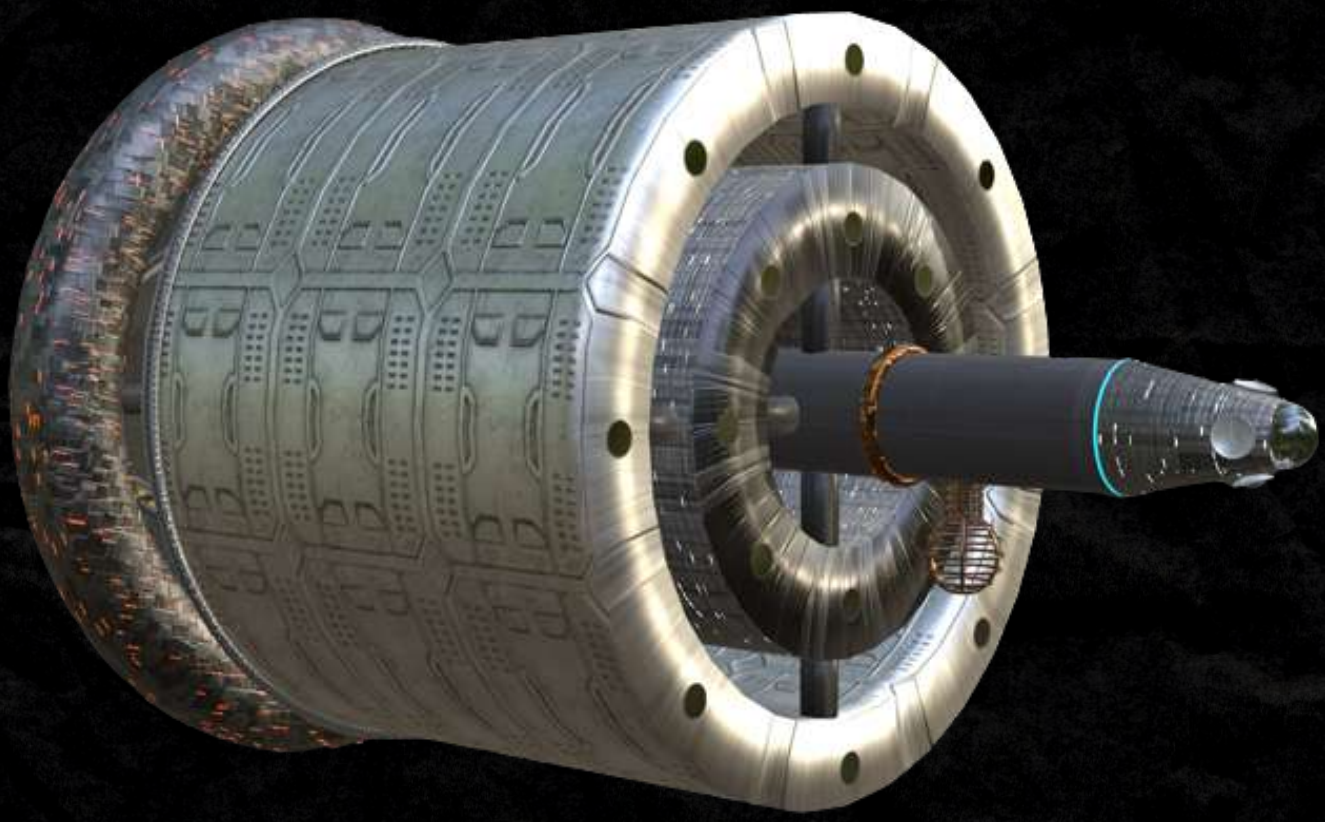

BELLEVISTAT

International School Lahore,
Lahore,
Pakistan.

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1.0 EXECUTIVE SUMMARY

“I think of space not as the final frontier but as the next frontier. Not as something to be conquered but to be explored.”
- Neil Degrasse Tyson -

After Alexandriat, a need arose not just for lunar refining of materials, but for living and thriving in space indefinitely. This need stems from the declining conditions of our world and mankind's inherent curiosity about this universe. Thus space travel and sustainable living welded together in the shape of Belevistat. Our home in the stars.

At Bellevistat, every passenger can easily forget earth and any desire to live there. They can expect every need they might have, met. Any craving they might have dealt with. A life of peace and luxury.

A completely sustainable system with industries and agricultural systems to make life more than just a possibility. With exquisite community design to keep the residents content.

2.0 STRUCTURAL DESIGN

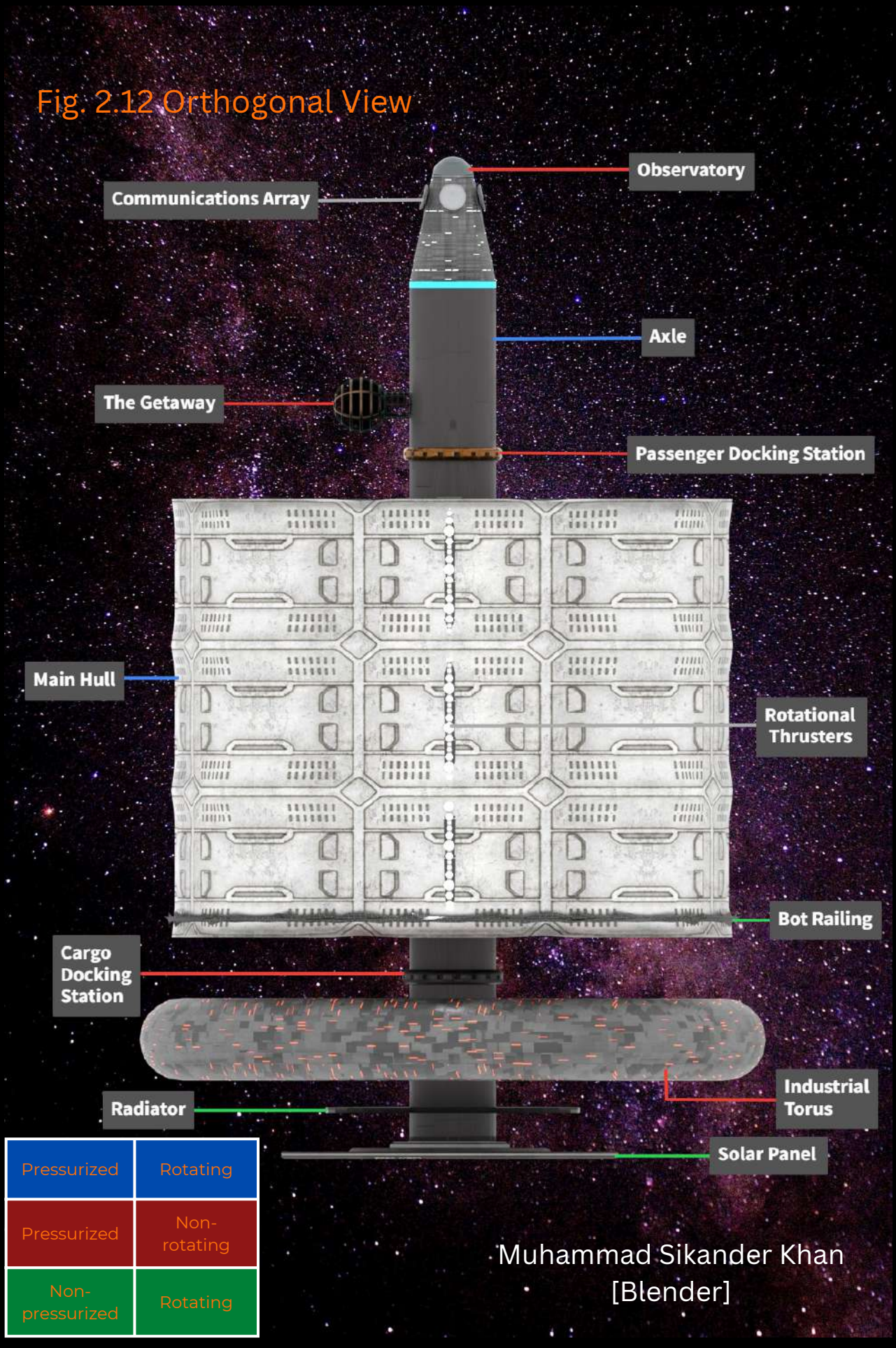
The basic structure of Bellevistat consists of 2 main cylinders attached to a rotating axle. This is enhanced with an industrial torus, solar panel, Communications array, state of the art observatory, and a 0g recreational center, The Getaway.

2.1 External Configuration

Fig. 2.11 Dimensions and specifications of major components

Components	Dimensions				Surface Area (m^2)	Volume (m^3)	Specifications
	Outer radii (m)	Inner radii (m)	Height (m)	Vertical Clearance (m)			
Inner Cylinder	300	200	500	100	9.4×10^5	7.85×10^7	• Rotating • Variable Pressure • 0.8 g
Outer Cylinder	475	400	500	75	1.49×10^6	1.03×10^8	• Rotating • Variable Pressure • 0.5 g
Industrial Torus	500	400	100	100	2.36×10^5	2.2×10^7	• Non-rotating • Variable Pressure
Axle	150	-	1500	-	1.41×10^6	1.06×10^8	• Rotating • Pressurized
Cone	150	-	100	-	-	-	• Rotating • Non-pressurized
Hexagonal Solar panel	700	-	-	-	1.27×10^6	-	• Rotating
Docking stations	250	150	100	100	9.42×10^4	7.07×10^6	• Non-rotating • Pressurized
Observatory	75	-	-	-	5.30×10^4	8.84×10^5	• Non-rotating • Pressurized
The Getaway	100	-	Tunnel = 75	-	1.26×10^5	4.19×10^6	• Non-rotating • Pressurized • 0 g

Fig. 2.12 Orthogonal View



Construction Materials

Fig. 2.13 Properties of materials used

Materials	Components	Properties
Aluminum	Cylinders, industrial torus, axle, the getaway, observatory, solar panel disc, docking stations, cargo ports	Non magnetic, non-toxic, highly malleable and ductile, high electrical conductivity, non- sparkling, corrosion resistant
Titanium alloys	Cylinders, industrial torus, axle, the getaway, solar panel, docking stations, spokes, cargo ports	High specific strength, Good high-temperature mechanical properties, Corrosion resistant
Magnesium	Cylinders, industrial torus, axle, solar panel, docking stations, cargo ports	One third less dense than aluminum, Improves mechanical and welding characteristics of aluminum when used as an alloy
Iron	Cylinders, industrial torus, axle, docking stations, cargo ports	High melting and boiling point, Average thermal conductivity and ductility, Shiny and lustrous, Can b easily magnetized and demagnetized, Can be used to manufacture steel
Steel	Cylinders, industrial torus, axle, docking stations, observatory, cargo ports	Corrosion resistant, Yield resistant, Good metallurgic properties, ability to overcome brittle fracture or fatigue, Hard and high tensile strength, Plasticity and malleability
Carbon bucky structure	Cylinders, industrial torus, getaway, observatory, docking stations	Super conductivity, Can trap other chemicals, Can be used as a lubricant
Electromagnets	Industrial torus, getaway, docking stations	A temporary magnet, Strength can be controlled, Can be turned on and off, Poles can be reversed, Usually made of a soft magnetic material such as pure iron
Carbon nanotubes	Industrial torus, getaway, docking stations	High strength, stiffness and tenacity, High thermal and electrical conductivity (free electrons), Flexible, High thermal expansion coefficient, Lightweight and easily portable, Can be used as a semiconductor
Carbon Fiber	Industrial torus, getaway, docking stations	Excellent tensile strength, Low density, High thermal and chemical stability, Good thermal and electrical conductivity, Excellent creep resistance
Glass	Observatory, solar panel disc	Transparency, Heat resistance, Resistance to pressure breakage, Chemical resistance
Silicon	solar panel disc	Solid at room temperature, Lustrous and shiny, Very brittle, Semiconductor (can be made to conduct electricity under certain conditions), High melting and boiling point

2.2 Internal Configuration

Cross sections and down surfaces

Muhammad Sikander Khan
[Blender]

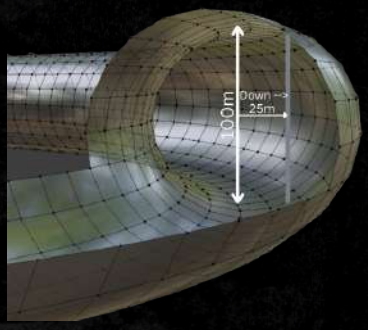


fig 2.21 Industrial torus

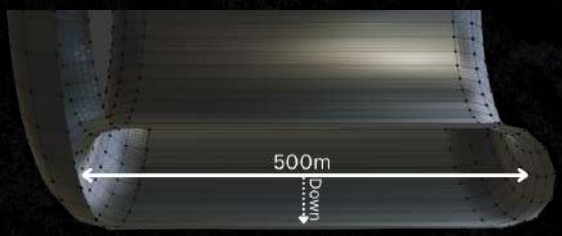


fig 2.22 Cylinders

Construction of Interior Structures

Elevators:
The Elevator would be built close to the edge of the inside of the axle, running parallel along its length. It would consist of a cylindrical structure of radius 20m and length 60m, with ample space for cargo transportation. There would be vertical elevators inside the spokes of the Torus, for the CASSSC's. Main construction is Subcontracted to ***BeamBuilders, Ltd & SpaceTrans, Inc.***

Rotational Interface:
The rotatory interface consists of Magnetic bearings on the axle and the non rotating structures which allow the axle to rotate while the structures themselves remain stationary.
Non rotating structures include: Industrial Torus, The Getaway, Observatory, Communications array, docking stations and cargo port.

