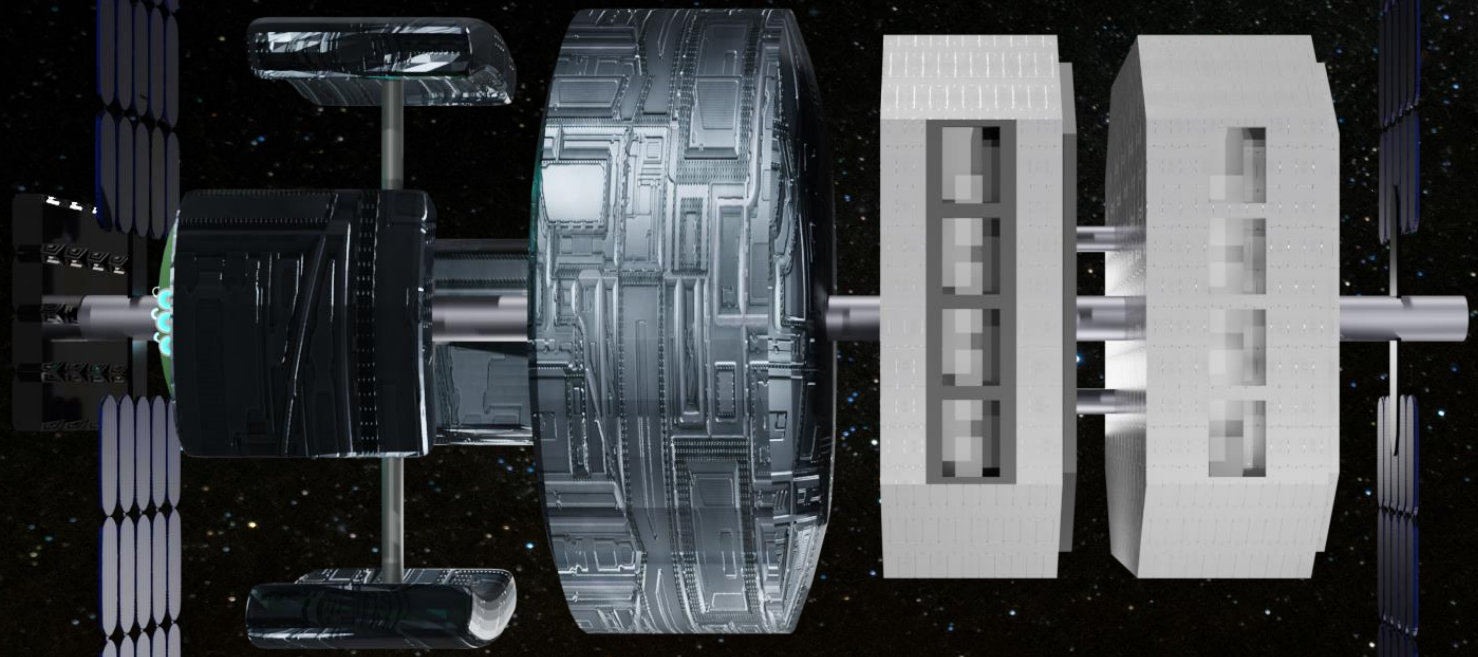
ROCKDONNELL



PROPOSAL FOR LIBERTY SPACEPORT

2.1 - Settlement Views

Fig 2.1.1 Liberty. (Soumik and Krish, Blender)

We will provide natural views of Earth to residents by windows subcontracted from **Vulture Aviation** through **Litigation Limiters,** which will be majorly located on the underside of the residential segment.

2.1.2- Hull Composition

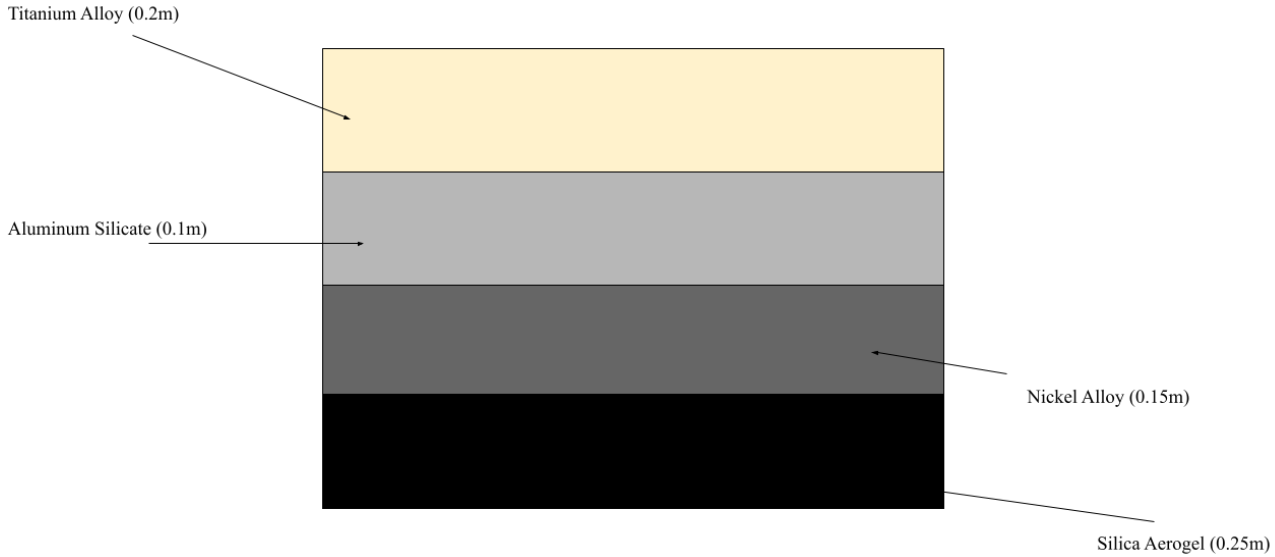


Fig 2.1.2 Hull Composition (Taarak Harjai, Blender)

2.1 - Settlement Views

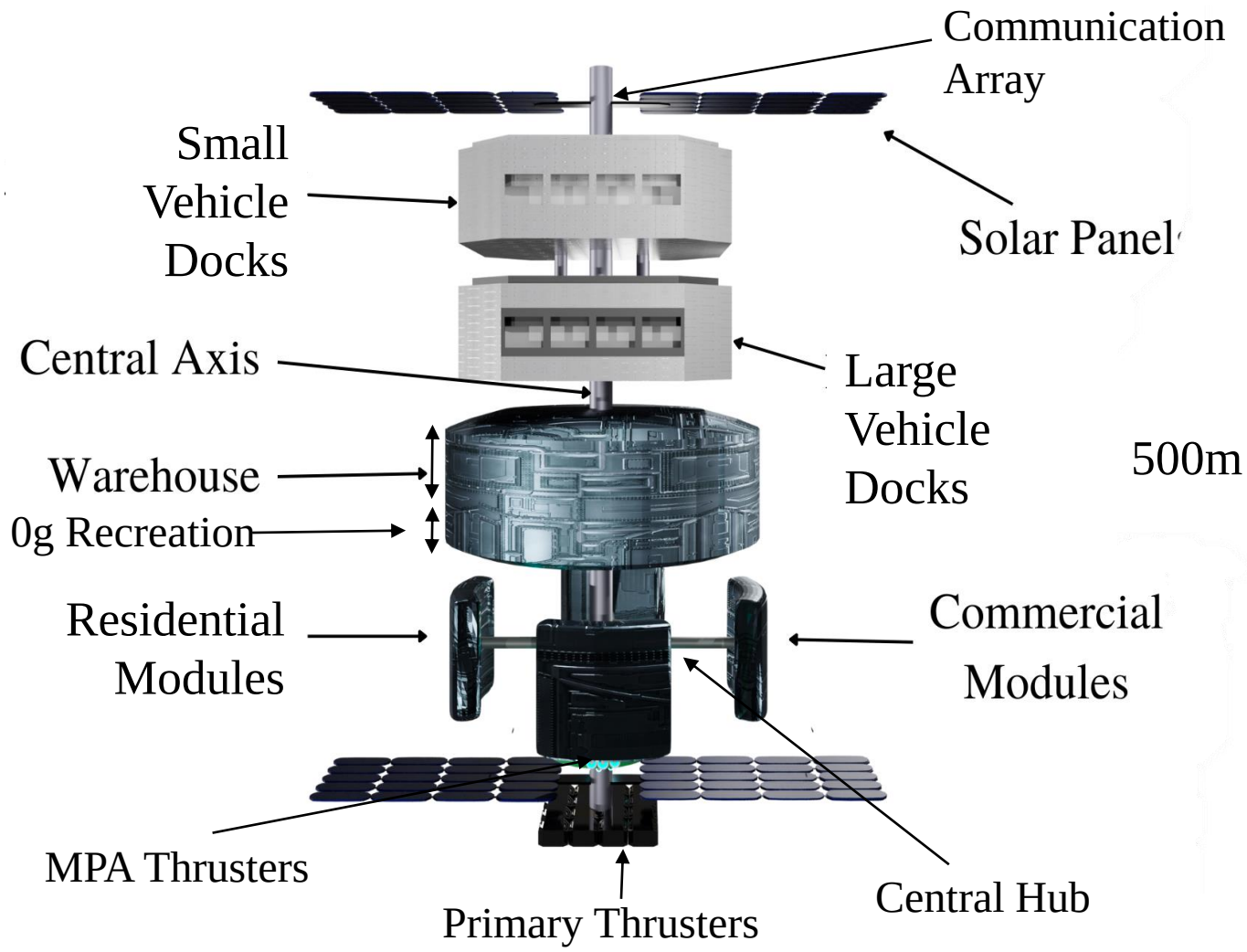


Fig 2.1.3 Major Structural Components (Krish and Soumik, Blender)

