressurisation	Step I :5 seconds Step II :2 minutes
Hull Breach	Assess and temporarily seal damages to hull	Evacuate citizens; if uncontained, lock area	Step I :1 minute Step II :5 minutes
Air Contamination	Residents shifted to safer area	Defect will be repaired	Step I : 5 minutes Step II: 12 minutes
Power Failure	Non-essential systems switched off, Lithium batteries used as backup	Defective solar cells will be repaired.	Step I : 2 minutes Step II : 10 minutes - 1 day
Fire Detected	Fire extinguishing ball will become active and alerts through alarms.	Areas are sealed and residents are shifted i case of a major fire	Step I: 3 seconds Step II: varies
External comm. failure	Backup system starts functioning.	Device causing failure is repaired	Step I: 1 minute Step II: varies
Internal comm. failure	Back up antenna starts functioning.	The antenna is repaired	Step I: 10 seconds Step II: varies

Solar Flares	Polyethylene, silica aerogel layers provide protection	Flaro will move to repair the walls	Step I: always active Step II: in 1minute
Unauthorized access to data	Smart card is blocked and the person is caught.	Network is restored	Step I: 1 minute Step II:2-5 min
Failure of Main Server	Back-up server starts functioning	Main server is repaired and restored.	Step I: 1 minute Step II: 5- 20 min
Medical Emergency	Medico will be called to the site	Medico operates with an automated arm.	Step I: 2 minutes Step II:2- 10 min
Docking Emergency	Doors of central corridor closed , incoming / outgoing ships shifted to other port.	Flaro repairs it usable again.	Step I:3 minutes Step II:5-15 min

5.2.3 PHYSICAL LOCATION OF COMPUTERS,SERVERS AND ROBOTS

Server	Location
Main server	Central Control Panel
Mining	Mining Control Panel
Industrial	Central Control Panel
Agricultural	Central Control Panel
Residential	Central Control Panel

Name of Robot	Location
Flaro	Semi cylinder
Celer	Semi cylinder
Nanobot	Semi cylinder Central Cylinder

Name of Computer	Location
PDG	Handheld
Desktops PC's	Homes
Supucom puter	Offices

5.2.4 Prevention of Illegal entrance into restricted areas

(a) Face recognition (Fig 5.2.4 a)-

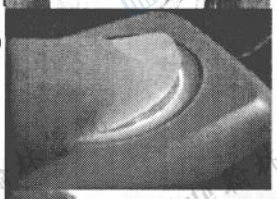
- In this technique, facial image of person will be scanned and then mapped into a series of 128 coefficients.
- To identify the person, the system compares the image to images stored in database.
- The entire process takes only 3 seconds which ensures a fast and safe process.

Fig 5.2.4 a

(b) Fingerprint recognition (Fig 5.2.4 b) -

- The fingerprint of every person is unique with no two persons having same.
- Fingerprint recognition technology will be used which identifies the fingerprints of persons and matches them with the information stored in database.

Fig 5.2.4 b



(c) Retinal Scanning (Fig 5.2.4 c)-

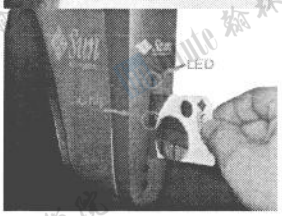
- During a retinal scan, infrared light illuminates the capillaries of eyes and the device captures an image of their pattern.
- The image formed is matched with the image stored in database.
- As no two individuals have same capillary pattern, there remains no chance of its failure.

Fig 5.2.4 c

(d) Smart cards (Fig 5.2.4 d)-

- Smart cards will be used in low risk security zones.
- Each person will be issued a smart card with a chip.
- In case of a theft or card loss, a backup card will be provided and the previous card will be blocked immediately.

Fig 5.2.4 d



5.3 COMMUNITY AUTOMATION

TABLE 5.3.1 Shows different automation systems that people will encounter in daily life

NAME	SIZE(L*B*H) (m)	PURPOSE
CLENO	1.5 x 1 x 1.75	For cleaning of roads and parks (ref. 5.2.1.a)
MAIRO	2 x 1 x 1.5	For delivering various articles to the residents.
SWAT	1 x 1 x 2	For maintaining law and order
ASIMO	1 x .5 x 2	To be used in homes for various purposes
M HOMES	Varies	Houses with different automated systems
PDG	0.15 x 0.5 x0 .2	Small personal computers.