Docking stations:
CASSSC docking station resides on the axle, connected via the rotatory interface. It would consist of numerous docking ports with openings large enough for the transportation of multiple CASSSCs at one time. The station will not be pressurized as the whole system of collection and transportation will be automated. For the Civilian and Drone Docking station, refer to Operations.

Axle Internals:
The axle will be non pressurized and rotating. It will mainly be used for Storage and power generation with a built in Spaceship assembly line
It will include:

- Batteries for Electricity Storage
- Subsidiary Nuclear Power Generation - Subcontracted to ***Fusion Founders***
- Storage Facilities for CASSSCS, agricultural and manufacturing industries
- Security center
- Bots and Drones Storage
- Spaceship Assembly line

Dimensions of Used Areas

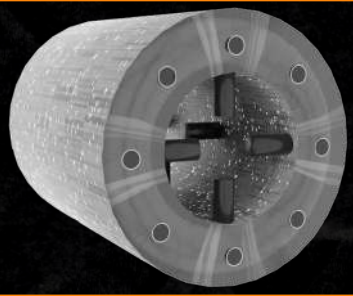
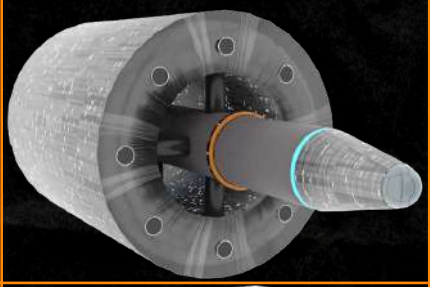
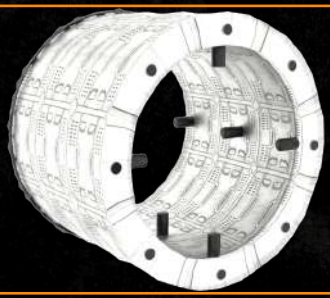
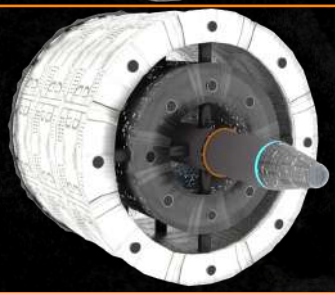
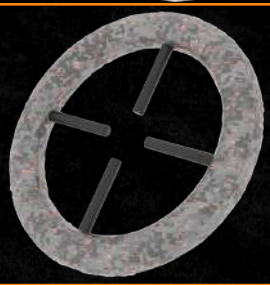
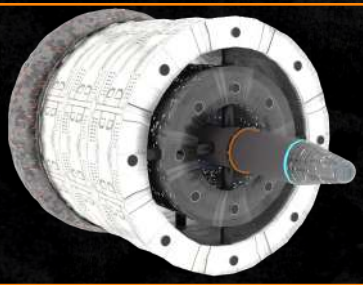
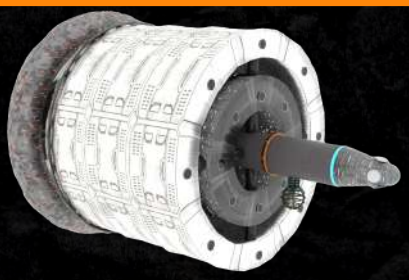
Fig 2.23 Dimensions of Used Areas		
Use	Placement	Total Area (m_2)
Residential	Outer and Inner Cylinder	$1.51 \times 10_5$
Agriculture and animal farms	Inner Cylinder	$2.00 \times 10_5$
Industries and commercial area	Multi-purpose Torus and Inner Cylinder	$3.75 \times 10_5$
Facilities (Health, Education, Security etc)	Outer Cylinder	$6.42 \times 10_5$
Public Open Spaces	Outer Cylinder	$1.64 \times 10_5$
Administration Area and Control Room.	Inner	$1.2 \times 10_4$
Transport Infrastructure	Outer and Inner cylinder	$1.75 \times 10_5$

fig 2.24 internal configuration of cylinders

ibrahim Arif Alvi
[Pro create]

2.3 Construction Process

Fig. 2.31 Steps for the assembly of the settlement

Steps	Added component	Assembled view
Step 1:- • Axle • Docking stations- • Cone • Observatory These structures will be assembled on Earth and launched in operating capability.	–	
Step 2:- • Inner Cylinder This will be launched with retractable spokes which attach themselves to the main axle after alignment. Here spin will be initiated via retractable thrusters in the Hull. Speed of Rotation = 48.5ms-1		
Step 3: • Outer Cylinder • Railing This cylinder will be launched with similar retractable spokes which attach to the inner cylinder.		
Step 4: • Industrial torus The industrial torus will be aligned with the adjustable spokes and launched to be positioned on the axle.		
Step 5: • Solar Panels • Radiators • Communications array All three components will be manufactured and launched before being assembled on the axle.		
Step 6: • The Getaway The getaway will be constructed on Earth and launched to set on the settlement. Muhammad Sikander Khan [Blender]		

2.4 Industry Environment

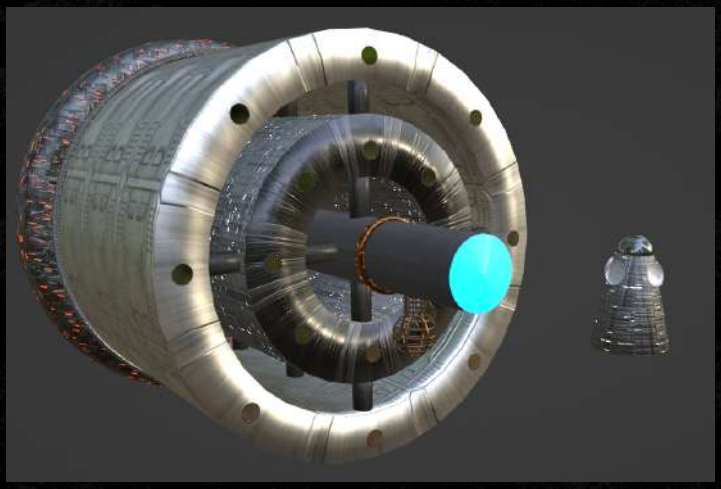
The industrial area would occupy ___ area in the inner cylinder and ___ area in the multipurpose area. The industries would include all the textile, waste processing, pharmaceutical etc.

The industrial area established inside the inner cylinder will be pressurized and will experience 0.5 g. Simultaneously, the other half of the industrial area established inside the industrial torus will be under 0 g and non - pressurized environment.

2.5 Settlement Expansion

Bellevistat's main axle has been built with the insight of any future developments. For any future expansion to the settlement, the cone could be detached from the axle creating the space for the addition of the secondary, new axle.

This axle would consist of all the components similar to the initial design and the detached observatory would fit to the other end of the new axle. This design would have a 400% (or more depending on the need) IOC manufacturing capability and a capacity of approximately 25,000 more residents.



Muhammad Sikander Khan
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fig 2.51 Removal of cone

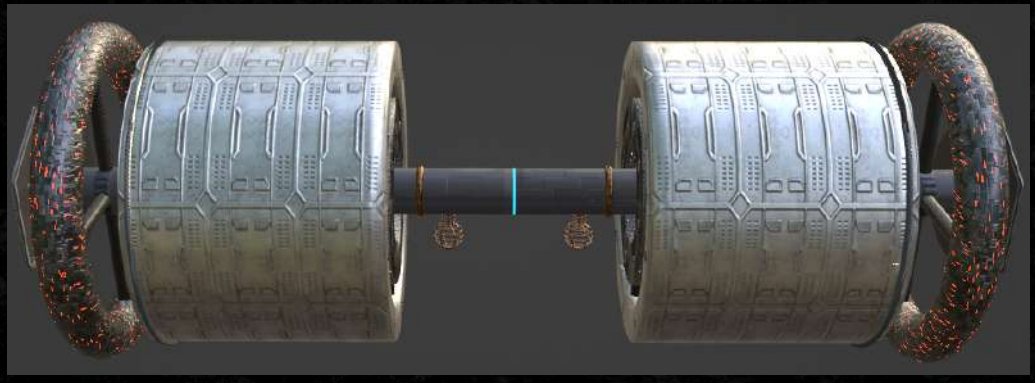

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fig 2.52 Mirroring of structure

3.0 OPERATIONS AND INFRASTRUCTURE

3.1 Locations and Material Sources

fig. 3.11 Raw Materials

Material	Amount	Sources	Use	Extraction
Hydrogen	2.5 x 10^2 kg	Lunar slopes on the poles deposited by solar winds	Propellant production, Industrial usage	Water-splitting, heat the regolith until hydrogen gas is released
Nitrogen	5.1 x 10^8 kg	Lunar soil-solar wind deposits	Farming activities as fixed nitrogen and fertilizers. Important component of atmosphere	Stepped combustion procedure: Samples combusted in oxygen supplied from copper oxide, in a double walled ceramic lined furnace. After some time oxygen is reabsorbed at 850-900 degrees. The gas released is mostly nitrogen, it is liquefied and collected.
Oxygen	3.2 x 10^{12} kg	Lunar regolith (iron rich lunar minerals-iron oxide)	Oxygen Tanks, Aerobic Reactions, Artificial Atmosphere within the settlement, Farming and Industrial reactions	Reducing oxygen in lunar soil by reacting with hydrogen to make Fe and H2O, water is then electrolyzed to produce oxygen. Fractional distillation of liquefied lunar air can also produce large amounts of oxygen.
Water	1.15 x 10^5 kg	Lunar South Pole-crater interiors-shaded by sunlight, comets asteroids and meteoroids near the settlement's orbit	Farming methods, Sewerage and drainage systems, Industrial Use, Residential use	Microwaves shot into the lunar surface to thaw the ice, water vapor collected above the lunar surface due to the vacuum, on plates as ice