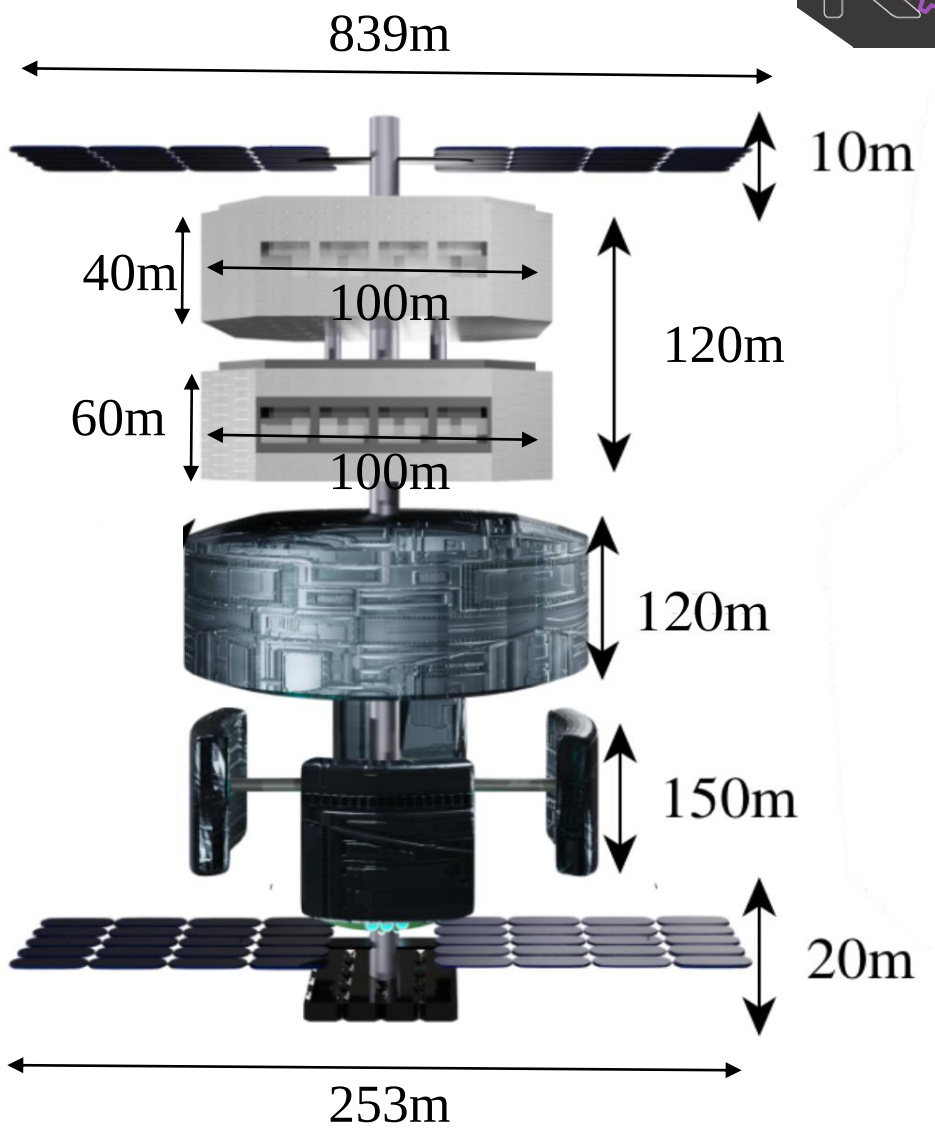


Fig 2.1.4. Dimensions (Krish and Soumik, Blender)

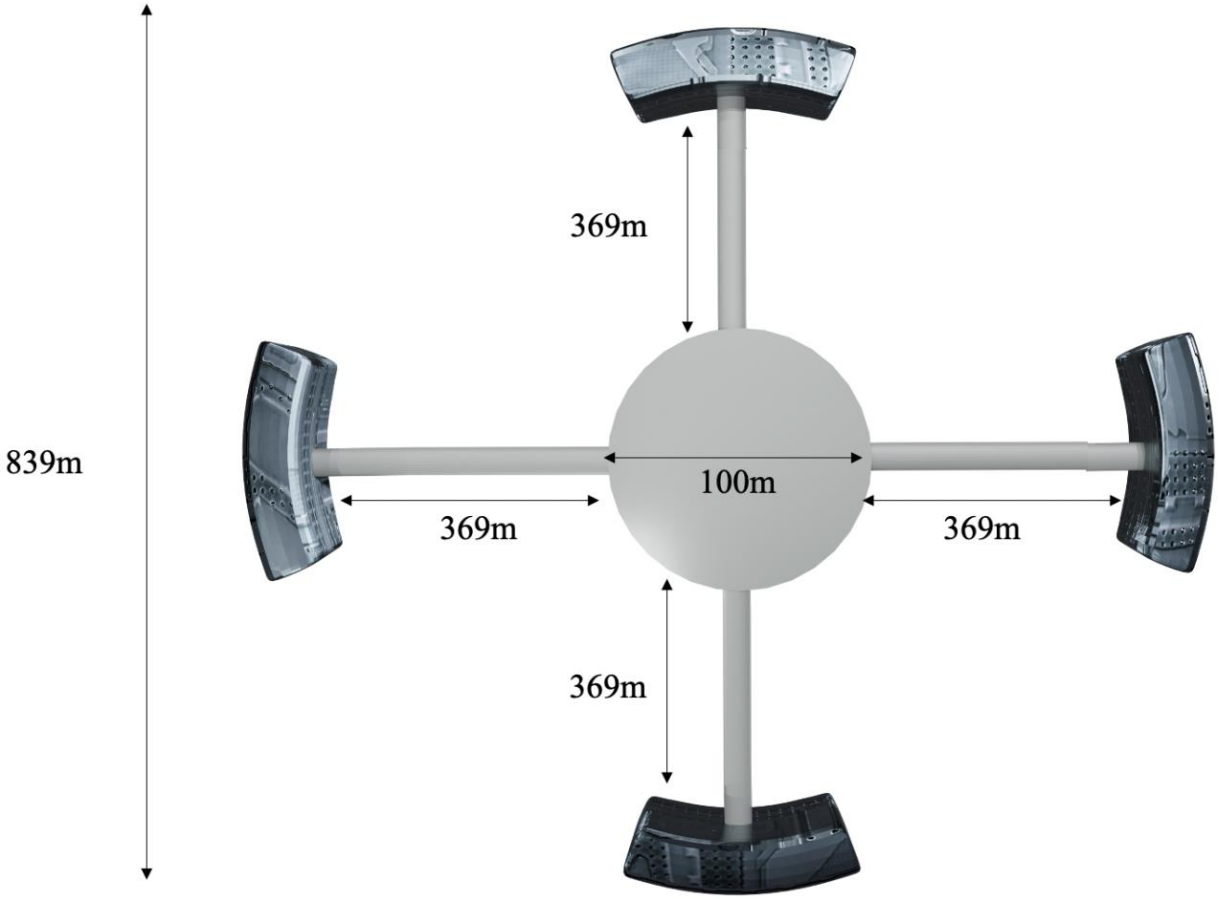


Fig 2.1.5 Dimensions (Krish and Soumik, Blender)