5.3.1 AUTOMATION FOR ENHANCEMENT OF LIVABILITY

5.3.1 a M HOMES: Houses will have various automated facilities to enhance livability and make life enjoyable in Bellevistat. They will be control by PDG which are handheld computers given to each resident (ref.5.3.1 b). There will be automatic temperature and humidity control inside the homes according to the season. Lightning will be switched on or off accordingly when the owner moves out or comes in. Entry into the house will be done through smart cards to avoid case of theft.

5.3.1 b PDG- Personal Digital Gadgets(PDGs) provided to each resident provides computing access in addition to control of M homes and other purposes. It is a powerful pen-sized computer with foldable screen and can also be used as a source of entertainment (Fig 5.0.1)

5.3.2 AUTOMATION FOR PRODUCTIVITY IN WORK AND ENVIRONMENT

Using different automated systems, productivity in work and environment will be increased.
Fusion-the industrial robot will do various hazardous industrial chores that can risk human life. It has a payload capacity of 100 kg in a single shift.
SWAT- SWAT, the robot used for maintenance of law and order is equipped with a 360^0 rotatable camera that maps the image of the suspect and has long line of sight so that it can trace the suspect from far only. It has two arms with claws to hold the suspect and wheels that provide fast and easy movement.

5.3.3 AUTOMATION FOR CONVENIENCES IN RESIDENCES

ASIMO (Fig 5.3.1)- It will be used as personal robot in homes.
- A sphere at top houses a 360^0 rotatable camera for easy viewing.
- Arms have claws at front which provide convenience in grasping.
- Vacuum cleaner at back cleans while it is roving around the house.
- Three trays at front are used in transporting food to eating place.

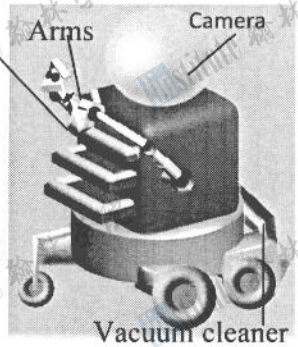


Fig 5.3.1

5.3.4 PRIVACY OF PERSONAL DATA

The private information stored in various computers will be prevented from hacking by protection (ref. table 5.0.3). For all research and business related data, quantum cryptography and physical encryption chips are used. All other data will be encrypted through physical encryption chips and software encryption. Critical data on servers will be firewalled and anti-hacking systems will be used to monitor data and detect any signal of hacking.

5.3.5 ACCESS TO COMMUNITY COMPUTING AND ROBOT RESOURCES

Residents and transients in Bellevistat will be accorded an account of their own, the database of which will be stored in main server and transmitted to all others. People will be able to access facilities depending upon the accounts accorded to them. These accounts will further be secured through the use of smart cards and Biometric sensors. All administrators will have the right to declare an emergency and unlock all the security measures. However this would only be implemented during dire emergency (e.g.in case of an asteroid attack, solar flare etc.) and with consent of simple majority of all administrators.

TABLE 5.3.2 SECURITY LEVELS IN VARIOUS AREAS

Account	Privilege	Verification
Residential	Access To Public, Home, Work Areas & Networks; Permanent Account	Smart Cards, Finger Print
Visiting	Access To Public, Home, Work Areas; Temporary Account	Smart Cards
Research	Access To Research Lab, Research Related Networks & Public, Home & Work Areas; Permanent Account	Smart Cards, Finger Print, Face Recognition, Retina Scan
Business	Access To Public, Home, Work Areas, Job related Areas & Networks; Permanent Account	Smart Cards, Finger Print
Administration	Access To All Systems, Networks & Areas; Permanent Account	Smart Cards, Finger Print, Retina Scan, Face Recognition
Official	Access To Control Panels, Public & Home Areas; Permanent Account	Smart Cards, Finger Print, Face Recognition, Retina Scan
Industrial	Access To Respective Industrial Work Areas, Public & Home Areas; Permanent Account	Smart Cards, Finger Print

5.3.6 NETWORK PLANNING AND BANDWIDTH

EXTERNAL AND INTERNAL COMMUNICATION (Fig 5.3.2)

For external communication, ka and ku band antennas will be used which can communicate within the frequency of 12-18 GHz and 18-40 GHz respectively.

For internal communication, FSP technology is used that has efficiency up to 5 Tbps of connectivity. Also video communication is provided to the residents through it as it has the ability to cope with severe channel conditions.