Uranium/Thorium	2 kg	Lunar regolith (in thorium dioxide)	Nuclear Fusion- energy for mining other materials from the moon	Ground up lunar dust, leaving fractions of iron-nickel and thorium and uranium. Iron and nickel fractions are extracted using electromagnets leaving thorium and uranium behind. For further purity: thorium is filled in a crucible and heated inductively causing it to melt and settle in the bottom and we can tap it off. Uranium is made by transmuting thorium with a beam of neutrons- obtained by exposing beryllium to gamma rays in lunar atmosphere.
Iron	6.56×10^4 kg	Lunar mare basalts and hematite (ferric oxide) Meteoritic debris	Mixed with carbon to make steel and used to make robots and rails; used to make electromagnets	Smelting, reduce with oxygen in a furnace to produce pure iron which is then tapped off
Titanium	1.11×10^5 kg	Lunar regolith (mineral ilmenite ($FeTiO_3$))	Alloyed with iron, aluminium, vanadium to make external structure of settlement	Smelting-using Krolls process by reduction with magnesium
Silicon	8×10^3 kg	Lunar regolith	To make solar panel arrays to convert solar energy into electricity; fiber glass and glass made from a blend of silica and iron compounds; semiconductor when achieving high purity; used in silicon based solar cells; silicon bucky structures for construction of building	Smelting-Dry extraction: 1. Reducing silicon dioxide content in the ore with an aluminum metal 2. Aluminium oxide is electrolysed producing aluminium and oxygen 3. Dinally calcium oxide is removed by electrolysis producing calcium and oxygen 4. This leaves silicon to be tapped off

Aluminum	4.77 x 10^9 kg	Lunar regolith, present in a mineral called anorthite ($CaAl_2Si_2O_8$) From Earth	Used as an electrical conductor, used to make wires; as a material for construction of settlement's exterior; atomized aluminum powder used as rocket fuel along with oxygen	Smelting- explained in silicon' extraction
Calcium	1.5 x 10^3 kg	Lunar regolith	Calcium oxides and silicates for ceramics, manufacture silicon based solar cells made through titanium oxide, silicon and aluminium	Smelting- explained in silicon extraction
Carbon	9.2 x 10^{12} kg	Lunar Regolith, carbon bearing ice traps in lunar poles	Lunar steel manufacture; atmosphere; manufacture carbon nanotubes which are mixed with lunar soil to make telescope mirrors, graphene used to make sensors; used with hydrogen to manufacture polymers in the industry to make rubbers, plastics and textiles, bucky structures used to make cables and fabrics used for themal insulation, electric conduction or light refraction	Ice traps composed of lunar carbon can be heated to produce carbon compounds such as methane CH_4, carbon monoxide CO, and carbon dioxide To produce elemental carbon:- 1. Organic material heated in an anaerobic environment to produce charcoal 2. Catalyzed methane reduction $CH_4 \rightarrow C + 2\ H_2$ 1. Carbon dioxide reduction (Bosch Reaction) using iron catalyst $CO_2 + 2H_2 \rightarrow C + 2H_2O$ 1. Sebatier Reaction-using nickel catalyst $CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$ 1. Direct CO2 Electrolysis $2CO_2 \text{ –. } 2CO + O_2$

Magnesium	1.5 x 10^3 kg	Lunar Regolith, present in magmas and in the lunar minerals pyroxene and olivine	Alloys for use in aerospace and electronics	Sulphating olivine, heated upto 250 degrees, solid silica precipitated, leaving magnesium solution behind which can be crystallized to form magnesium compounds
Rare Earth Elements	3 x 10^3 kg	Earth's crust Lunar Regolith	Electric vehicles, electronic devices manufacture	Solvent Extraction-organic extractants and centrifugal columns are used to separate rare earth from the lunar soil
Nickel	2 x 10^3 kg	Iron ores from nearby asteroids	Catalyst for our atmosphere system	Smelting-using extractive metallurgy: 1. Ore is roasted to remove the moisture. Nickel oxide is reduced in a furnace to produce 75% pure nickel 2. Flash and electric smelting: ore placed in a furnace with preheated oxygen, iron and sulfide oxidize leaving 45% pure nickel behind
Lithium	8 x 10^3 kg	Earth's crust	Carbon coated lithium batteries	Mineral rich brine drilled from earth's crust and distilled to make lithium carbonate, the main constituent of lithium ion batteries
Phosphorus	2 x 10^3 kg	Earth sedimentary rocks, Lunar soil in phosphides and phosphates	Used as a fertilizer and for industries	Sodium hydroxide and EDTA (ethylenediaminetetraacetate) used to treat soil to extract organic phosphorous
Argon	1 x 10^2 kg	Lunar soil	Used as trace amounts in atmosphere	Step by step combustion-explained in extraction of Nitrogen

Processing Methods

Lunar Regolith can be turned into usable materials using the following processing techniques:-

1. Sintering (forming a solid mass of material without heating it to the point of liquefaction)
2. Hot pressing (applying uniaxial pressure to a material using cubes)
3. Liquefaction (generating liquid from a solid or a gas, or a material that behaves in a fluid-like manner)
4. Cast-basalt method (quarrying rock, melting at 1280 degrees and cooling in molds)
5. 3D printing (construction of a three-dimensional product from a CAD model or digital 3D model)

Fig 3.12 Processed Materials Used for Construction		
Material	Sources	Use
Lunar crete	Made in a similar way to concrete but materials from lunar regolith are used including, glass fibers, glass composites, and metals	Used as a construction material for buildings: residential and industrial
Acrylonitrile butadiene styrene	Carbon and hydrogen polymerization	Mixed with lunar regolith to make a light, thermal resistant plastic to construct pipes, domes and overhead bridges
Nylon, spandex	Carbon and hydrogen polymerization	Used for making spacesuits, airbags
Kevlar	Made by a condensation reaction of an amine (1,4-phenylene-diamine) and and acid chloride (terephthaloyl chloride)	Used to construct buildings
Xylon	Made by mixing a polymer called PBO (para-phenylene benzobisoxazole), while forcing it through a spinning machine.	Used to construct buildings
Pavement blocks	Regolith and ice mixture poured into molds and hardened	Used to pave the roads and sidewalks

3.2 Community Infrastructure

3.21 - Atmosphere & Climate

Item	Quantity	CASSSC Shipments
One Time Shipment of Pressurized O2 (NASA Special Pressuired Air Tanks (0.2 m^3 - 108 kg))	6500 kg	1
Water	2000 kg	1
Nitrogen (NASA Special Pressuired Air Tanks (0.2 m^3 - 108 kg))	21700 kg	1
MLI Blanket	4349200 m^2 - 5219040 kg	329

Bellevistat aims to replicate an Earth-like atmosphere suitable for human habitation over an extended period of time. Specifically, we aim to replicate Earth's atmosphere at 0.75 Earth (within reason); ~21% oxygen ~7 % water vapour ~2% trace element gases like Argon and ~70% Nitrogen, used as a balance element. In this, we also seek to replicate, to some extent, the pressurization achieved in the International Space Station.

To a similar effect, Bellevistat will also operationalize a Sabatier System throughout the settlement, as employed by the ISS to maintain settlement atmosphere levels in a resource efficient manner.

Initial atmosphere will be established by releasing oxygen and nitrogen from high pressure storage tanks as needed as the settlement is constructed. A generous estimate of 8500 kg of oxygen will be used per day when the system is fully operationalised with a population of ~7500 on board. Subsequently, ~21700 kg of N2 will be added to atmosphere, though it will more or less be ever-present in the atmosphere.

We will later perform electrolysis on water, gathered from the settlement itself (elaborated upon below) as well as supplemented by imports from Earth, which will give us Oxygen and Hydrogen as products. The oxygen will be released either into the ship's atmosphere or into pressurized oxygen tanks for storage.

Some of the hydrogen produced as result of the electrolysis will be used again in the Sabatier system where it will be reacted with the carbon dioxide produced as a result of respiration. This reaction will produce Water and Methane, the form of which will be redirected to be used in further electrolysis, completing the cycle.

Fig 3.2.1.1 is a graphical representation of the Sabatier System in use on Bellevistat.

Oxygen reserves in pressurized NOR tanks, both to establish the initial atmosphere of the settlement at IOC as well as backup supply will initially be imported from Earth until the settlement becomes self-sufficient in its production and regulation of O2 in its atmosphere. A supplementary supply of oxygen can also be established if need be from unmanned lunar expeditions as many oxides are present in rocks excavated from the moon, although that is not an avenue Bellevistat is likely to need to explore.

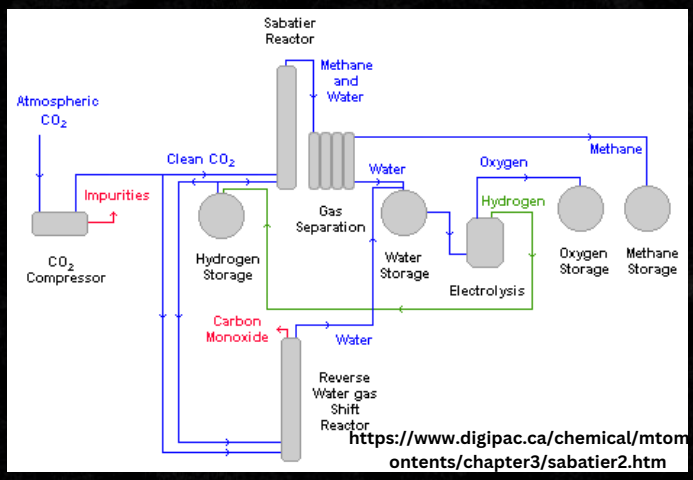
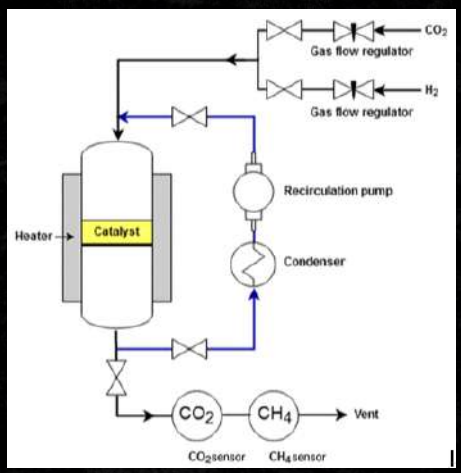


Fig 3.2.1.1 Afnan shahid [MS Word]

A very important aspect of maintaining atmosphere on the settlement is the removal of CO2 created on the space station, with one of the main causes being respiration. Using monitoring systems (to be elaborated upon later), our Air Control System will vent the excess CO2 (not needed for our Sabatier System) out to space.

Bellevistat will make use of sensors constantly monitoring air composition levels throughout the system and comparing with preset values to ensure ideal air composition (specified above) similar to that at 0.75 sea level is maintained. To ensure this precarious balance, the Air Control System will use storage pumps and gas flow regulators attached to pressurized tanks which store N2 and O2 respectively and openings throughout the entire settlement, pumping them out when and where as needed.

Fig 3.2.1.2 demonstrates this aspect of the Air Control System.



Afnan shahid [MS Word] **Fig 3.2.1.2**

As for the climate, we aim to maintain a mean temperature of 298 K throughout the settlement (unless specified otherwise),, allowing for variation of ± 15 K to simulate changing of seasons in accordance with the changing of the seasons on Earth. This will be achieved by making use of a system of radiators and air conditioners making use of water and ammonia (as used on the ISS) stationed throughout the settlement, operated by a pre-programmed series of sensors and actuators controlling and restricting air flow and use of said machines.

However, the main focus of Bellevistat with regards to temperature will be ensuring complete insulation of the entire settlement to protect from the cold of space as well as the heat loss through radiation. To this effect, nearly the entire settlement will be covered with MLI blankets made of Mylar and Krypton.

3.2.2 - Food Acquisition

Item	Quantity	CASSSC Shipments
Lunar Soil	1.6028 x 10^{12} kg	100957420
Aeroponics	861113 kg	55
Stem Cells	937500 kg (2.9 x 10^{11} cells/kg of cultured meat)	60

The bulk of food generated on the settlement of IOC will be farmed in the form of High Pressure Aeroponics as well as arable land allotted to farming, with terrace farming supplementing.

Belleveistar will have a large fully operation grid of sensors and systems monitoring conditions of the food being grown, e.g. the pH level of the soil etc., all of which will be regulated automatically by actuators and pre-programmed software which accompanies the sensor grid.