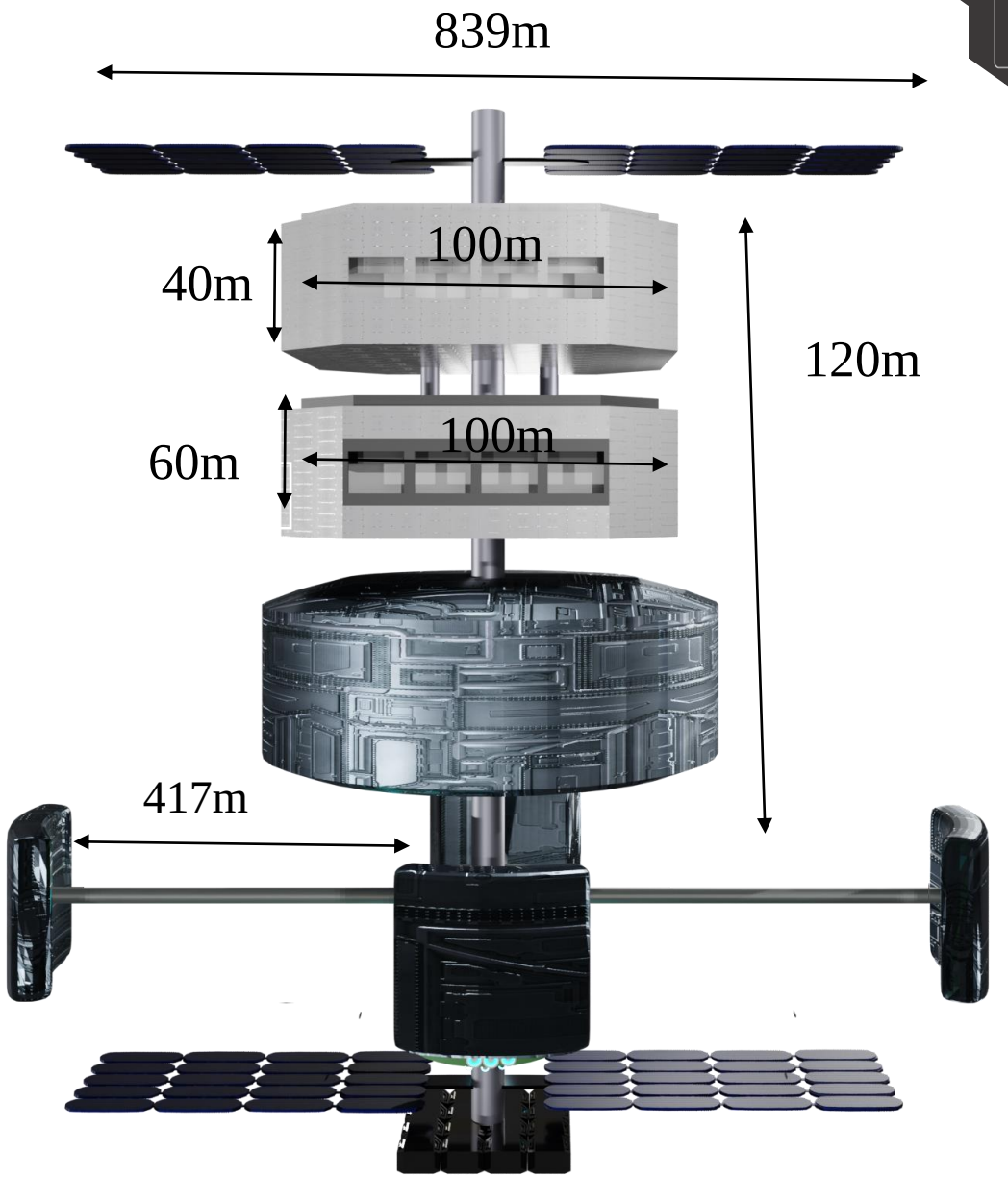


Fig 2.1.6 Dimensions (Krish and Soumik, Blender)

2.1.3 - Gravitational Ranges

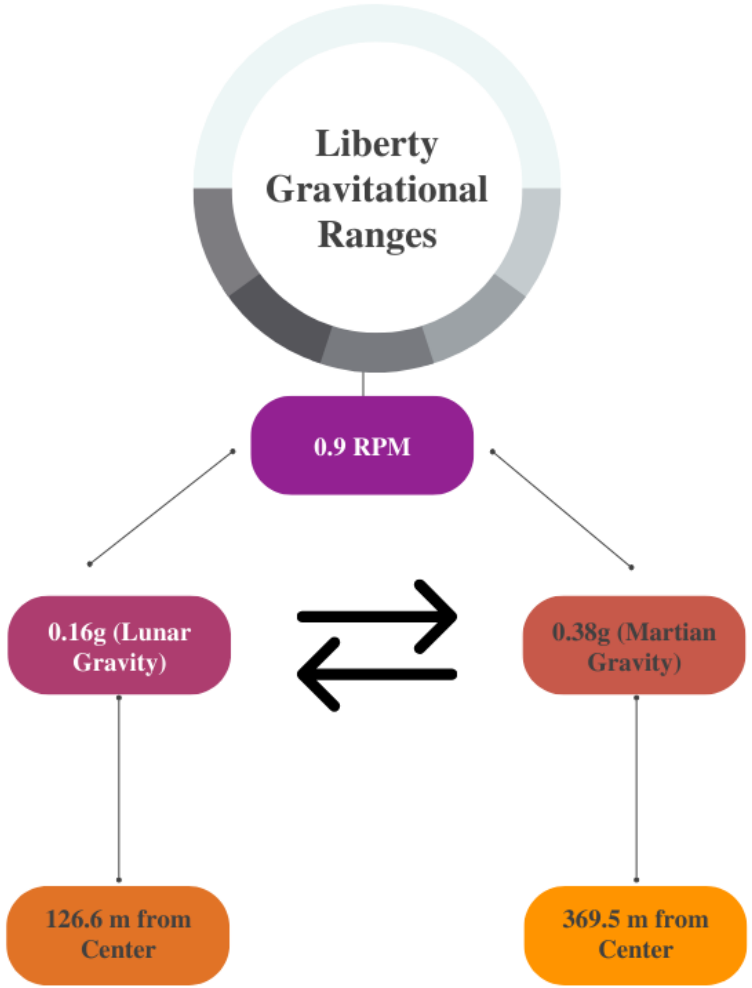


Fig 2.1.7 Gravitational Ranges (Arav, Canva)

2.1.4 - Pressurisation and Rotation

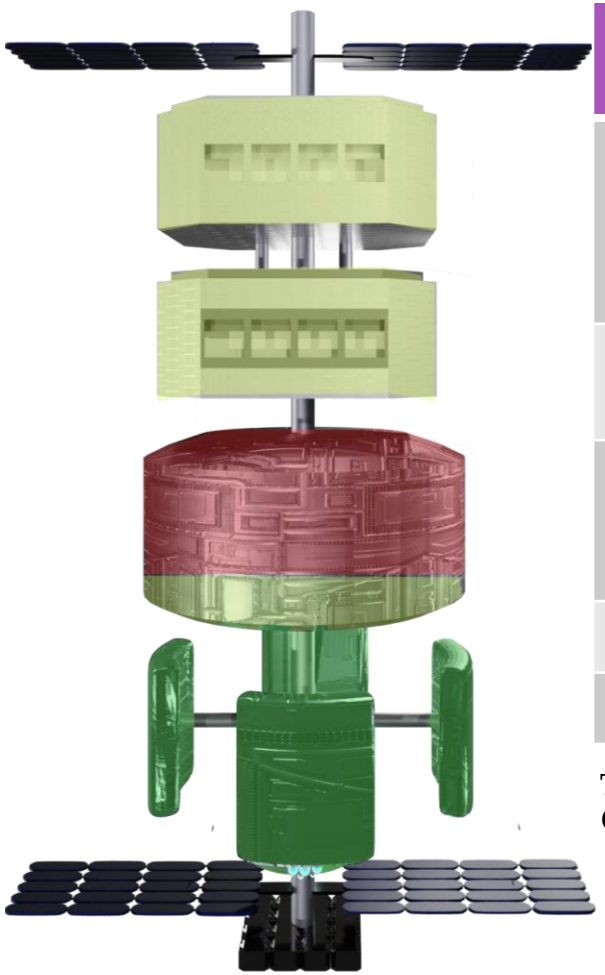


Fig 2.1.8 - Pressurization Components (Zubin, Photoshop)

Component	Rotating/Non-Rotating	Utilisation
Residential + Commercial Modules	Rotating	Facilities for residents to enjoy in Lunar gravity. Commercial – Temporary Residential – Permanent
Central Hub	Rotating	Base of Operations and Primary Axle. Storage
Spokes	Rotating	Allows extension and connects residents to spaceport
Warehouse	Non-Rotating	Storage of Vehicles
Docking	Non-Rotating	Loading vehicles

Table 2.1 -Rotation and Pressurization of Components (Arav, PowerPoint)

- Rotating and Pressurized
- Non-rotating Pressurized
- Rotating Non-Pressurized
- Non-Pressurized Non-Rotating

2.1 - Volumes

Component	Volume (m^3)
Residential + Commercial Modules	5,529,203
Spokes	47,433
0g Recreation	71569.41
Docking	1,178,100
Central Hub	1,230,970
Warehouse	1,683,700
Operational Facilities	49,260.17
Total	9.8 Million

Table 2.2 - Volumes (Arav, PowerPoint)

2.1 - Space Settlement Protection

- Understanding its location, Liberty has recognized the possible threats in its environment.
- Refer to Image 2.1.2, the spaceport utilizes Reinforced Titanium.
- The settlement also has a compact design, suited to avoid higher chances of collisions with space debris.
- Liberty is also equipped with a unique type of thruster which we call the Minor Position Adjusting (MPA) Thruster. This thruster allows for minor changes in position, without firing of the primary thrusters.