NETWORKING (Fig 5.3.3)

Mesh topology will be used for networking of the thirteen domes. . In a true mesh topology every node has a connection to every other node in the network through fibre optics. The Bandwidth provided will be 5 Tb/second.

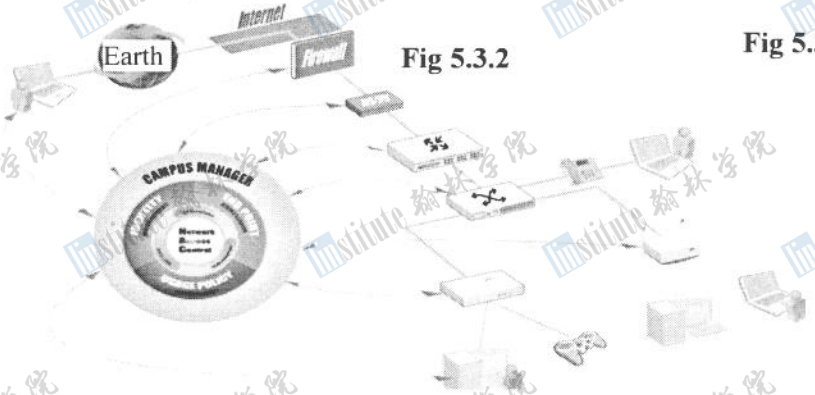
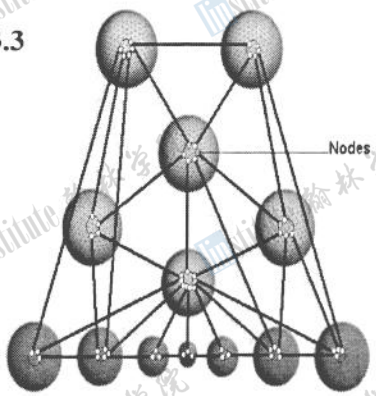


Fig 5.3.2

Fig 5.3.3



5.4 AUTOMATION FOR INTERIOR FINISHING

Robots will be used for interior finishing of residences and other buildings. By utilizing a combination of speed with accuracy and neatness, buildings would not only be built in a short duration of time but also with adequate strength and stability. Robots will have a database of inhabitant's interests, requests etc. and will be human controlled to personalize living space.

TABLE 5.4.1 TIME TAKEN FOR COMPLETION OF BUILDINGS

Location	Type Of Building	Construction Phases	No. Of Days
Visual Centre	Auditorium, Planetarium	**Phase1**- Frame Work, Plumbing, Wiring **Phase2**-Ventilation,Painting,Lightning,Furniture **Phase3**- Acoustics, Seating	5
Museum	High Ceiling Hall	**Phase1**- Frame Work, Plumbing, Wiring **Phase2**-Ventilation,Painting,Lightning,Furniture **Phase3**- Seating	4
Residential Area	Houses & Apartments	**Phase1**- Frame Work, Plumbing, Wiring **Phase2**-Ventilation,Painting,Lightning,Furniture	3
Multiplex	Showrooms	**Phase1**- Frame Work, Plumbing, Wiring **Phase2**-Ventilation,Painting,Lightning **Phase3**- Seating	4

TABLE 5.4.2 ROBOTS FOR INTERIOR FINISHING

NAME	PURPOSE
WIROBOT	USED FOR WIRE AND LIGHTING INSTALLATION
PFR	USED FOR PAINTING AND FLOOR INSTALLATION
PRINTY	FOR PLUMBING APPLICATION
FURNITO	USED FOR MAKING FURNITURE

5.4.1 WIROBOT (Fig 5.4.1)

- Wirobot is a robot meant for wiring and lighting installations.
- It is equipped with four arms-two at front and two at back.
- The front arms have claws meant for grabbing pipes and installing them.
- The front arms are also used for lighting installation.
- The rear arms are used for picking and placing the wires into the pipes.
- Fig 5.4.1 shows wirobot indicating its various parts and dimensions.

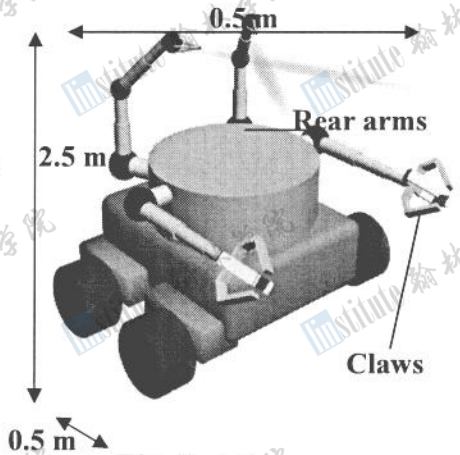


Fig 5.4.1

5.4.2 PFR

- Painting and Floor installation Robot (PFR) is used for painting and floor installation in various buildings.
- It has two extendable robotic arms for painting so as to reach higher heights of the buildings.
- Floor installation is done through bottom of the robot. Tiles to be used are ejected from the storage area present at the bottom of robot.