We will also be using LED to induce photosynthesis, as well as influencing yield by changing wavelength of the light, allowing also for the growth of both fruits and vegetables as that relies on a difference in wavelength when conducting photosynthesis. It is important to note, however, that we will have a focus on growing nutrient dense “micro greens” so as to prioritize resource efficiency and nutritional value over all other factors.

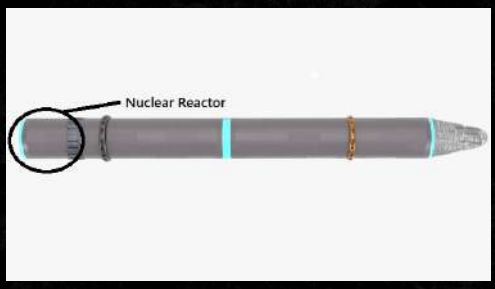
The secondary source of food on the settlement, also grown locally, is cultured meat, which is grown by feeding animal stem cells food they need to grow while producing animal muscle/tissue, wholly bypassing normal age or life cycle requirements, thus making it perfect for utilization in a space station.

3.2.3 - Electrical Power Generation

Bellevistat will have one main power source, i.e. the giant solar panel pointed directly at oncoming sun rays, which will produce enough power to run the entire station and then some. They will be arranged in a grid covering 1.27 x 106 m2. Projections say that the total power generated is close to 80 MW, which more than fulfills the requirements of the entire station.

A thorium based nuclear fission reactor will also serve as a secondary backup power source, although it will be present at IOC to power the station as it is constructed until solar panels are operational throughout the building process. It will be stored in the main axle and will be present at launch.

Power will be stored in carbon nanotube-coated lithium batteries, to be used to make up for deficiencies all over the settlement.transferred through the existing power lines systems established at launch.



Nuclear Reactor in Axle

Muhammad Sikander Khan [Blender]

Muhammad Sikander Khan [Blender] **Solar Panels**

3.2.4 - Water Management

Bellevistat places immense importance on resource efficiency and recyclability from within the settlement. Therefore, the sewage system on the settlement, connected to the residential areas (to be elaborated upon later) will be run through a filtration and water treatment plan, and will then be used in the sabatier system, for cooling, etc. (essentially wherever on the space station water is required).
The same water generated through perspiration, breathing etc etc and filtered out by our Atmosphere Control System will also be treated using chemicals and repurposed into drinking water, maintaining our very own artificial water cycle, although supplementary shipments of fresh water will also be delivered fairly regularly to make up for any deficiencies within the water supply.

3.2.5 - Solid Waste Management

The solid waste generated within the settlement will, in most cases, be treated appropriately and then either released to space or reused somewhere within the settlement as to maximise recyclability and self-reliance within the settlement. Human feces, for instance, will be used as a possible source of radiation shield after going through treatment, while any excess will be sent to our subcontractor to safely dispose of. To facilitate collection of human feces as well as easy separation of the water waste, settlers will be using vacuum toilets which is more resource efficient as it regulates water use for urination and defecating.

3.2.5.1 - Internal Communications

5G Bands will be used throughout the settlement due to their extremely high and reliable internet speeds, working in tandem with Li-Fi technology (using LEDs as the delivery mechanism).

For memos, announcements and other general mass-communication purposes, there will be an abundance of LED screens and loudspeakers all over the settlement, connected remotely together in the Internet of Things. Each resident will also have communication equipment mandatory for them to carry, which includes a smartphone, a digital watch/gyro-fit technology to monitor health and facilitate quick communication as well as a two-way radio designed to communicate directly with the control centre built into all space suits.

In addition to this, there will also be HAM radios utilizing radio waves as a last-resort lower-tech old-school communication facility in case of emergencies, to be able to be used in contacting both within the spaceship as well as speaking to people on Earth. Knowledge on how to operate this equipment will be mandatory to live on the settlement, and regular classes to educate people before settlement as well as newer settlers (children born on the spaceship etc.) will be regularly conducted to ensure adequate proficiency.

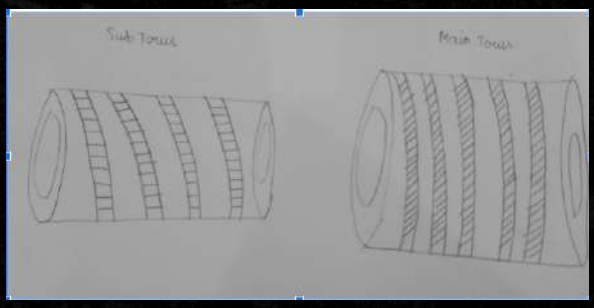
Centrally, all these technologies will be present in control centers throughout the settlement as well as the main Control Hub where all technological systems are maintained and present in the settlement (the Command Centre so to speak), which will make relaying message quickly throughout the space station easy and convenient provided you have the proper authorization. Furthermore, each citizen will also be equipped with the ability to signal about a pre-programmed possible series of warnings

relating to possible disasters on the settlement, although generating ID of each member delivering said warning to the entire system will be logged, which in addition to a limit set of pre-set warnings mainly detailing the incident and area it may have occured, will work to prevent misuse of this facility while providing an excellent user-operated warning

3.2.5.2- Internal Communications

For external communications, in addition to aforementioned 5G bands, the settlement will also utiliise radio waves and HAM radio technology to establish a reliable communication method with Earth.

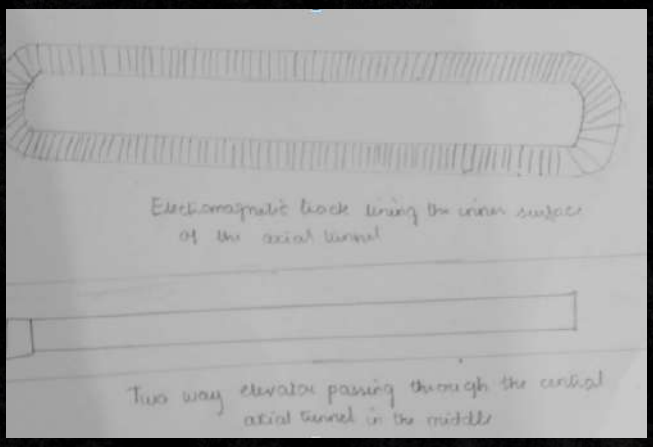
3.2.6- Internal Transport Routes



For transportation of cargo, we have a space elevator going across the length of the settlement, which will transport cargo unloaded from the docking station.

For transport of people as well as smaller cargo, we will have a maglev train system running throughout the station using electromagnetic tracks. For travel of individuals, mobility scooters etc. will be made accessible throughout the settlement.

3.2.7- Day/Night Cycle

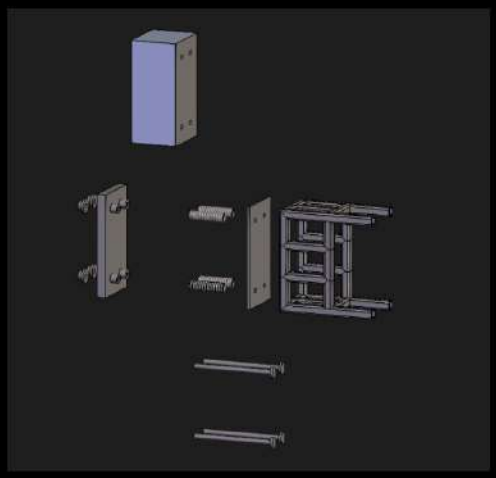


An artificial day/night cycle will be established on bellevistat with the use of mechanical shutters which fold in and out to cover all sources of external sunlight. The shutters will be operated according to varying day/night distribution of hours which corresponds with the chosen "climate" conditions at the time in the settlement, ranging from 10-14 hours of sunlight.

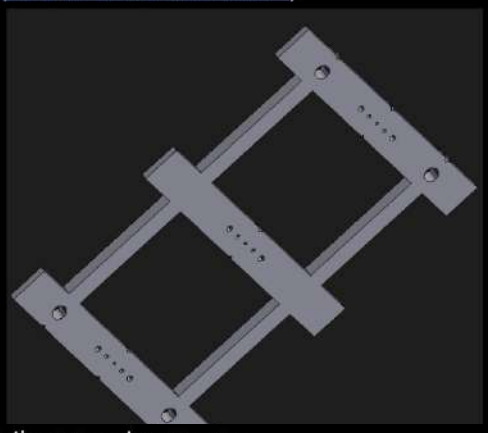
3.3 Drawings of construction jigs and how they are assembled on site

Drilling Jig (source: Grab CAD https://grabcad.com/library/drill-jig-78)

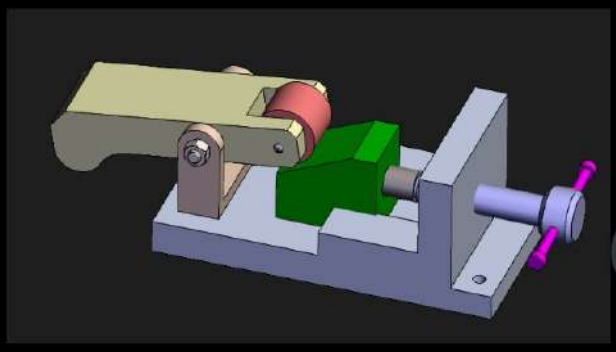
Pressing Jig (Source:presssig tool-Grab CAD https://grabcad.com/library/press-tools-spring-automation-1



Box jig and support for board lamination (source: https://grabcad.com/library/us-box-jigs-and-supports-for-board-lamination-1)

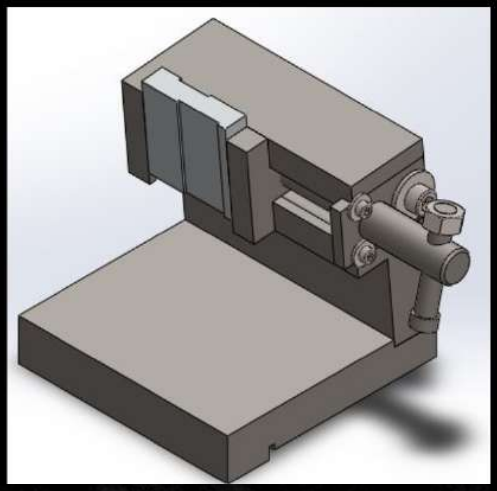


Clamp (source:https://grabcad.com/library/clamp-409

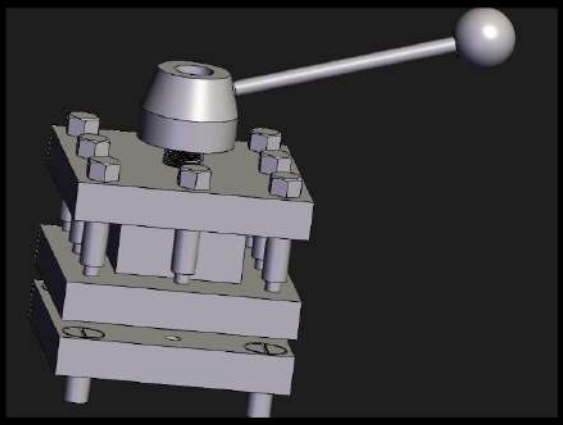


Robotic excavator source: https://img.favpng.com/16/5/2/lego-technic-construction-set-lego-minifigure-excavator-png-favpng-xASbHBYxzJ15cT76NdM7yjL11.jpg

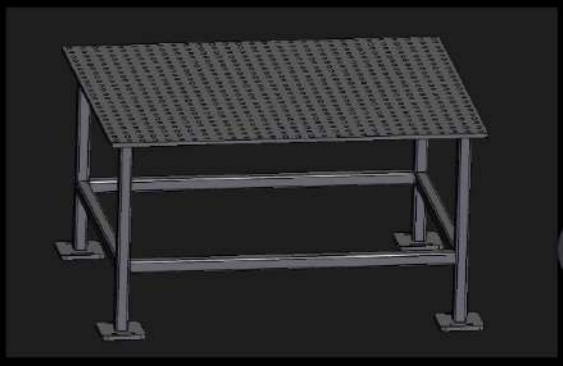
Grinding jig:source https://grabcad.com/library/jig-for-surface-grinding-1