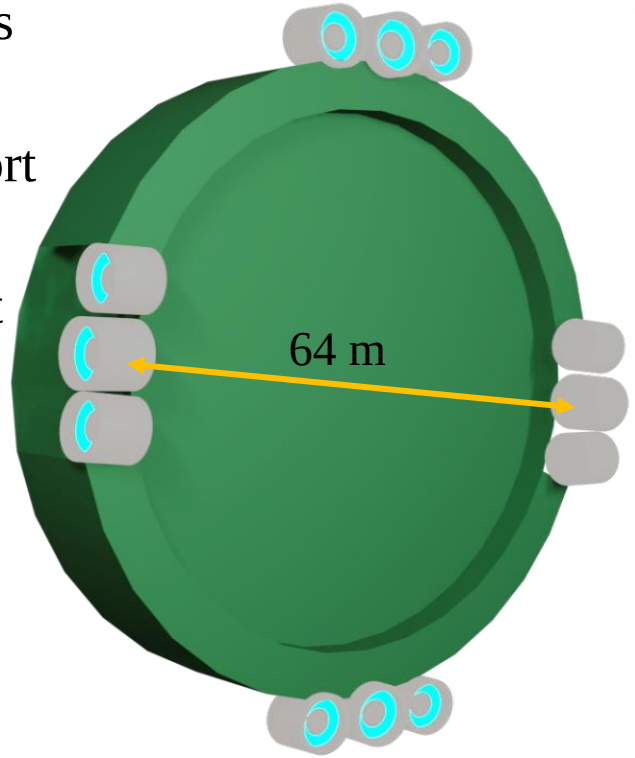


Fig 2.1.9 - MPA (Soumik, Blender)

2.2 Internal Configuration

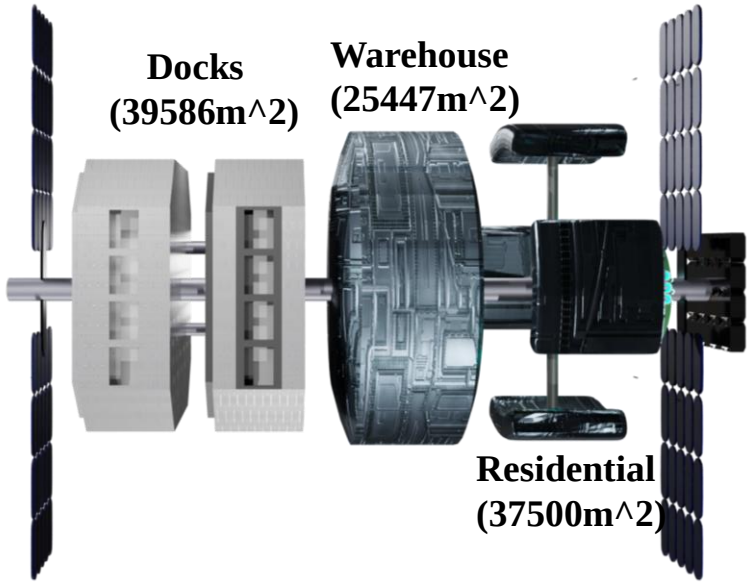
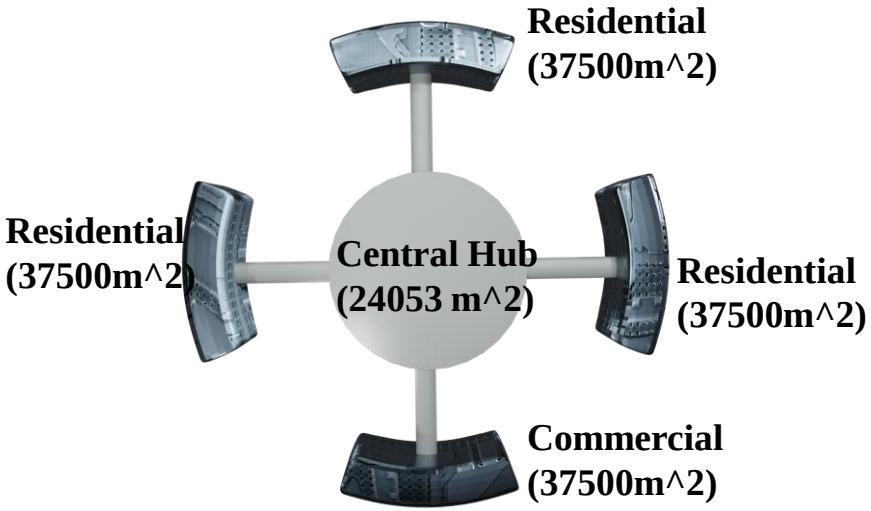
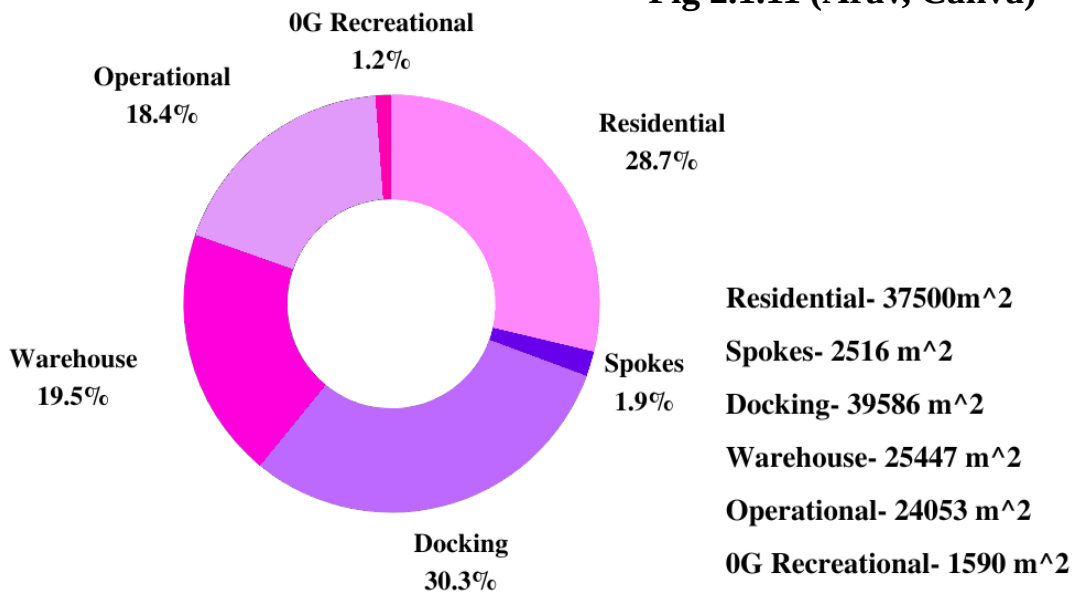


Fig 2.1.8-10 - Land Uses and DSA (Soumik, Blender)



Down Surface Area Allocation

Fig 2.1.11 (Arav, Canva)



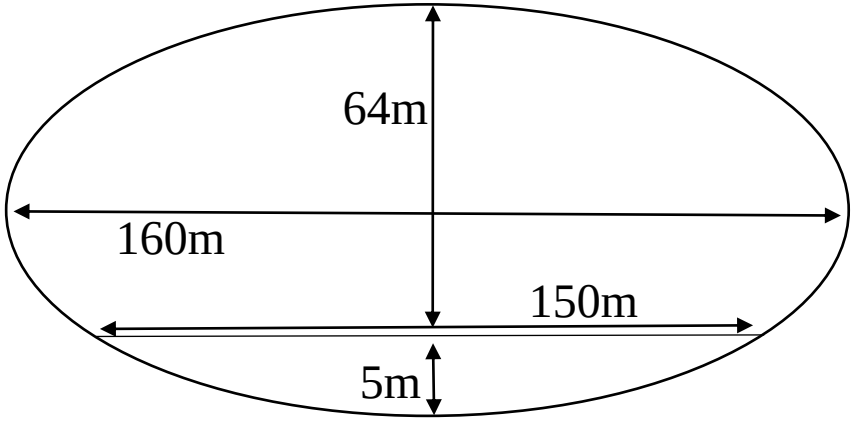


Fig 2.1.12 - Cross Section of Residential Module (Arav, Canva)

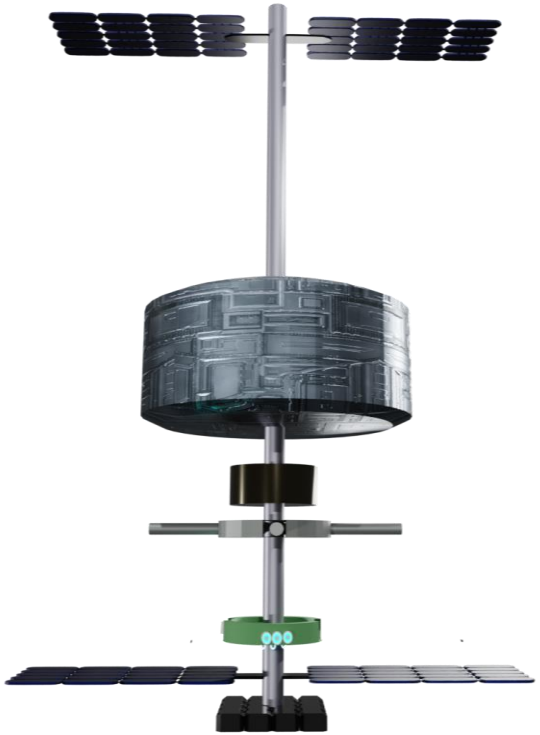
2.3 - Construction Processes

Step 1 – Construction Shack Launches

Fig 2.3.1 First Stage of Construction (Krish, Blender)

Step 2 – Spokes and MPA will be assembled from the construction shack.