5.5 MINING OPERATIONS

- Equipment used to conduct mining operations will be built on other stations, and then deployed to their intended destination.
- Mino (Ref Fig 5.5.1) will arrive at a pre-mapped spot on surface of asteroid.
- Perimeters will be setup, each of which will be 47 meters in diameter. Within each of these, there will be an 11m x 11m x 7m central station.
- Each perimeter is split in to 4 sections and each section is assigned a single Mino.
- The robot will have 4 capsule robots and 4 mini ones on it sides of it. The capsules fill dust and ores while the Mino mines.
- After ten minutes the capsule robot detaches itself from the Mino and drives to the center of the perimeter where all capsules go.
- For each asteroid there are 900 perimeters and 3 stages, each stage taking 9.5 weeks.
- After 9.5 weeks, the central station of the perimeter will be filled from each ¼ section.
- For each asteroid 40 ships will be used per day, each will be able to collect the ore from 3 central stations per day and once it has reached its maximum limit it will transport the ore back to the station.
- The process will be repeated three times and mining of entire asteroid will be completed.
- Four human controllers will be required for each mining base.
- Total no. of Minos required are 1200.

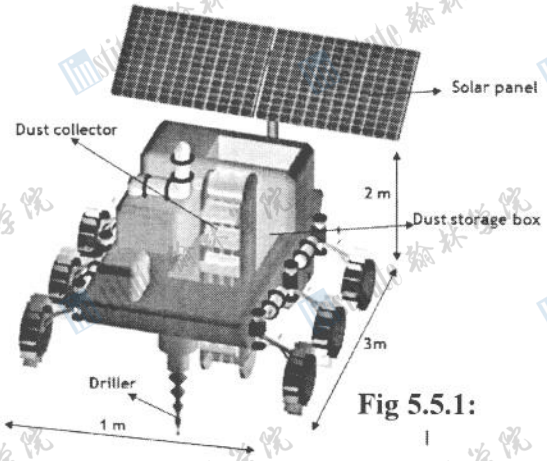


Fig 5.5.1:

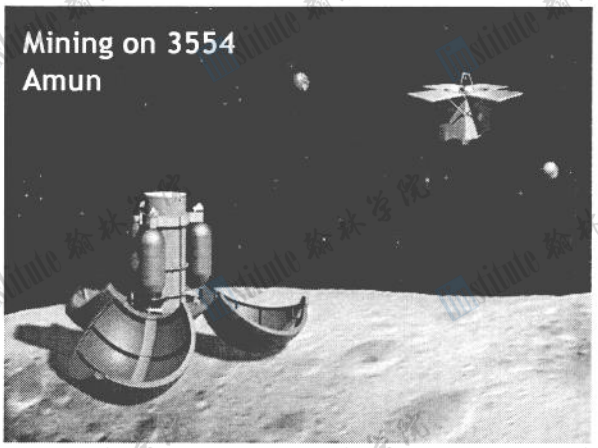


Fig 5.5.2:

Mining on captured Asteroid

6.0 SCHEDULE & COST

INITIAL PHASE

Days/ Date	3089 / May 10,2028	Cost ($)	Unit	Total ($bn)
Designing /Research		-----	-----	1.2
Training		1.1 mn	24	26.4
Pilot plants		0.04	-----	0.22
Transit Vehicles		20 mn	18	0.3
Construction Equipments		------	-----	0.7
Assembly System of Mining		2 mn	5	1
Back- Up	----------	-----	-----	0.9
Maintenance	----------	-----	-----	1