Tool holder (source:
https://grabcad.com/library/tool-holder-56



Welding table source:
https://grabcad.com/library/a-simple-weld-table-1300x950-1



Tool uses

- Pressing jig

Press two components together and flatten them into wires or plates

- Drilling jig

Drill in the surface to be mined e.g. lunar regolith or asteroid

- Box jig

Assemble box like structures or plates

- Clamp

Used to hold the workpiece together temporarily

- Welding Table

Mounting components with a secure hold and weld them together

- Channel jig

Drilling flat plate, a bush is used to guide the cutting tool to drill the hole

- Turning mill

Capable of rotating workpiece operations such as turning and rotating tool operations such as milling and drilling

- Grinding jig

Used to grind complex shapes and holes where highest accuracy required

- 3 D printer

Create models and prototypes using materials such as stainless steel, aluminum and carbon fiber

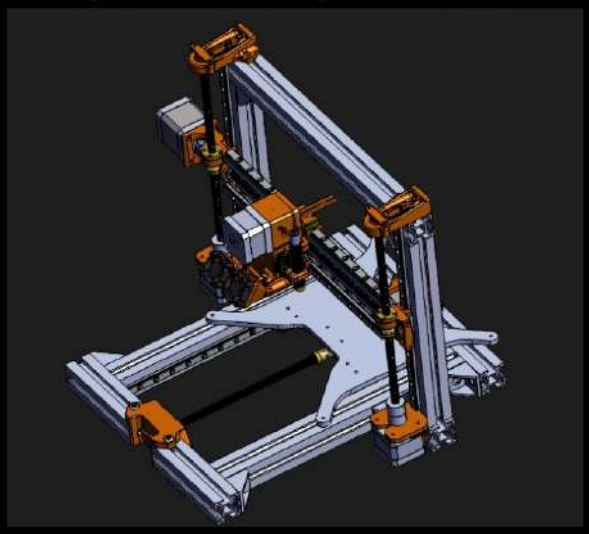
Robotic excavator

Excavation of materials from the mining surface

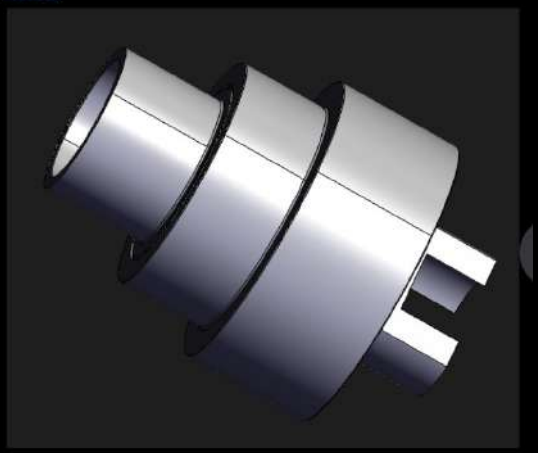
Jigs and tools assembled with the help of 3D printing and shipped using CASSSCs

Subcontractor: 3D Logistics and Custom Cargo Accommodations)

3D printer source:
https://grabcad.com/library/3d-printer-36

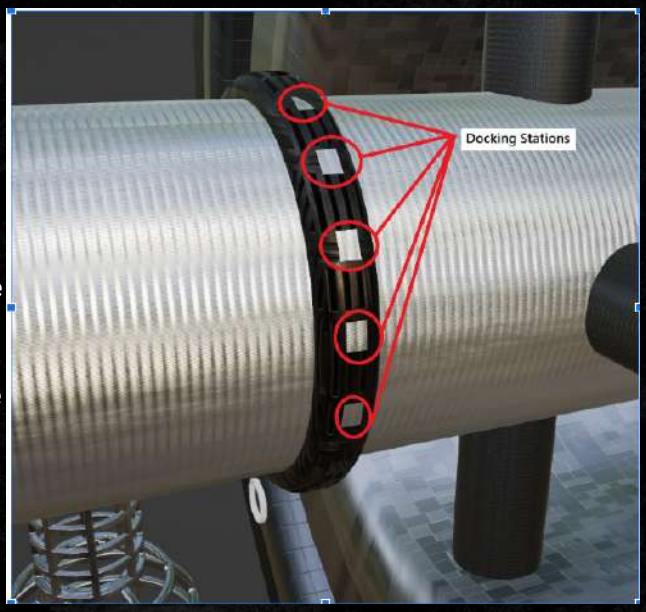


Turning mill source:
https://grabcad.com/library/example-of-turn-mill-13-1



3.4 Visiting Capability

The “axle” of Bellevistat launched at IOC will be capable of entertaining several ships at launch, with the visitor hubs pointed out in Fig 3.4.1. While the main structure is rotating, the docking stations are completely stationary as to accommodate easier landing of ships (and CASSSCs as covered by Structure and Design)



This facility will be available at launch as it will be part of the structure sent to space at IOC. The airlocks will be pressurised to facilitate the loading and unloading of cargo. There will also be a decontamination facility attached to the landing dock for both passengers and cargo, which will make use of sensors and scanners to identify and cleanse possible sources of contamination before cargo and/or passengers will be allowed entry to the rest of the space station.

Next to the decontamination facility will be a Visitor’s Center where all visitors’ identification and authorization will be verified by biometric scanning, with human supervisors to oversee the entire process. This center will also have detention facilities in case of unwanted visitors, and have temporary housing facilities, initially for use by the human crew immediately after IOC while permanent housing is being established/constructed. Later, this space will be transitioned as temporary housing for visitors who, for whatever reason, are not authorized to enter the rest of the settlement but do not yet warrant detention.

3.5 Expected Expansion

We have chosen to prioritise making improvements that service the immediate future rather than being overly cautious and possibly falling victim to over-planning.
Keeping that in mind, we aim to account for both the increasing number of people, the sharp increase in the elderly and children as significant demographics within the settlement, as compared to the initially mostly young adult demographic which is projected to be amicable to volunteering and choosing to settle in a space station as pioneers of the new Space Age. Therefore, we will need elder care facilities and mobility options within the settlement as well as the residential and recreational communities established on the settlement.
In this vein, alongside the addition of more subway cars running more often throughout the settlement, we also aim to section off more of the seats within the vehicles as designated seats for the disabled, elderly and pregnant women. Automated mobility scooters will be introduced and made available throughout residential areas for use throught the settlement, and there will be special effort made to make the settlement accessible for the differently abled wherever feasible, in so far as it it isn’t too impractical or otherwise impede the function of that area of the settlement.
Our health monitoring systems which residents were already equipped with will be calibrated/pre-programmed to recognize the different expected data recorded by the sensors for a senior citizen compared to a young adult.
Subsequently, housing, healthcare, recreation, etc. will also gradually shift over time in the settlement to make room for the demographic shift from young adult to elderly, while simultaneously expanding to accommodate the increase in sheer numbers.

Following this trend, transportation systems will also expand to accommodate the increase in people. Food growth and cultivation, both aeroponics and cultured meat, as well as terrace farming in residential areas will also be allotted more land, facilitated through utilising existing space that was otherwise unused, as well as by adding more toruses after initial assembly of Bellevistat.

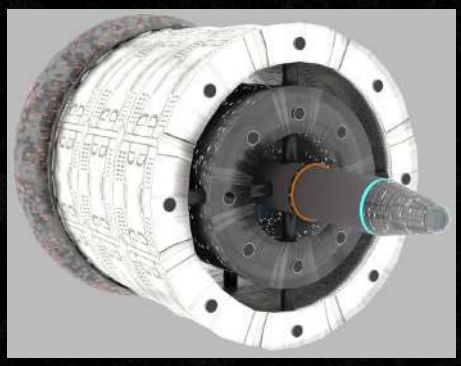
The settlement's air control system will also increase production of O2 and venting of excess gases like CO2 and H2 will increase proportional to the increase in people, with more nitrogen needing to be sourced, as well as more drinking water needing to be sourced.

And, of course, it goes without saying that every new citizen will have up to date equipment, which includes communication devices, vitals monitor, their own pressurised suits, etc.

HUMAN FACTORS AND SAFETY

Provision of sunlight

The cylinders are covered with 32 circular windows, allowing natural light to enter the settlement. Each cylinder has eight electrochromic glass windows on both the front and back sides. The windows will be 25 meters across, with a distance between them of 500 meters on the outer cylinder and 300 meters on the inner cylinder. The opacity of the electrochromic glass can change from transparent to opaque, or anywhere in between, allowing control over the light and heat energy that passes through it. Depending on which side of the settlement faces the sun, the charged solar panels will activate artificial light sources that will provide an experience similar to the natural light passing through the electrochromic glass windows. The amount of light emitted by artificial light sources can be adjusted.



4.1.2 The Getaway

The getaway, as the name implies, is the ultimate place for the residents of Bellevistat to escape from their daily lives. A place isolated from the rest of the community, primarily built of electrochromic glass. It allows residents to view the moon and the Earth while experiencing zero gravity. When the getaway is facing the sun, it provides abundant sunlight; when it is not facing the sun, it provides a spectacular view of the stars through its transparent glass. Besides that, the getaway has laser beams that will entertain the audience through laser lighting displays accompanied by music, as well as special laser light shows for celebrations and festivities. The getaway is designed in such a way that it is able to create simulated environments. The best part is that the residents only need to express their desires. They request a beach, and the getaway will recreate an incredible beachy environment for them. They ask for a zombie apocalypse, and they will receive the most terrifying zombie apocalypse experience. The most amazing thing about the getaway is that it serves as the stadium for 'Dive ball,' a sport unique to Bellevistat.

4.1.1 THE HUB

The HUB has been designed in a way that it becomes the central community centre for the people to gather, like a mall but bigger and more options. This hub would be divided into 3 sections, the recreational & shopping (1:2), the administrative/official zone(1:4), and the daycare (1:4). From play areas to food courts, offices to research facilities, cinemas to laser parks, gymnasiums to spas, the HUB will be the main place for everybody to be as it is centralised; it is close to the schools and universities, surrounds the residential area, making it accessible to everybody all the time.

The Northern half of the HUB will be used for the mall. In the mall we will have the shops, clothing outlets, departmental store, food court and cinema. In addition for the kids to enjoy, we will have an ice rink, a play area with automated rides and games, a jumping castle, and laser tag arena. A section of the HUB will entirely be used for indoor sports. We will have a basketball court, a football court and a tennis court, along with these, we will have more sports such as snooker, table tennis, and football. This section of the HUB will be the one close to the educational and business sectors.

The Southern section is for the offices and services like banks, spas, pharmacies and sports. The Southern section's one half will be used to build massive halls/auditoriums for events and exhibitions.

The park will serve as the most natural earth like site there is on Bellavistat. It will not only serve as a park but it will be used as the assembly point in case of emergencies, sealed from ground to roof, it will protect whoever is inside with the metallic seal.

4.1.3 Industrial Area:

Our settlement's industrial area is located in the 0g Multi-purpose Torus and in the 0.5G Outer Truncated Torus. The industrial sector includes a wide range of industries essential to human survival, including but not limited to pharmaceutical, food processing, textile, furniture, waste processing, and water treatment. The waste will be treated in the decontamination plants and any useful resources (mainly water and biomass for use as fertiliser in terrace farming) will be extracted before the waste is ejected into space. Tree plantations will be established in industrial areas to provide cleaner air and reduce noise pollution. The industries are located away from the human communities to avoid disturbing the residents.The total industrial area measures 0.375 km2.

4.1.4 Business Hub:

The business hub is the place where all the offices will be located. Different kinds of buildings with different sizes to accommodate different sizes of business. The different businesses will be operating on their respective floors of the building providing them with privacy and inclusiveness. The business hub is mapped in the inner cylinder right over the HUB in the outer cylinder so that the HUB is connected to the business centre and transportation is made easier there are more access points to the inner cylinder too.