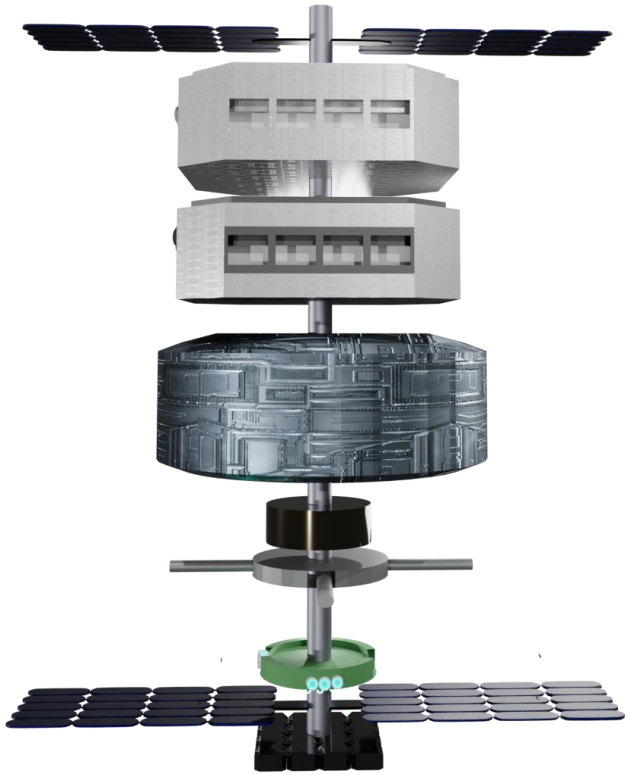
Fig 2.3.2 Second Stage of Construction (Krish, Blender)



Step 3 – Assembly of Warehouse

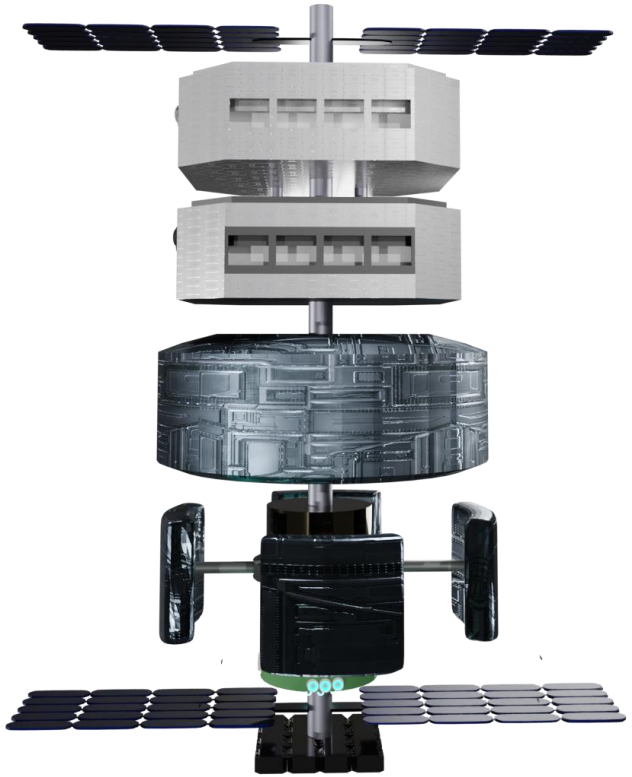
Fig 2.3.3 Third Stage of Construction (Krish, Blender)

2.3 - Construction Processes



Step 4 – Installation of Docking Systems

Fig 2.3.4 Step 4 (Krish, Blender)



Step 5 – Establishment and Construction of Residential and Commercial materials. Residential Structure begins rotation, hence generating artificial gravity. Rotation happens through a system of superconducting magnets.
Fig 2.3.5 (Soumik,Blender)

2.4 - Expansion of IOC

- Residential Expansion has space to accomadate for future expansion
- For spacecrafts of unknowable size, the structure of the dock can expand or contract to merge docks.
- Due to residential modules being located underneath, residents view of the earth is not hampered no matter the amount of expansion.

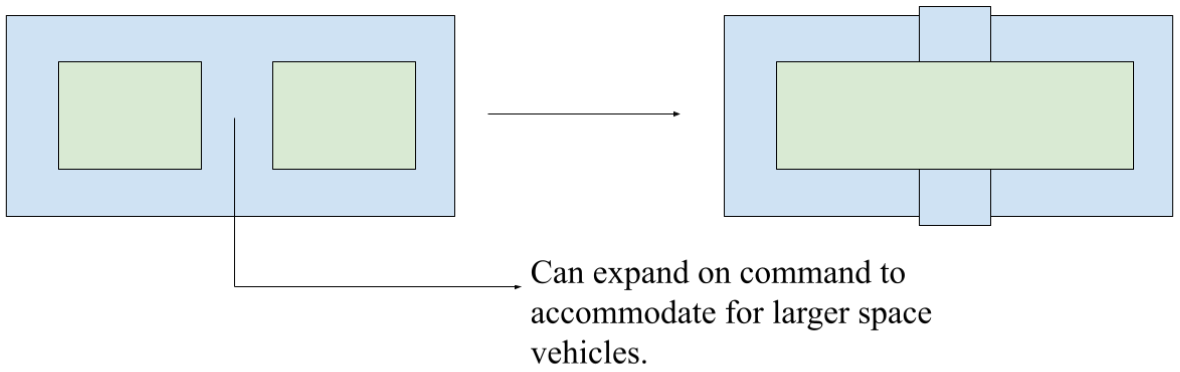


Fig 2.4.1 - Expansion of Dock(Taarak and Krish, Google Drawings)

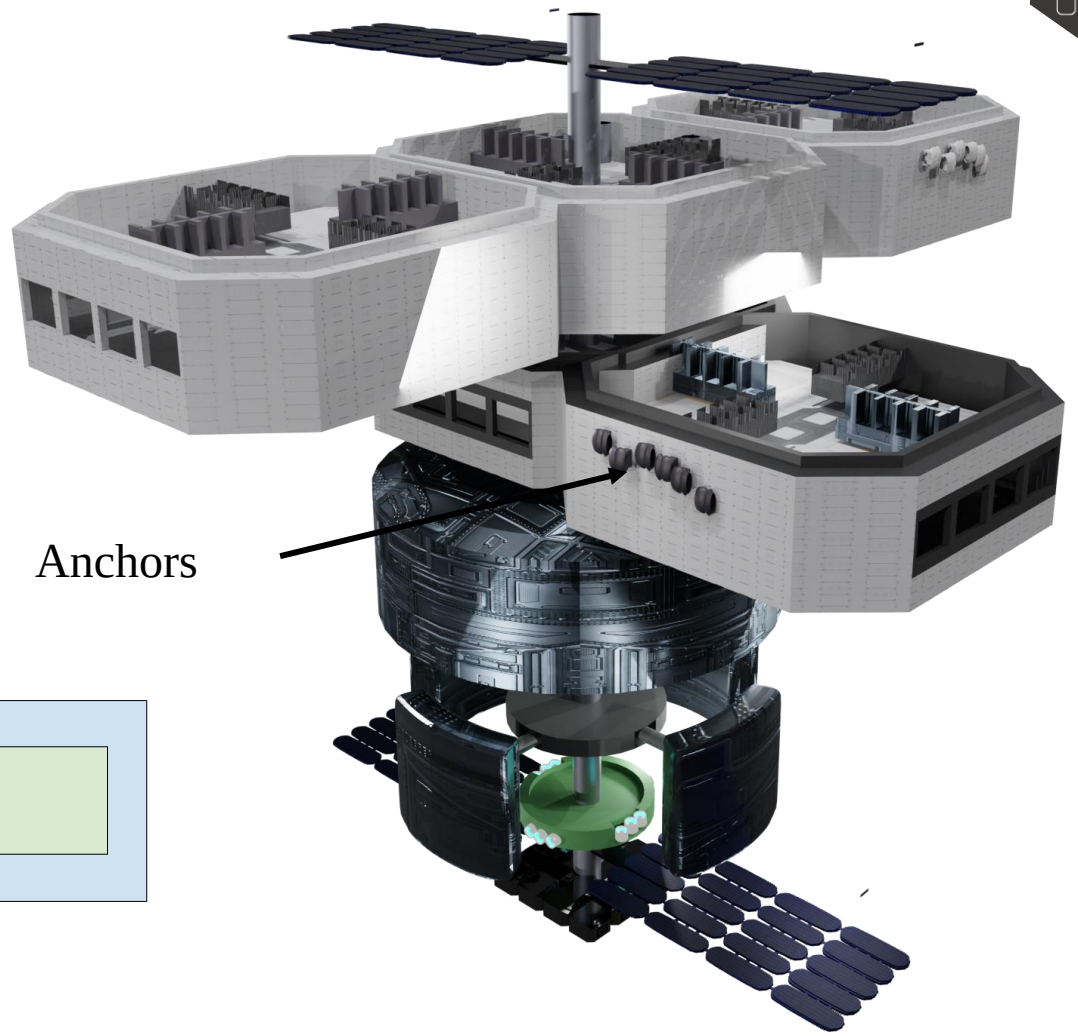


Fig 2.4.2 Dock Expansion(Krish and Soumik, Blender)

3.1 Materials

S. No	Material	Usage	Property	Source	Volume (m3)	Number of CASSSCs
1	Radiators	Interior construction/Hull	Radiation, High Resistance	Subcontracted	169,385.8	930
2	Windows	Windows	High tensile strength,	Subcontracted	169,385.8	930
3	Silica Aerogel	Machinery/Hull	Insulation and Dust Control	Earth	450.00	3
4	Borosilicate Glass	Windows	Radiation shielding, high tensile strength	Earth	84,692.9	465
5	Titanium	Hull	Debris protection, Impact resistance, thermal insulation	Earth	211,732.25	1163
6	Aluminium Silicate	Internal Construction/ Hull	High strength, Thermal resistance	Earth	84,692.9	465
7	Nickel Alloy	Hull	Reinforcing the hull	Earth	56,892.9	326

Table 3.1.1: Materials (Vyom and Rohan, PowerPoint)

*We will be outsourcing radiators and windows from **Vulture Vulture Aviation** via the Subcontractor **Litigation Limiters**.