ASSEMBLY PHASE

Phase/Days/ Date	1 / 1478 / October 24, 2036	Cost ($)	Unit	Total ($bn)
Initial Power (SPS)	----------	-----	-----	0.3
Const Central Cylinder		$3000/m^3$	383777	1.15
Docking port		20 mn	1	0.02
Artificial Lightning		-----	-----	0.06
Atmospheric Generation		$80/m^3$	26154814	2.09
Set up of Industries		$2500/m^2$	540600	1.35
Robots		1.5 mn	650	0.97
Back-Up	----------	-----	-----	5.1
Maintenance	----------	-----	-----	5
Phase/Days/ Date	2 / 865 / November 10, 2040	Cost ($)	Unit	Total ($bn)
Initial Power (SPS)	----------	-----	-----	0.75
Linkage Spokes		-----	-----	0.01
Const. Small Hubs		$3000/m^2$	192114	0.57
Const. Semi Cylinder		$3000/m^2$	233942.4	0.7
Docking Ports		20 mn	2	0.04
Internal Set-Up		----	-----	0.2
Robots		1.5 mn	700	1.05
Back -Up	----------	-----	-----	2.5
Maintenance	----------	-----	-----	3
Phase/Days/ Date	3 / 1630 / March 25, 2043	Cost ($)	Unit	Total ($bn)
Initial Power (SPS)	----------	-----	-----	0.4
Linkage Spokes		-----	-----	0.03
Const. Agricultural Torus		$3000/m^2$	510920.07	1.53
Artificial Lighting		-----	-----	0.1
Atmosphere generation		$80/m^3$	19081759	15.26
Agricultural setup		$8400/m^2$	1330000	11.17
Processing & Research Unit		$3400/m^2$	52660.02	0.18
Robots		1.5 mn	900	1.05
Back -Up	----------	----	-----	5.5
Maintenance	----------	-----	-----	6

Phase/Days/ Date	4 / 1765 / September 10 ,2047	Cost ($)	Unit	Total ($bn)
Initial Power (SPS)	----------	-----	-----	0.5
Linkage Spokes		----	-----	0.04
Const. Residential Torus		3000/m^2	1186194.55	3.56
Artificial Lightning		-----	-----	0.25
Atmospheric Generation		80/m^3	687750700	55
Communication Set Up		100 mn	3	0.3
Setting Different zones		8400/m^2	1900000	15.96
Robots		1.5 mn	900	1.35
Back -Up Facility	----------	-----	-----	12.21
Maintenance	----------	-----	----	15.96
Phase/Days/ Date	5 / 1350 / July 10 ,2052	Cost ($)	Unit	Total ($bn)
Shock Absorber		----	----	0.7
Reflector		----	-----	0.1
Solar Panels		11/m^2	551445	0.006
Robotic Arms		1 bn	6	6
Final Testing		----	-----	2.2
Human Transportation		-----	-----	8.27
Robots		1.5 mn	1400	2.1
Back -Up Facility	----------	-----	-----	1.6
Maintenance	----------	-----	-----	2.65
Employees		-----	------	10
Alexandriat		-----	-----	3
	TOTAL COST = 236.556($bn)			

Table 6.2.1 Number of employees per phase

Employees	Initial Phase	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Pilots	40	60	130	60	70	100
Engineers/Scientists	400	420	280	220	140	160
Designers	450	370	50	60	160	60
Operators/Managers	250	110	140	190	150	140

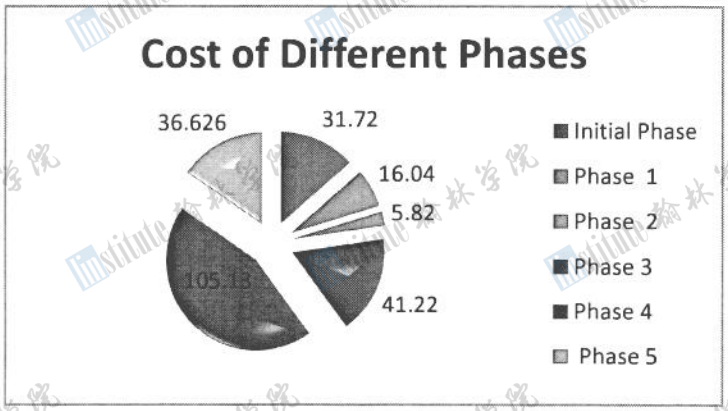


Chart 6.2.1 Showing cost of different phases

Table6.2.2

Starting Date	May 10,2028
Total time taken to built	27.8 years
Total Cost	236.556 ($bn)
Date when population will be established	March21,2056