4.1.5 The Services:

Banks: The banks have been spread out in the settlement to make sure people have access to their accounts whenever they want and wherever they are. The bank will be in the HUB, near the residential services area, the education sector and near the resorts and other recreational areas.

Clinics: The clinics will be located near the residential areas. 6 clinics will be in the residential areas to make sure that all the residents have easy access to the medical facilities at all times. A clinic will be inside the HUB. One near the resorts and other recreational areas. 2 will be near the sports fields.

Services and spots like restaurants, clinics, libraries, casinos and parks will be spread out in the whole of Bellevistat so that these services are readily accessible to the people residing.

4.1.6 The residential areas:

The residential areas have been divided into sectors with different apartment sizes to facilitate the family sizes and to match their standards. People of various backgrounds will be living together and to promote unity and for positive and healthy interaction, public spots have been added. The residential areas are inclusive of small parks and grounds nearby for sports and open air recreational activities. The sectors will have their own service plazas. The residential areas will have open areas such as open air gymnasium, open small parks with jogging tracks, play areas and parks. Each of the parks will have a fresh juice bar and snacks corner to make a normal evening refreshing and promote positive interaction. The planning is done in a way that the apartments will be separated from the townhouses and studio apartment buildings. The studio apartment buildings will be closer to the Business hub and University so that the individuals have easy access to their daily routine work area.

The townhouses in Bellevistat are next to the resorts and golf course to develop the luxury ambiance around the touwnhouses. Families with a size of 3 or more will be living in the townhouses sector. The sector will have its own services which will include indoor pool, spa, gymnasium, private cinemas, high end restaurants, parks with jogging and bike track.

4.1.7 EDUCATION:

The schools and university are in the inner cylinder, next to the business hub. The school will be a science and social science school where the courses will be designed in a way that will be focused to benefit the Bellevistat community.

4.3.1 Safety and Evacuation Plan

With the help of our subcontractors Blown Away and Lossless Airlocks, we will have several inflatable shielded structures at 24 different spots with a holding capacity of 24, these inflatable structures will automatically move from the elevators to the axle and from there to the HUB.

In case of any emergency, everyone in the community will be reporting to the HUB's main Park upon hearing the special siren that will be turned on. In that park will be an inflatable structure built by the subcontractor Blown Away along with Lossless Airlocks. In addition to that, the roof of the HUB will unfold to form a thick protective metal shield to the inflatable structure and the HUB will be sealed. One week's supply of atmosphere for 8000 people will be injected. The seal will be safe from any kind of radiation and/or solar flares. In case of evacuation of the settlement, the sealed hub will detach itself from the settlement and it will move away from the settlement. The rescue at Earth will be informed and people will be transported safely through the exit tunnel in the sealed HUB.

4.3.2 Space suit

The spacesuit is designed specifically for zero-gravity sports and work outside of pressurised volume. It is made of nylon, spandex and other synthetic polymers. Instead of being divided into parts, it will be a one-piece spacesuit. The astronauts will enter the spacesuit through a hatch in the back, allowing them to slide directly into the spacesuit from pressurised volumes into Bellevistat, eliminating the need for traditional airlocks. The spacesuit will be adjustable from the shoulders and waist, allowing anyone to fit into it, and it will be 3D printed to the residents' exact specifications, ensuring a perfect fit and function. The space suit will have LED lights that will indicate the status of the spacesuit and the person inside it.

4.5 There is ample space in both the cylinders to build on more structures in the settlement. Addition to the residential areas will be made every 25 years. The people living will be able to implement their new ideas using the free space that there is. After 50 years, the HUB will have another floor built on top of it making it a larger place to accommodate more people. The resorts will be expanding, the roads will increase in length adding an additional lane in the roads.

RESIDENTIAL

Type	No. of apartments per floor	Capacity per apartment (No. of people)	Total no. of apartments	Area per apartment (sqft)	Total Area of bulding (sqft)	Floors (G+x)	No. of buildings	Total area sqft	msq
Studio building	4	1-2	12	425	2400	2	150	360000	33445
2 Bed buildings	3	2-4	9	1125	4250	2	120	510000	47380
							Total	870000	80825

Townhouses	Floors (G+	Area	No. of buildin	Capacity	Area sqft	msq
3 Bed	1	1250	350	3-6	437500	40645.08
4 Bed	1	1600	200	4-6	320000	29728.9728
				Total	757500	70374.0528

SERVICES

Type	No of uni	Area per uni	Floors (G+x)	Total Area sqft	sqm
Universities	2	10000	2	20000	1858
Schools	2	6250	2	12500	1161
Hospitals	2	4250	2	8500	789
Clinics	3	1250	1	3750	348
Libraries	2	2500	1	5000	464
Banks	2	1850	1	3700	343
Departmental Stores	4	3000	2	12000	1114
Restaurants	10	3250	1	32500	3019
Shops	8	850	1	6800	631
Charging Stations	4	250	0	1000	92
Sports grounds	4	5000	0	20000	1858
Automation Services	1	8000	1	8000	743
Law and order	1	50000	0	50000	4645.152
Mini golf course	1	200000	0	200000	18580.608
Resort	1	100000	0	100000	9290.304
Worship Places	1	100000	0	100000	9290.304
Open Public parks	10	50000	0	500000	464515.2
			Total	1083750	518741.568

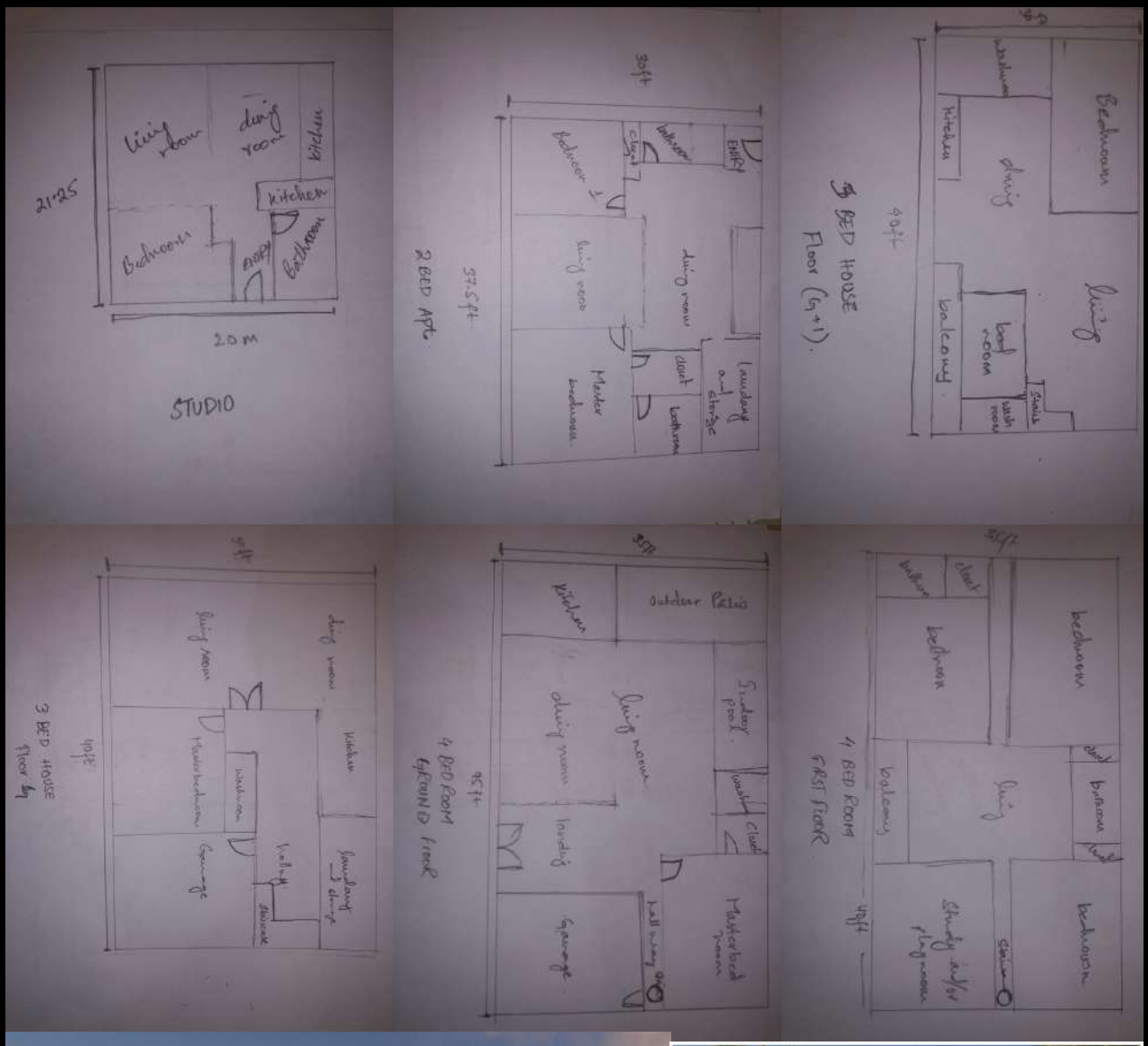
THE HUB

Community Centre	Units m/s
Latitudinal Length (e)	300
Latitudinal Length (i)	200
Longitudinal Length (e)	193.7
Longitudinal Length (i)	93.7
Floors	G+2
Height	16
Park Area	59810
Buildings Area	123700

BUSINESS

Type	Capacity	No.of units	Area per unit	Floors (G+x)	Total Area	sqm
Office Buildings	150+	1	8500	3	8500	788
Office Buildings	100+	1	6500	3	6500	603.8698
Office Buildings	50+	2	4750	3	9500	882.5789
Office Buildings	10+	2	5000	3	10000	929.0304
Warehouses	-	1	5000	3	5000	464.5152
Research Facilities	100+	2	20000	3	40000	3716.1216
Plazas	-	8	6250	2	50000	4645.152
				Total	129500	12029.2679

Floorplans



Muhammad Sikander Khan
[Minecraft]

Muhammad Sikander Khan
[Blender]

Toiletries	Person/Annum	Total/ Annually
Toothbrush	8	60000
Toothpaste	12	90000
Shampoo	24	180000
Conditioner	12	90000
Skincare items	6	45000
Towels	4	30000
Feminine Hygiene Products	15	73125

Total Amount	Bathroom Sanitary Items
10,000	Toilets
3,000	Bidets
5,000	Urinals
12,500	Sinks
6,250	Bathtubs/Showers

Furniture	Total Amount
Bed set	6,000
Study/office table and chair	12,000-polki
Dining Table Sets (with 6 chairs each)	2,000
Chairs	20,000
Night stand	12,000
Dressing Tables and Mirror	4,500
Cupboard	7,000
Couch Sets (3+2+1)	4,000

Items	Quantity/ Person annually (kg)	Total Quantity/Annually (kg)
Applesauce	46	340000
Fruit cocktail	96	720000
Dried fruits	15	110000
Peanuts	4	29000
Dried beef	32	240000
Granola bars	1	6000
Canned food	108	810000
Fruit juices	43	320000
Tomatoes	20	150000
Potatoes	60	450000
Onions	50	375000
Lettuce	30	225000
Cabbage	40	300000
Mizuna Mustard	30	225000
Red russian kale	40	225000
Carrots	50	375000
Peaches	30	30000
pears	20	150000
Apricots	40	300000
Apples	50	375000
Bananas	60	450000
Rice	80	600000
Maize	70	525000
Wheat	100	750000

AUTOMATIONS

5.1 Construction and Automations

Construction Robots:

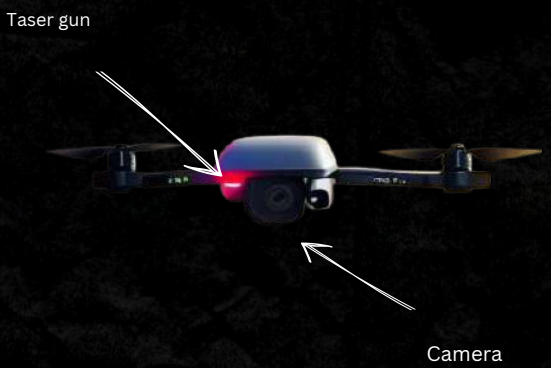
They will be attached to an electromagnetic railing similar to that of maglev trains. Programmable Robotic arms will be subtended to the railings present on the outside; they will number about 500. 3D logistics will build these robots. These robots will be equipped with a heavy duty extension cord to reach different isolated parts of the outside surface. They will have various precision tools on each arm for use in construction. After the construction phases end the bots will be repurposed for outside maintenance, removing the need for any human intervention on endangering lives. For interior construction a similar setup will be used with electromagnetically propelled robots on rails with large extendable arms. When not in use these bots will be held in garages which have doors flush with the inside walls of the structures. The railing for these bots will reach all over the structure and various garages located throughout bellevistat. The series of railway jiggs will each be equipped with detachable 3D printer tips which will be provided by 3D logistics. Inside these garages they will undergo repairs and maintenance, automatic for the most bit but human supervision would be required. There will be different variants for the construction robots on both the inside and outside.