3.1 Correction of orbital decay

Thrusters:

- The settlement will make use of 4 oxygen methane thrusters, with integrated injectors capable of operating with gaseous or liquid propellants.
- Thrusters will be used for re-boosting purposes to sustain orbital altitude.

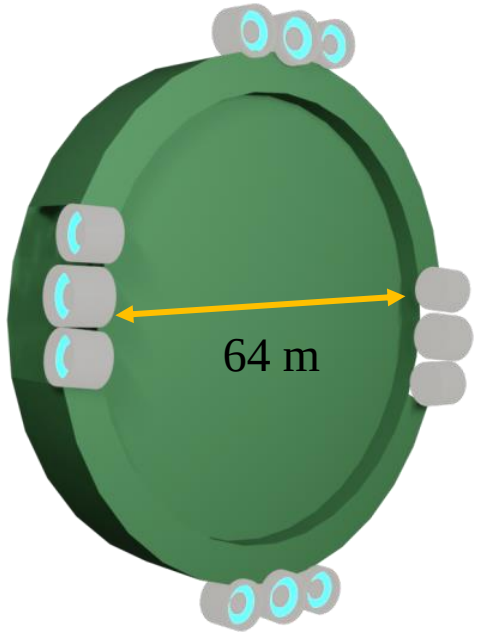


Fig. 3.1.2. AMP Thrusters (Soumik, Blender)

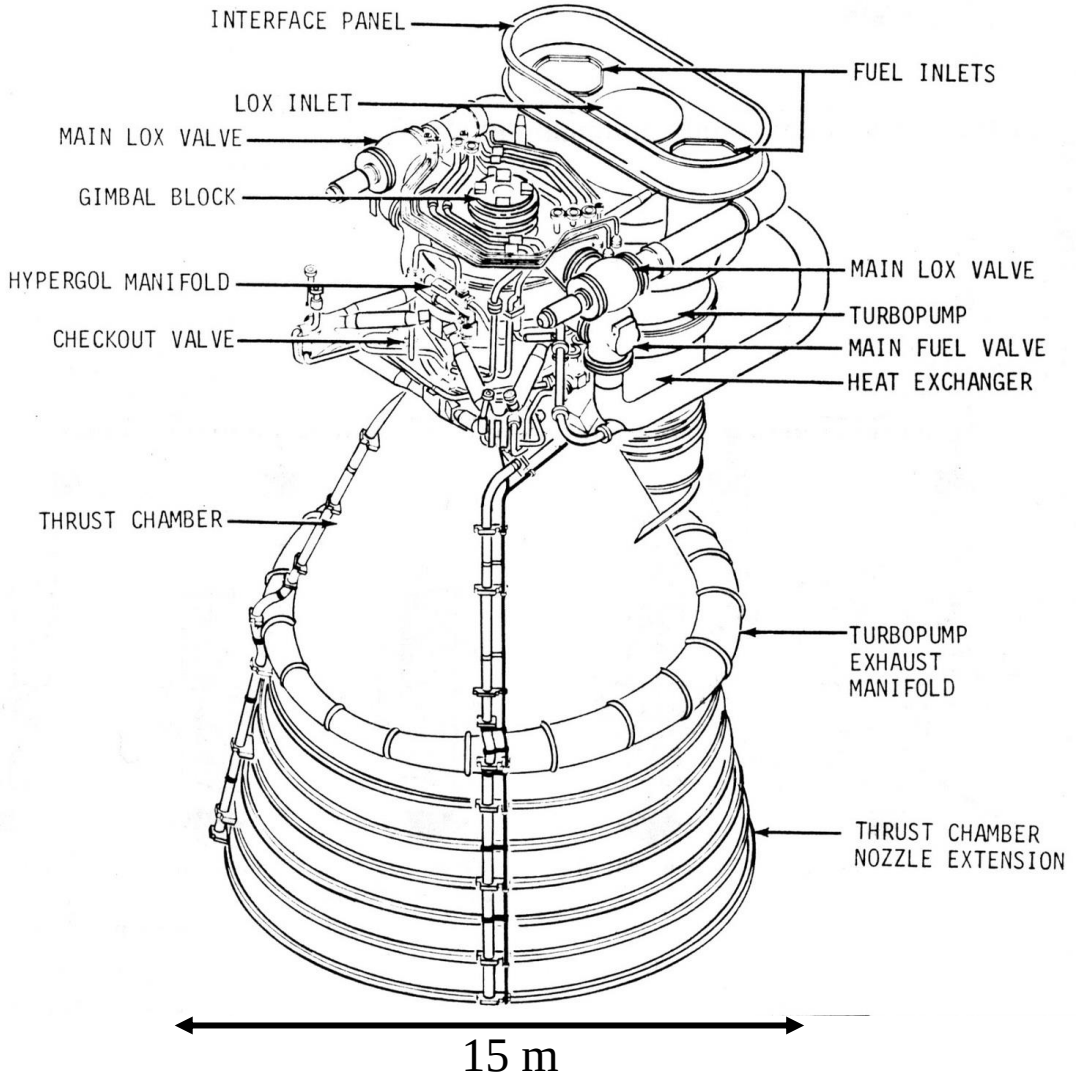


Fig 3.1.2.B Oxygen Methane thrusters Source: Benjamin Munro

3.2 Basic Infrastructure

Commodity	Source	No. Of CASSSCs
Air	Subcontracted	3888
Water	Subcontracted	593
Food	Imported from Earth	3
Toiletries	Subcontracted	1
Stationary		1
Consumables		2
Appliances and Furniture		4
Cutlery and crockery		1
Clothing		1

Table 3.2.1: CASSSCs of basic infrastructure (Arjun Mitra & Keshav B, PowerPoint)

Subcontractors: **Stuff of Life** and **Litigation Limiters** will be used to facilitate the supply of these materials.

3.2 Atmosphere and Climate

- The initial quantity of gases will be transported by **Stuff of Life** in liquid state.
- 5% extra air will be kept as reserve volume in case of emergency, or to regulate air composition.
- **Clean Up Your Act** will maintain the atmosphere.
- **8,596,000,000 litres** of air will be required to subcontracted.

Element	Residential	Warehouse	Quantity (m^3)
Oxygen	21.01%	21.64%	1,517,956.47
Nitrogen	72.55%	78.28%	5,329,437.14
Water Vapor	5.42%	0%	299,682.8
Carbon Dioxide	1.02%	0.08%	57,744.83

Table 3.2.2 Atmospheric Composition (Taarak Harjai, PowerPoint)

Atmospheric Pressure

0.75 atm will be maintained via a **Pneumatic Air Pressure Regulator**

Humidity Control

35 - 36% will be maintained via a **Hybrid Ultrasonic Humidifier**

Climate Control

293 - 298 K for Residential Areas via **Liquid Drop Radiator** and **Electric Resistance Heat Pads**

3.2 - Food Production

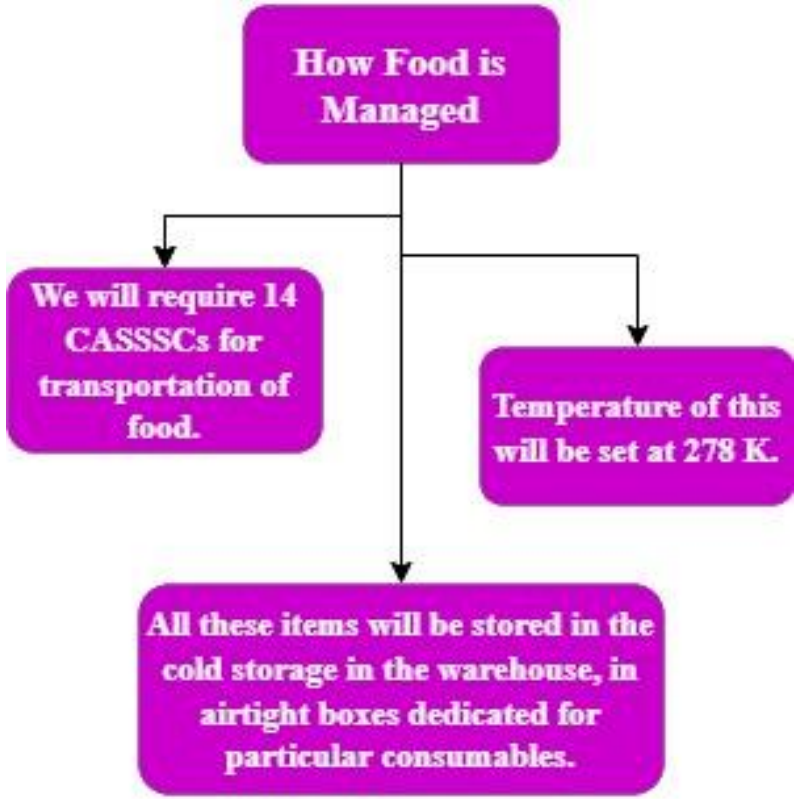


Fig 3.2.1 Management of Food (Arjun M, draw.io)

Meiti (Refer 5.3) will be used to transport these foods to each resident and Meat products will be synthesized from animal cells.