7.0 Compliance Matrix

Sections	How Accomplished	Page no.
Section 1.0	Executive Summary	1
Section-2.0 Structural Design		
2.1.1Basic structure	•Basic structure of Bellevistat consists of Residential torus, Agricultural torus, Central cylinder, Semi-cylinder, Solar Panels strip, Mylar Reflector, Shock Absorber Frustum, Hubs, Docking Ports & antennas. •Fig.2.1.1, fig.2.1. 2, fig.2.1.3 represents the Basic structure, Top view and the Cross-sectional View of the Bellevistat respectively.	2-3
2.1.2 Construction Materials	•Table 2.1.2 shows the various construction materials along with their utilization and properties. •Describes the materials used in walls and windows of the settlement. Fig.2.1.4 represents layers of window and the respective wall.	3-4
2.1.3 Artificial Gravity	•Describes the justification for different values of gravity in different regions. Table 2.1.3 describes the magnitude and rationale for gravity. •RVS have been used to monitor the rotation rate.	4
2.1.4 Natural Views	•Means of providing natural views have been described.	4-5
2.1.5 Radiation and debris protection	•Doped glass sheet is used to detect the path of radiations. •Layers of materials and LIDAR SYSTEMS for debris protection	5
2.2.1 Residential torus	•Explains the internal arrangement of the residential area with recreation zone, commercial area, hospitals, public area, parks as shown in fig.2.2.1	5
2.2.2 Agricultural region	•Describes the internal layout of agricultural region with distribution of agricultural torus as shown in fig.2.2.2 and vertical clearance of agricultural down surfaces fig 2.2.2	5
2.2.3Hubs	•Describes the internal arrangement of hubs as shown in fig 2.2.3	6
2.2.4central Cylinder	•Describes internal arrangement of the central cylinder in fig.2.2.4.	6
2.2.5 Semi cylinder	•Describes the composition of the semi – cylinder.	6
2.3 Construction sequence	•Describes the construction sequence adopted (fig.2.3.2) in 7 phases (including 7th phase for expansion facilities).	6-7
2.4 Structural attachment	• Attachment to capture and hold the settlement with captured asteroid is depicted in the fig 2.4.1 • Dust removable systems like Centrifugal Multiple Cyclone Separator & Electrostatic Precipitator are used to remove the dusts referring table	7-8
2.5 Docking port facilities	• Describe the location of three widely located ports (fig 2.5.1). • The Androgynous Peripheral Attached System (APAS) for docking facilities along with other systems (fig 2.5.2).	8

Section 3.0 Operation & Infrastructure	How accomplished	Page no.
3.1.1 Orbital location	• Location of Bellevistat and reason for its selection (fig 3.1.1)	9
3.1.2 Materials & equipments	• Various materials & equipments for construction of Bellivistat along with there sources is depicted by table 3.1.1 and table 3.1.2 respectively.	9-10
3.2.1 Food Production		
3.2.1.1 Growing	• Food production will be done with the help of Nutrient Film Technique (NFT) (fig 3.2.1)of hydroponics and plantation will also be done • Table 3.2.1 describes the various food items along with their requirements. • Area for growing is 1330000 m^2.	10
3.2.1.2 Harvesting	• Harvesting is done by Quaradz	11
3.2.1.3 Storing	• Food Irradiation Technique (fig 3.2.2) is used for storing . • Food will be stored in area of 95,000m^2 in the agricultural torus	11
3.2.1.4 Packaging	• *Hypobaric Vacuum Packaging* technique would be used (fig.3.2.3)	11
3.2.1.5 Delivering & Selling	• Elevators would be engaged for delivering food products from agricultural torus to residential torus.	11
3.2.2 Electric Power Generation	• For generation of electricity, 40 solar panels are used. • Table 3.2.2 shows power requirement of various sectors.	11-12
3.2.3 Communication Systems		
3.2.3.1 Internal Communication system	• To provide full time communication within the settlement Free Space Photonics is installed.	12
3.2.3.2 External Communication	• External communication is done through 3 DSN antennas using ka and ku bands.	12
3.2.4 Internal Transportation		
3.2.4.1Private Transportation	Flight bike, Joey chair, Pulse car etc referring fig 3.2.5 , fig 3.2.6, fig 3.2.7 along with their dimensions.	13
3.2.4.1Public Transportation	• Automated tram system with two trams moving in opposite directions (fig 3.2.8) would be used.	12-13
3.2.5 Atmosphere/ Climate/Weather Control	• Atmosphere would be controlled by **ARS** (fig 3.2.9) • Trace contaminant control system (TCCS) eliminates trace organism from the atmosphere. • Humidity and thermal control will be done using Condensing Heat Exchangers (CHX). • Carbon would be reduced by Carbon Reducing System(CRS) and oxygen produced by OGS • Composition of Air has been described in table 3.2.4	13-14
3.2.6 Household & industrial Solid Waste Management	• Solid waste management unit(fig 3.2.10) is installed . • Anaerobic digester will be used for organic wastes whereas microwave incinerator will be used to manage inorganic wastes.	15
3.2.7 Water Management		
3.2.7.1 Procution	• Procured from Moon & treated at water treatment plant.	15