For electricals, transport, mechanical. Another variant will be used for firefighting and rescue from dangerous scenarios. This one will be equipped with fire fighting material and padded arms to allow for the comfortable rescue of in danger citizens.
For smaller loads drones will be utilized, the model can power refrigerated containers, both on the ground and above ground. The drones will make use of an automatic guidance system based on sensors. The number of drones utilized will be directly proportional to the load that is required.

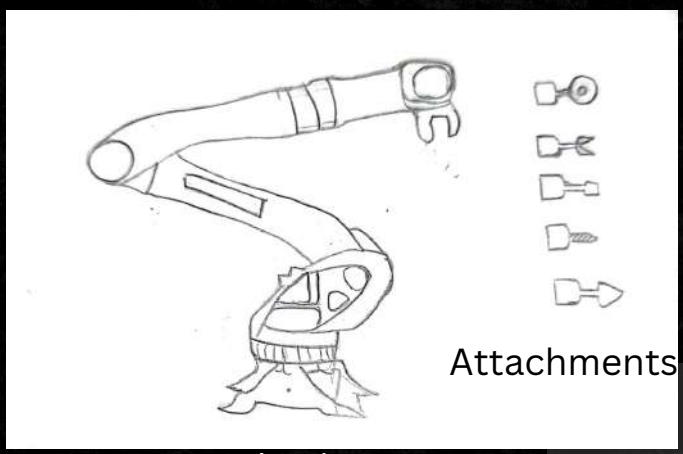
5.2. Robots and Uses

Name	Description	Quantity
Robotic Arm	**Construction attachments:** These bots will be used for all interior and exterior construction purposes. These are modular bots with interchangeable extensions that will be attached according to the use case. These extensions include hands, jigs, welding extensions, etc. **3D Printer Tip Extension:** This printer will be used to print different buildings, rooms, structures, furniture, etc. according to the requirement. It will also be used to construct parts to repair the structure or different robots.	1000
Servant Robots	This servant bot will be responsible for carrying chores as well as keeping track of the health of the people within the settlement. Its tasks will include all that a modern-day smart assistant is able to do and beyond that cleaning, laundry, cooking, getting food from the groceries, etc., as well as directing people with instructions on how to deal with emergencies.	1500
Bionic Inspection Robot	It monitors equipment, carry out inspections and perform maintenance tasks, it will be equipped with video cameras, vibration sensors, laser sensors, environmental sensors and other hardware that can help in maintenance.	500
Security Robot	It will monitor and guard the system and residence, they will make use of sophisticated systems of sensors and hardware to monitor and track individuals. Their main purpose will be monitoring and patrolling, which would include the enabling of authorization through detection of biometrics.	1250

Name	Description	Quantity
Drones	The drones will make use of an automatic guidance system based on sensors. Weight Lifting: The number of drones utilized will be directly proportional to the load that is required. Security Drone: Will include a built-in taser which will be used to immobilize criminals. As well as cameras and sensors to alert the Law Enforcement Officers.	500
Health Care Bots	This robot will be used for medical purposes with a multipurpose arm fitted with various medical tools. The robot would make use of sensors attached in the middle to monitor vitals and perform scans. It can be used to give diagnoses as well as perform advanced technical surgeries.	
Farmer Robot	This robot will have a monitoring system installed, PH sensors will be used to monitor the PH of the soil, and soil moisture sensors will be used to measure the amount of water in the soil, yield monitoring sensors will be used to analyze the crop yield and moisture content in a given field. VRT(Variable reluctance sensors) technology will be used to provide crop materials to a given landscape, these materials include fertilizers, crop protection chemicals and seeds, which help to optimize crop production. These robots would also actively aid farms through seed planting and taking care of the crops using algorithms.	750



Surveillance drone



Robotic Arm

5.3 Security and Surveillance

5.3.1 Security and Surveillance:
Drones with tasers will be used to monitor and protect the area, for police and security purposes.

5.3.2 Routine tasks help:
Servant robots(cleaning, delivery purposes doing simple tasks) will be available to everyone and every resident at the settlement, they will be available at offices, houses and workplaces.

5.3.3 Security and Privacy:
Private spaces or capsules for each worker at the office and other areas in the settlement, they'll be protected by finger prints or face IDs. Each person and worker will have its own private capsule, in which they can sleep. Each capsule will have dimensions of (1m×1m×1.5m).
Special game and sport facility available for the community.

5.3.4 Connectivity:
Orbitlink communications will be used for communication, a communication network system will be built to provide communication services to the residents. Which will use dedicated fiber optics cables for the transmission of signals.

5.3.5 Offices and Automations
Spaces allotted to officers to do office work.
Noise reduction glass known as acoustic glass, made up of a thin layer (0.388mm) of PVB, which reduces noise.
Announcement system for any emergency, an alarm which will be equipped with different speakers sensors, such as pressure sensor, motion sensor, etc.

5.3.6 Entertainment:
For kids entertainment (playland like wonderland),a Entertainment Centre of (30m×35m×8m) is established with the facility of a movie theater,playland, consoles, video games, children and adults can go outside for space sightseeing, in spaceships.

Bandwidth required for surveillance drones and servant robots will be 2gbps.
Orbitlink communication will provide with fiber optic cables and internet connectivity.

5.4 Delivery and loading/unloading of CASSSCs

5.4.1
Automated forklifts will be used for loading and unloading the heavy material from CASSSCs. Forklifts could carry 1 ton of weight and will contain a displacement sensor for detecting dimensions of the object that it has to carry. 4 meter long metal rods with rubber grips, on top and bottom of the lifter will be placed to fit the material to carry it in zero gravity. A detachable electromagnet will be attached to the forklift for it to extract metal ores from other materials easily.

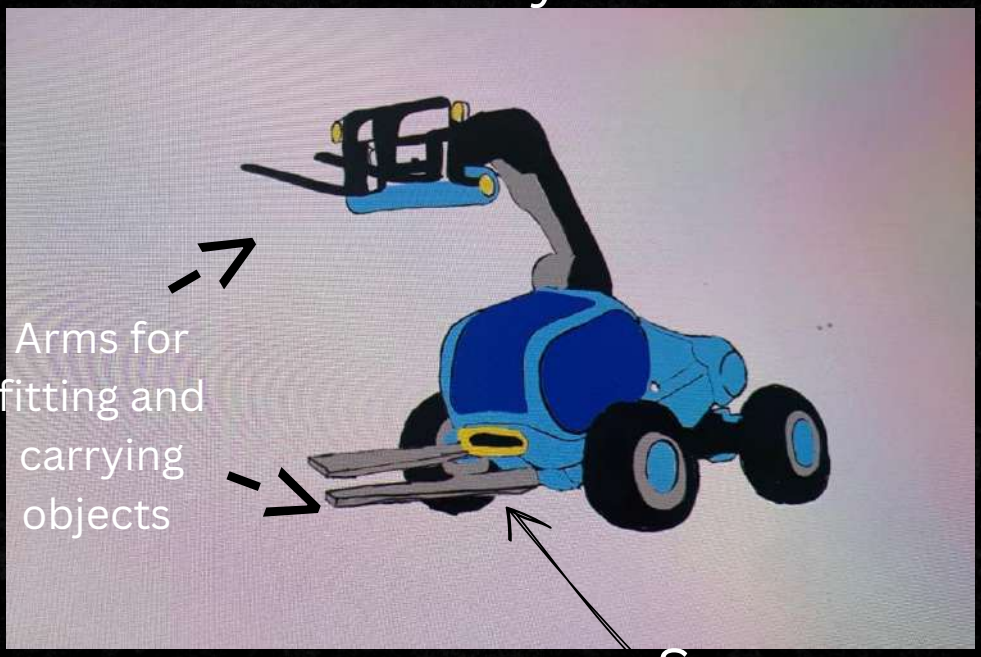
5.4.2

On the floor of CASSSCs travellator will be attached to easily move materials to the end CASSSC that forklift load. The travellator would be detachable as well so it can be used with other CASSSCs to minimize cost.

An exclusive entrance will be provided for moving CASSSCs in and out of the settlement. The speed of the Torres which have the entrance of CASSSC will be slowed down when CASSSCs are incoming. Once they are loaded, the rotation will come to an optimum speed so loading or unloading can be done.

Transportation of CASSSCs from Earth to Space settlement will be contracted to and handled by SpaceTrans, Inc.

CASSSCs Delivery to Belevistat



Automatic Forklift

5.5. Interspace Travel Facility

A factory will be built for spaceship manufacturing. Factory would have an assembly line to accommodate more machinery and do more processes in less space. Robotic arms and jigs that were used in settlement construction will be then used on the assembly line for spaceship manufacturing. Metals extracted from collected metal ores will be used as materials for spaceships. Robotic arms will have bolting drill machines and welding machines attached, to join different metal pieces of the body. A system to operate the spaceship will be installed at the control center, and the spaceship will be directly linked to the control center.

USAGE	SUBCONTRACTORS
Robotic arms circuitry	ElectroProtect
3D printer tips as an attachment to robotic arms to build furniture	3D Logistics
Circuitry of drones, robotic arms	ElectroProtect
Internet and Fiber Optic Cables	OrbitLinks Communications
CASSSCs	Custom Cargo Accommodations
Travelator for CASSSCs, as large treadmill platform	Bots4U
Pressurized CASSSCs locks and sealing	Lossless Airlocks
Electromagnetic roof railing	Wiring: ZAP! Industries
Servant Robots	Bots4U
Surveillance and security drones	Bots4U
Taser gun and cameras in drones	Nano Solutions
Transport of CASSSCs	SpaceTrans, Inc
Metal ores refinement	Toss It To Me
Space Suits for interspace travel	Extreme Survival Technologies (EST)
Wiring and circuitry of interspace travel spaceships	ZAP! Industries and ElectroProtect
Plastics as inputs for 3D printer, after collection of materials from interspace travel	Carbon Creations
Automatic Forklift carrying arms	Bots4U
Automatic Forklift circuitry	ElectroProtect
Sensors for robotic arms and automatics forklifts for measuring dimensions, and sensors for Farmer bots	Nano Solutions

Robots and Parts and their Subcontractors

USAGE	SUBCONTRACTORS
Robotic arms circuitry	ElectroProtect
3D printer tips as an attachment to robotic arms to build furniture	3D Logistics
Circuitry of drones, robotic arms	ElectroProtect
Internet and Fiber Optic Cables	OrbitLinks Communications
CASSSCs	Custom Cargo Accommodations
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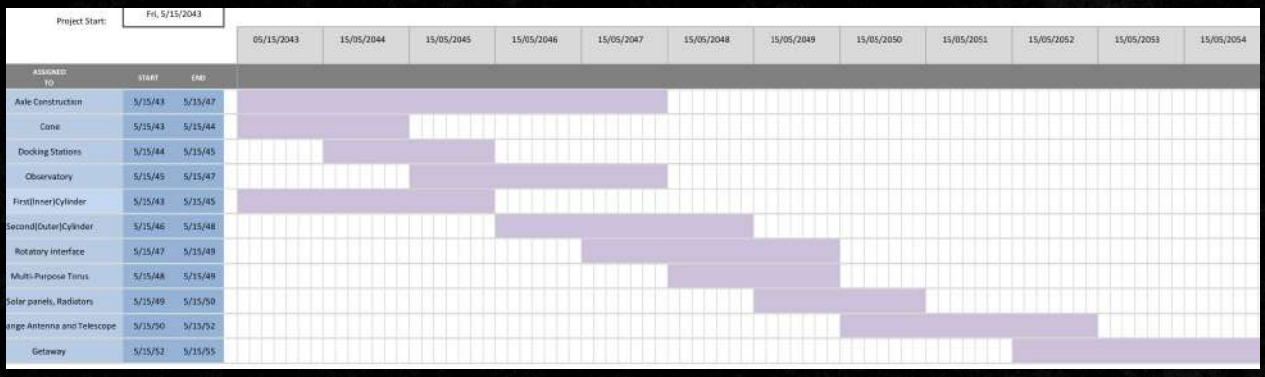
6.1 Design and Construction Schedule



Construction of Bellevistat is scheduled to be completed by 15th of May, 2055.