Item	Amount per person per day (g)	Total quantity required annually (kg)
Rice	150	24,500
Wheat/ Flour	85	14,000
Sugar	36	6,000
Fruits	180	29,000
Oil	50	8,300
Salt	5	850
Milk	480	79,000
Legumes	250	41,000
Total	1,236	212,650

Table 3.2.3 Quantities of Food (Arjun M & Keshav B, PowerPoint)

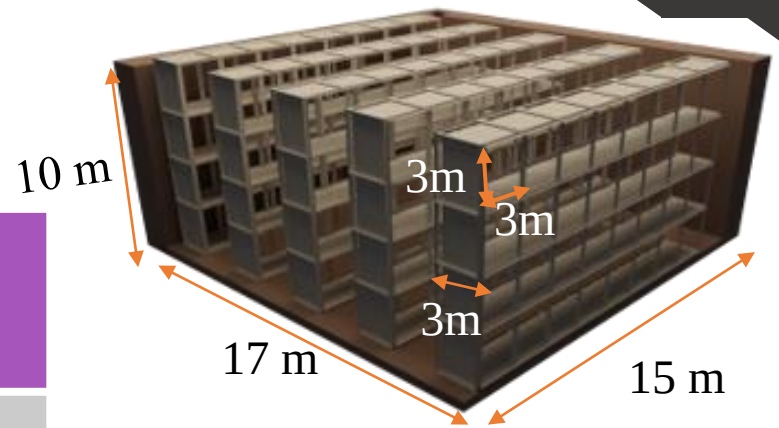


Fig 3.2.2 Cold Storage and Stacking System (Arjun Mitra, PowerPoint)

- The Storage facility for the consumable will be located in the warehouse.
- Food will be stacked in boxes in compartments, based on their type and use.

3.2 Storage System of Commodities

- We will have commodities weighing 1545.5 kg in total(**refer to Fig 3.2.3)** on monthly basis in addition to storage needed to monthly food consumption.
- We will make in to use to the block stacking system **(refer Fig 3.2.2)**
- Total Space used will be 976m^3

Items	Total Quantity Consumed (kg)	Sources
Toiletries	806.00	Litigation Limiters
Stationary ware	105.00	
Laundry Utilities	292.50	On Site
Other	342.00	Litigation Limiters
Total	1545.50	

Table 3.2.4 Quantities of commodities (Arjun M & Keshav B, Powerpoint)

3.2 Electrical Power Generation

- The main energy source will be the Solar Panels placed on the surface of the settlement.
- 134,400m2 of solar panels are going to be placed.
- A SPSS System subcontracted from **Dougledyne AstroSystems** who will be contracted with the help of **Litigation Limiters**.
- The SPSS will act as a secondary source
- Rectennas will be set up on the surface for the same.
- The power storage will be done by SMES Batteries and Liquid Sodium Ion Batteries.
- These units will be placed in the allocated space in the warehouse.

Sources	Total electricity required (kW)
Residential	6500
Warehouse	9800
Miscellaneous	19000
Infrastructure	28500
Total:	63,800

Table 3.2.5 Amount of Electricity required for various activities (Arjun, powerpoint)

3.2 - Water Management

- "Stuff of Life" will be subcontracted to provide us with 593 CASSSCs of water.
- Water from agriculture, kitchens (cooking) and cleaning will be recycled through ‘Clean Up your Act.’ Water from sewage systems will be recycled through ‘Water Products.’
- Water management project will use ‘Waste Products’ for the creation and installation of the sewage systems, in collaboration with Clean up Your Act.
- "Clean Up Your Act" will maintain the pipelines and supply the transportation of water to bring recycled water back into the homes.
- Water Management will take place in the same place as Waste Management.

Utilities	Estimated water needed for the settlement per day (litres)	CASSSCs required annually
Residential	407,500	122
Warehouse	595,500	180
Infrastructure	255,000	77
Miscellaneous	314,500	95
Total	1,572,500	474 + 119 (as contingencies)

Table 3.2.6: Quantities of Water required (Arjun Mitra, Powerpoint)

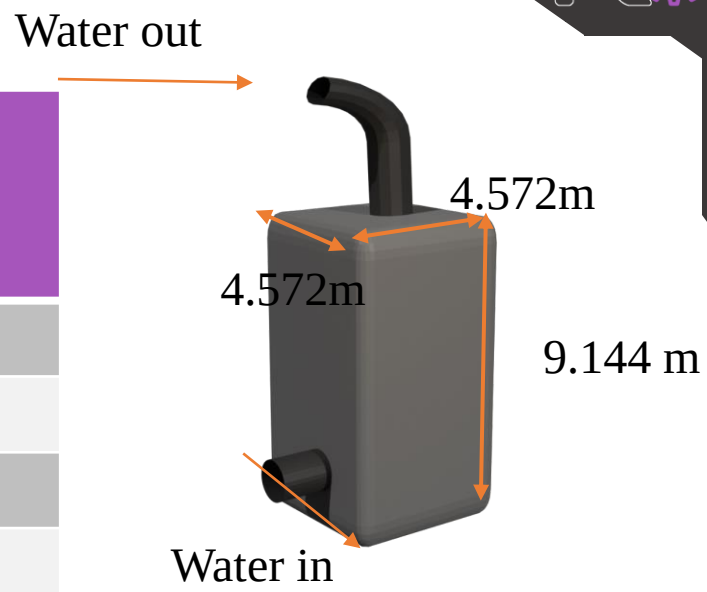


Fig 3.2.3: Refurbished CASSSCs (Arjun Mitra, Blender)

Fig 3.2.4: Water Management System (Kritvi, Canva)

3.2 - Waste Management

•‘Toss It To Me’ and ‘Waste Products’ will be used to recycle the waste from communities and systems:

•All completely non-recyclable waste will be incinerated.

•Waste Management will have a dedicated storage facility in the warehouse to conduct all these processes. All wastes will be disposed of there only.

•The non-recyclable waste from the residential and industrial sectors will be transported to Earth through Dirtbuilders, which work with CalEarth. On Earth, the waste will be sent to landfills and incinerated.

•Liberty will use a waste segregator known as ‘Cleani’ for primary solid waste segregation into recyclable or non-recyclable.

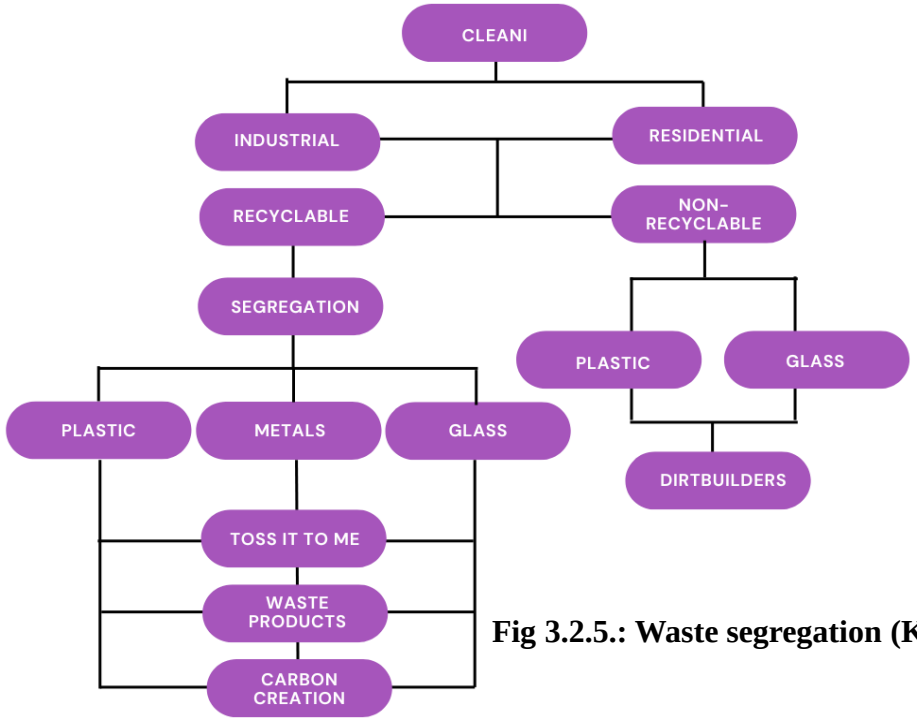


Fig 3.2.5.: Waste segregation (Kritvi, Canva)