	• Daily procurement of water is 25693 m^3.	
3.2.7.2 Storage	•Storage units would be installed.	15
3.2.7.3 Distribution	• Distribution would be done by two water humping centres.	15

3.2.7.4 Recycling	• Recycling is done through water recycling unit.	16
3.2.8 Transportation Corridor	• Table 3.2.13 shows transportation of goods through the transportation corridors. • 6 elevators are used in the transportation corridor.	16
3.2.9 Rights Of Way	• Distribution of road have been shown in fig 3.2.15 • Fig 3.2.14 depicts the functioning of various elevators in the corridors.	16
3.2.10 Movements of export from source to port facilities	• Mass catchers & mass drivers are used in transporting materials. • Various vehicles have been used for transporting materials (fig3.2.16)	16-17
3.2. 11 Day & Night Cycle	• Day & night cycle provision would be ensured by using glass inclined at an angle of 45 degree. • Intensity of light will be lowered during the night using electro chromic smart glass	17
3.3.1 On-orbiting Infrastructure		
3.3.1.1 Space Infrastructure	• Table 3.3.1 shows on orbit infrastructure being used by Bellivistat	17
3.3.1.2 Space Manufacturing	• Describes the different facilities for manufacturing & assembly of spacecraft • Table 3.3.2 shows different products to be manufactured	18
3.3.3 Extra terrestrial materials harvesting & refining	• Table 3.3.3 shows Value of semi-conductors and precious metals to be exported	18
3.3.4 Space vehicles	• Table 3.3.3 shows various space vehicles to be used by BELLIVISTAT along with purposes.	19
3.4 Plantation in residential area and Animal Husbandry		
3.4.1 Animals husbandry	• Table 3.4.1 shows various fodder to be grown for animals. • The total area for animal husbandry comes out to be 3, 80,000 m^2 • Table 3.4.2 shows various facilities to be provided to animals.	19-20
3.4.2 Plantation in the residential area	• Plantation in the residential area would be done in the form of kitchen garden using hydroponics. • Table 3.4.3 shows various plants to be grown in residential area.	20
3.5 Innovative approaches		
3.5.1 Types of furniture	• Table 3.5.1 shows various celestial furnitures with their construction materials and innovative approaches used in their construction.	20-21
3.5.2 Interior Finishing	• Table 3.5.2 shows various materials for interior finishing of houses.	21
3.5.3 Kitchens and plumbing equipments	• Table 3.5.3 shows various kitchen equipments • Table 3.5.4 shows various plumbing equipments.	21

Section- 4.0 Human Factors	How accomplished	Page no.
4.1Community Design	• Easy access to each facility like school, university, health centers, offices, shopping centers, amusement parks, lake, and emergency services and sports center have been shown in fig 4.1.1.	22
4.1.1 Features of community	• Various facilities have been discussed to show their role in making the life of the residents cozy and easy.	22-23
4.1.2 Variety, quantity of consumables consumables	• Variety of the consumables have been illustrated through table 4.1.1 and table 4.1.2 and their quantity is depicted via table 4.1.3	24
4.1.3 Consideration Psychological factors	• Various Psychological problems, their effects and mitigation have been discussed in table 4.1.4	24
4.1.4 Distribution of consumables	• The whole distribution of consumables is simplified by the figure 4.1.5	24
4.2 House Plans	• Table 4.2 depicts the allotment of the houses or apartment on the basis of population type. • Fig 4.2.1 & fig 4.2.2 is the floor plans for the houses and apartments respectively along with their dimensions. • Fig 4.2.3 & fig 4.2.4 portrays the exterior view of apartments & houses.	24-25
4.3 Work Environment		
4.3.1 Designs of systems	• The designs of the various systems like monetary, Hazard management and security systems, fraud detection system etc have been discussed.	25-26
4.3.2 Designs of devices	• Designs of the devices in Bellevistat have been referred. Fig 4.3.2.1,fig 4.3.2.2 & fig 4.3.2.4 are various designs of the systems	26-27
4.3.3 Design of vehicles	• Vehicles used for external transportation are described	27
4.3.3.1Re-entry vehicle	• Describes design of re-entry vehicle (EDDY)(fig.4.3.4)	27
4.3.3.2 Tourism	• Describes various facilities for tourists • Fig.4.3.3.2. depicts the transparent tunnels used to allow tourists to observe refining & manufacturing operations	27-28
4.3.4 Movement in Low Gravity Regions	• Systems and processes for safe movement in the low gravity. • Fig.4.3.6 shows movement of a person with magnetic boots.	28
4.3.5 Occupations and materials required	• Occupations and materials required have been illustrated in the table 4.3.4 along with the no. of people employed in each.	28-29
4.3.6 Space suits	• The space suit (Fig 4.3.7) with touch screen controls and its uses to the astronaut have been discussed in this segment. These are skintight body suits, which provide mechanical counter pressure to the body with an elastic non-air tight fabric.	29
4.4. Neighbourhood Plan	• Housing on the basis of affordability & choices (economic basis) have been illustrated via a map(fig 4.4.1) • Lifestyle choices for Families like Commercial neighborhood, Restive neighborhood, Economic neighborhood are mentioned.	29-30
4.5 Varieties of activities	• Table 4.5 describes the variety of activities including recreational activities & entertainment are provided to the residents.	30