6.2 Costs

Research, Planning & Analysis Cost

	Cost
Research	$6,000,000,000.00
Planning	$1,000,000,000.00
Analysis	$3,500,000,000.00
Total	$10,500,000,000.00

Cost of Settlement Construction

Construction Phase	Structures	Cost
Step 1	Axle, Docking Stations, Cone, Observatory	$27,000,000,000.00
Step 2	Inner Cylinder	$25,000,000,000.00
Step 3	Outer Cylinder, Railing	$31,000,000,000.00
Step 4	Multi-Purpose Torus	$20,000,000,000.00
Step 5	Solar Panels, Radiators, Antennae	$14,000,000,000.00
Step 6	Getaway	$18,500,000,000.00
	Total	$135,500,000,000.00

Cost of Housing

Type of Housing	Number of Units	Cost / Unit	Total Cost
Studio Apartment Buildings	150	$648,000.00	$97,200,000.00
2 Bed Apartment Buildings	120	$1,417,500.00	$170,100,000.00
3 Bed Townhouses	350	$225,000.00	$78,750,000.00
4 Bed Townhouses	200	$288,000.00	$57,600,000.00
		Total	$403,650,000.00

Cost of Services

Building	Number of Buildings	Cost / Building	Total Cost
Universities	2	$3,000,000.00	$6,000,000.00
Schools	2	$1,875,000.00	$3,750,000.00
Hospitals	2	$1,275,000.00	$2,550,000.00
Clinics	3	$250,000.00	$750,000.00
Libraries	2	$500,000.00	$1,000,000.00
Banks	2	$370,000.00	$740,000.00
Departmental Stores	4	$900,000.00	$3,600,000.00
Restaurants	10	$650,000.00	$6,500,000.00
Shops	8	$170,000.00	$1,360,000.00
Charging Stations	4	$25,000.00	$100,000.00
Automation Services	1	$1,600,000.00	$1,600,000.00
Sports Grounds	4	$500,000.00	$2,000,000.00
Law and order	1	$5,000,000.00	$5,000,000.00
Mini Golf Course	1	$10,000,000.00	$10,000,000.00
Resort	1	$10,000,000.00	$10,000,000.00
Worship Places	1	$10,000,000.00	$10,000,000.00
Open Public Parks	10	$5,000,000.00	$50,000,000.00
		Total	$114,950,000.00

Cost of Commercial Buildings

Building	Number of Units	Cost / Unit	Total Cost
Office Building 150+ Capacity	1	$4,080,000.00	$4,080,000.00
Office Building 100+ Capacity	1	$3,120,000.00	$3,120,000.00
Office Building 50+ Capacity	2	$2,280,000.00	$4,560,000.00
Office Building 10+ Capacity	2	$2,400,000.00	$4,800,000.00
Warehouses	1	$2,400,000.00	$2,400,000.00
Research Facilities	2	$9,600,000.00	$19,200,000.00
Plazas	8	$3,000,000.00	$24,000,000.00
Community Centre	1	$371,022,950.00	$371,022,950.00
		Total	$433,182,950.00

Maintenance Costs

Department	Cost
Structure Maintenance	$6,500,000,000.00
Automated Bots Maintenance	$1,000,000,000.00
Operations Maintenance	$7,000,000,000.00
Human Factors Maintenance	$5,500,000,000.00
Total	$20,000,000,000.00

Cost of Materials

Material	Cost
Hydrogen	$4,500.00
Nitrogen	$3,060,000,000.00
Oxygen	$188,500,000.00
Water	$22,890.00
Phosphourous	$40,000.00
Iron	$65,600.00
Titanium	$1,998,000.00
Silicon	$800,000.00
Aluminum	$11,066,400,000.00
Lithium	$88,000.00
Magnesium	$9,000.00
Carbon	$386,400,000.00
Other Materials	$112,000.00
Total	$14,704,439,990.00

Sum of Costs

Procedure	Cost
Settlement Construction	$135,500,000,000.00
Research, Planning & Analysis	$10,500,000,000.00
Services	$114,950,000.00
Business	$433,182,950.00
Residential	$403,650,000.00
Materials	$14,704,439,990.00
Maintenance	$20,000,000,000.00
Total	$181,656,222,940.00

The total cost for Bellevistat has been calculated to be $181,656,222,940

7.0 BUSINESS DEVELOPMENT

Production of Goods:

Lunar ores will be used to produce various products. The ores will be transported by CASSSCs. The manufacturing of these products will be leased to companies mentioned above in the report. Goods will be produced in an excessive quantity. The excess goods will be exported from the settlement which will provide valuable exchange and maximize the settlement's revenue.

Manufacturing of space craft & MRO:

Future expansion of manufacturing areas have been addressed in the report. Repair docks will be included in the docking stations of the structure and different types of ships will be able to dock at the settlement. Safety alarms with AI sensors will be included and there will be an emergency team of safety bots and humans available at all times to prevent any disastrous scenarios in case of emergencies and docking of visiting ships.

Workplace Features:

Offices and Co-working spaces at Bellevistat will have state of the art facilities. There will be high speed Wi-Fi available at all office hours from 9am to 5pm and co-working spaces will be open 24/7. Companies will be able to rent offices at a fixed monthly rent. The working space rents will be divided into 3 levels of $5000 , $7500 and $9000 per floor depending on the size of the floor and the quality of the features provided in the working spaces. Companies will also have to submit a one time security deposit of $10000 when they start renting to account for potential damages. Conference rooms, laboratories and other designated spaces will also be provided. Security and confidentiality will be provided. There will be 24/7 CCTV cameras and all people working in the office will be given ID cards which only they can use to enter the office and each company card will only be able to access the floors designated to the company. The office rooftops will have botanical gardens and places where employees will be able to relax which will promote productivity. Canteens and Cafes will also be available so employees do not have to leave the building during their lunch breaks. All employees will also be provided with secure personal lockers for them to keep their valuable belongings safe.

Stock Market:

Bellevistat will also follow the stock market and settlers will be able to invest. This will allow the investors decent returns on their investments. Their profits from investments will be taxed at 10% of the total profit to provide another source of income. Public companies inside the settlement will also pay taxes to the settlement to appear on the stock sheets which will create a large revenue stream for the settlement.

Bank Features:

Bellevistat will have a Government controlled bank with 2 branches across the space settlement. All branches will have 24/7 running ATM machines along with 10 other separate locations where ATM machines will be available. There will be customer service centers within these banks which will have a customer care employee for every 250 customers to provide undelayed customer service, this will also create more jobs. The banks will provide the customers the facilities of both debit and credit cards and there will be an infrastructure in place to calculate credit scores. The banks will also provide student loans, business loans, and mortgages. The rate of interest will vary on the loans depending on the credibility and financial strength of the loanees. There will be a digital app available to every customer where they can access their financials and banking details. They can also pay through the app using their mobile devices which will act like digital wallets. The banks will also boast secure lockers for valuable personal belongings of the customers. A standard locker will be allocated to each customer. The lockers will be under surveillance of CCTV cameras 24/7 and will be behind a secure room only accessible by the bank employees.

Property Ownership Rules & Regulations:

Properties will be divided into residential and commercial areas which will be initially owned by Bellevistat. Residencies will be allocated for all families in the settlement. As the properties will be owned by Bellevistat the families will not be taxed on them but they will have to pay a $ monthly to the settlement. People will be encouraged to buy commercial areas by easy mortgages provided by the Bellevistat bank at flexible interest rates and payment timings, this will promote business development in the settlement while also providing another source of income for the operational costs of Bellevistat. The residential areas for sale will have varying prices depending on their distance from amenities such as parks, entertainment centers and the facilities provided in those areas. The prices for commercial land will be divided in 3 different levels of $1000/ sq.ft , $1200/ sq.ft and $1500/sq.ft which will be dependent on the properties access to roads and transport and various other factors. All bought properties will be taxed at 5% of the current cost annually and buyers will have to submit a fixed $10000 security deposit when buying the property. These measures will create a source of passive income for the settlement. There will be tax exemptions available to the businessmen under certain conditions to further promote business development in the settlement.

SUB-CONTRACTORS

Structure:

- BuckyBreakthroughs : Windows and observatory.
- Custom Cargo Accommodations: Transport of construction materials.
- ElectroProtect: production of durable exposed circuitry.
- Fusion Founders: provision of power for early stages of assembly and backup power source.
- Lossless Airlocks: airlocks for passenger docks, cargo port, the observatory, the getaway.
- OrbitLink Communications: For communications array.
- Tubular Technologies: production of spokes for the torus and cylinders.
- ZAP! Industries: Production of Main Solar Panel.
- Carbon Creations: for structural needs.
- SpaceTrans, Inc. and BeamBuilders, Ltd: space elevator in axle.

Operations:

- Fusion Founders: Fusion Reactor at IOC to power stuff until solar is established and backup source
- Garden-A-Go-Go: Hydroponics for food in the settlement
- Lossless Airlocks: For docks, receiving ships and cargo
- OrbitLink Communications: For internet and telecommunicaton throughout and outisde the settlement
- Stuff of Life: For Water, Oxygen and Nitrogen for use in Sabatier system
- Toss It To Me: For treatment of waste
- Waste Products: For sewage and plumbing
- ZAP! Industries: For solar panels and solar batteries to store power

Human Factors:

- Blown Away: used to build services centres that need not to be in the settlement permanently- facilities such as vaccination centres, extra hospitals, evacuation centre in the HUB's ground.
- EST (Extreme Survival Tech): For the building of space suits.
- Litigation Limitation: For law and order in the settlement
- Lossless airlocks: Needed to seal the evacuation plan of the HUB.
- Totally remote ultimate escapeways For luxury resorts and spa would be needing the luxury facilities.
- 3D Logistics: 3D model the spacesuit that is needed exactly according to the size of th person and purpose.

Automations:

- ElectroProject: Robotic Arms and drones Circuitry, Automatic forklift circuitry
- 3D Logistics: 3D printer tips as an attachment to robotic arms to build furniture
- OrbitLinks communications: Internet and Fiber optic cables
- Custom Cargo Accommodations: CASSSCs
- Bots4U: Travelator for CASSSCs, Servant robots, surveillance & security drones, Automatic forklift carrying arms
- Lossless Airlocks: Pressurized CASSSCs locks and sealing
- ZAP! Industries: Electromagnetic roof railing
- Nano Solutions: Taser gun and cameras in drones, sensors for robotic arms and automatic forklifts for measuring dimensions and sensors for farmer bots
- SpaceTrans, Inc : Transport of CASSSCs
- Toss It To Me: Metal ores refinement
- Extreme Survival Technologies: Space suits for inter-space travel
- ZAP! Industries & ElectroProject: Wiring and circuitry of inter-space travel ships
- Carbon Creations: Plastics as inputs for 3D printer