Section- 5.0 Automation & Design		Page no.
5.0 .1 Types of computers	• Table 5.0.1 shows computer systems along with their specifications.	31
5.0.2 Types of Servers	• Table 5.0.2 shows various servers provided along with proper specifications & the accumulated backups.	31
5.0.3 Types of Softwares	• Table 5.0.3 shows the various softwares along with their uses.	31-32
5.1 Automation for assembly and construction of settlement	• Table 5.1.1 shows various robots required for construction of the settlement along with their purpose and numbers. • Fig 5.1.1 & Fig 5.1.2 are various construction robots along with their dimensions.	32
5.2 Automation for maintenance and repair	• Table 5.2.1 shows purpose, location and dimension of robots used for maintenance and repair • Quartz will be used for harvesting plants. • Celer will be used for repairing purposes. • Cleno(fig.5.2.1) will be used for cleaning purposes.	33
5.2.2 Automation for safety	• Describes back-up systems • Table 5.2.2 describes the contingency plans in case of emergency	33-34
5.2.3 Physical location of servers	• Table 5.2.3 depicts the physical location of computers, servers & robots for critical function.	34
5.2.4 Prevention of illegal entrance into restricted areas	• Describes security level and authorization and how to prevent illegal entry in restricted areas.	34
5.3 Community automation	• Table 5.3.1 depicts different automation systems.	35
5.3.1 Automation to enhance livability in the community	• Describes M-homes, PDG for enhancement of livability.	35
5.3.2 Automation for productivity in work and environment	• **Fusion** will do various hazardous industrial chores • **SWAT** used for maintenance of law and order	35
5.3.3 Automation for convenience in residence	• **ASIMO** (fig5.3.1) will assist the household purposes.	35
5.3.4 Privacy of personal data	• Techniques for encryption and protection of data have been described.	35
5.3.5 Community computing and robot resources	• The various accounts created and the liberties given to various individuals have been described	36
5.3.6 Network planning & bandwidth	• Fig.5.3.2 shows the network diagram. • Describes bandwidth for internal & external communication	36
5.4Automation for interior finishing	• Table 5.4.2 shows robots for interior finishing • Wirobot(fig.5.4.1),PFR, Printy & Furnito will be used for automated wiring, painting, lighting & plumbing	37

5.4.1WIROBOT	• Wirobot for automated wiring and lighting installation described • Fig. 5.4.1 shows a Wirobot	37
5.4.2 PFR	• Painting and floor installation robot has been described	
5.5 Automation for mining purposes	• Fig. 5.5.1 shows Mino and 5.5.2 shows mining on captured asteroid .	38

Section-6.0 Schedule & Cost		
6.1 Schedule must describe contractor tasks from the time of contract award.	• Describes the whole schedule in phases starting from May 10, 2028 and ending on March 21, 2056. • Numbers of employees to be employed per phase have been given in the table (Ref fig 6.2.1) and total time and cost are given(Ref fig 6.2.2)	39 40
6.2 Specify cost for BELLIVISTAT design in construction US ($)	• Cost for the construction of Bellevistat has been given (in U.S. dollars) simultaneously Pie chart(6.2.1) depicts cost in phases .	40

WEBSITES CONSULTED

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