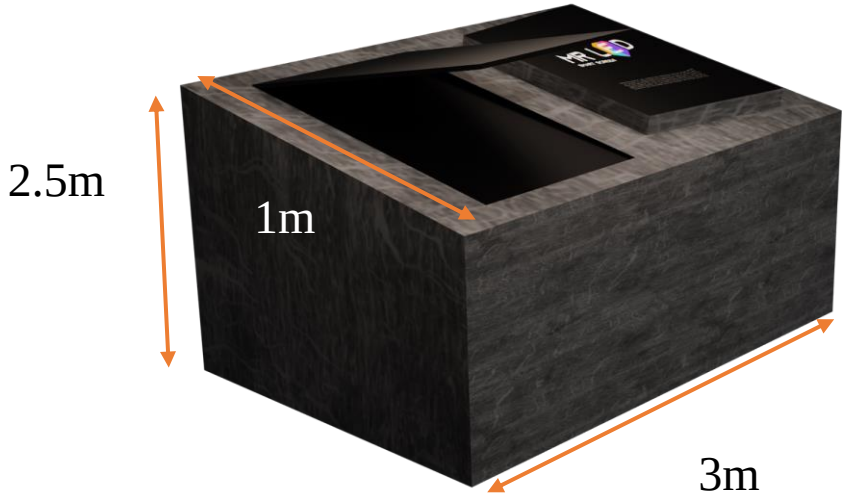
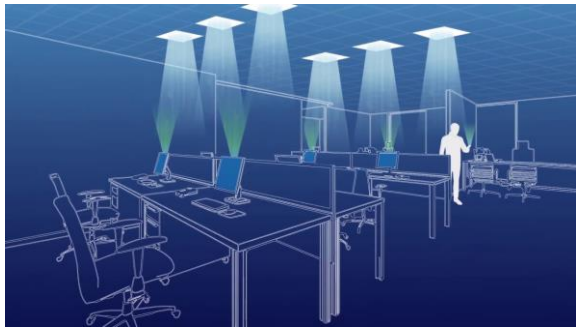


Fig 3.2.6.: CLEANI (Arjun Mitra , Blender)

3.2 – Communication

Category	Internal	External
Primary	Light Fidelity (LiFi): • A Wifi Mesh will be used in collaboration with Li-Fi • Optical and electrical multiplexing techniques • Speeds up to at least 5 GBps for Li-Fi and over 200 GBps for Mesh Wi-Fi • Circuitry provided by subcontractor ElectroProtect • The personal device, Refer to Automation (5.1) will be used • Heimdall Band (refer 5.3) - a personal device will be using LiFi in collaboration with WiFi.	External Communication Antenna and satellite: • Antennas used for communication with Foundation Society settlements • Communication Satellite Subcontracted from by "Dougledyne Astrosystems" with the help of "Ligation Limiters". • The antenna will be 10m in diameter.
Secondary	Super high speed Optic fiber provides reliable, rapid communication during an emergency to areas where it is required the most.	Second Antenna to reduce redundancy



Source: - https://www.youtube.com/watch?v=GkXyEgHRAcY

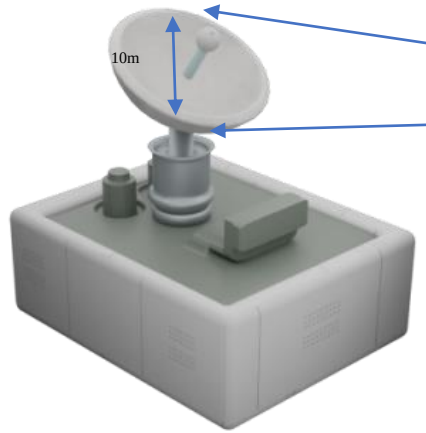


Figure 3.2.7.1 Communication Array (Soumik, Blender)

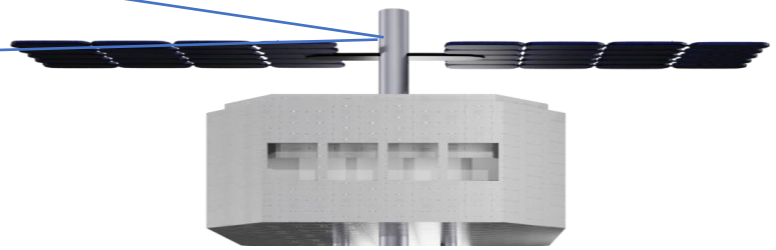
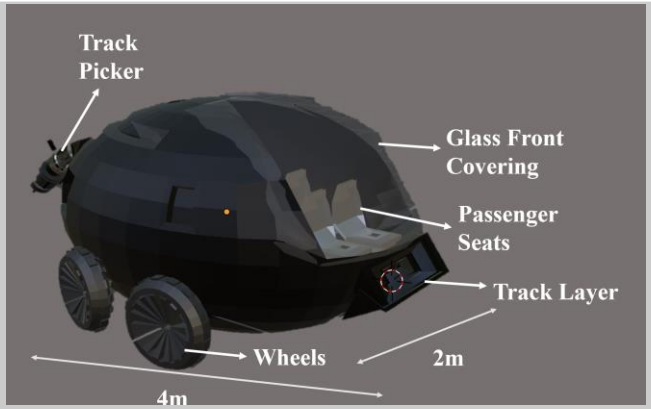
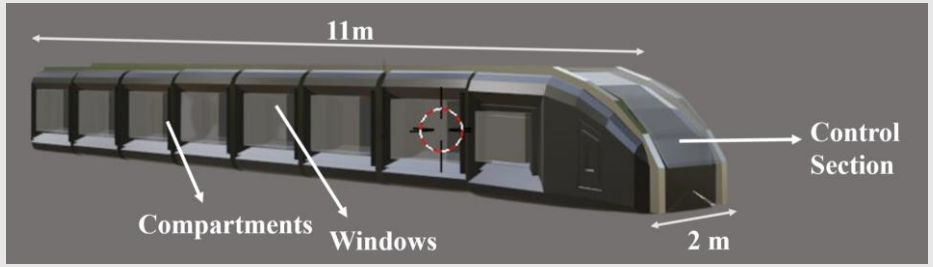


Figure 3.2.7.2 Liberty Settlement (Soumik, Blender)

3.2.8 Internal Transportation

Description	Design
Residento- • It is a capsule-shaped rover • Seating capacity of 4 people. • It will lay tracks and pick them up as it moves, hence no need for roads • It is fully automated	 **Fig 3.2.9 Residento (Aadvik, Blender)**
Monorail- • The monorail, a streamline body will run in the main axis connected to all the spokes with periodic stops. • It will primarily transport packages, but will be able to transport passengers too, with a maximum capacity of 100 people.	 **Fig 3.2.10 Monorail (Aadvik, Blender)**

Description	Design
Elvt- • They will be able to store a maximum of 30 passengers. • The dimensions for the lift- 23m,3m,3.5m. • It would be able to transport cargo and passengers.	

Fig 3.2.11 Elvt (Aadvik, Blender)

3.3 Construction Machinery

- **Exterior construction robots** will be used for building and repair along with **Interior construction bots (refer 5.1.1 and 5.1.3)** which will provide tools for maintenance, repair and building. Bot shown in process in **Fig 3.3.1**
- Components will be transported and hence delivered using **Monorail (refer 3.2.8)**
- Loading and Unloading will be carried out using **Clasp N Clamp: Clasp n clamp (3.3.2)** is an arc-shaped tool with 4 clasps on the front, it will help in loading and unloading of CASSSC.
- Furthermore, the parts will be assembled to into complete spaceport structure with help on **Supporto** which will take care of assembly of parts once transported and unloaded: **Supporto(3.3.3)** is a cylindrical bot with rings in middle of it to give support and strength. It will extend automatically and will be used in 0g

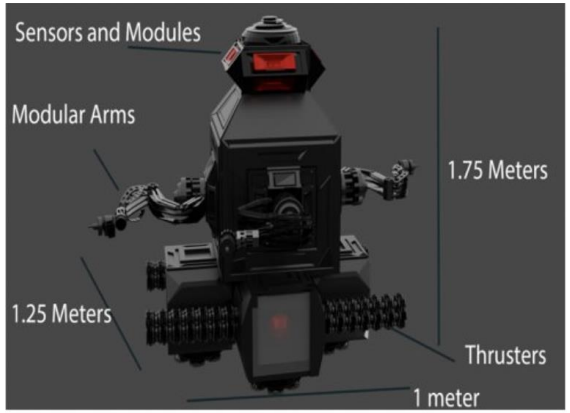


Fig 3.3.1: Construction bot helping in the construction process (Aadvik, Blender)

Fig 3.3.2 Clasp N Clamp (Aadvik, Blender)

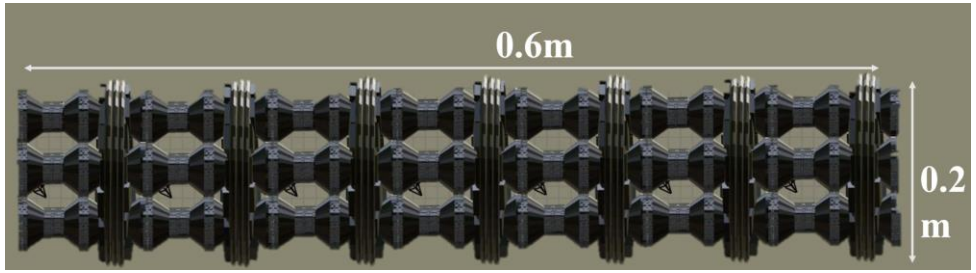


Fig 3.3.3 SUPPORTO (Aadvik, Blender)

3.4 Port infrastructure and MRO Docking

In essence, analysis for condition-based and predictive maintenance happens within the port infrastructure.

- The docking and storage systems will be modular in design.
- The docks (3.4.1) at IOC will feature hooks for attachment, and when the X-axis expands in the future, additional docks may be attached.
- The space craft will enter through the entry point labelled in (**Fig 3.4.2)** and will be docked in the Storage/Transport. The storage points are all intersecting in the MRO where the space crafts can go for reparations

- The fuel depot will be located inside the dock, around the MRO and storage space. The dock is covered by four fuel depots.

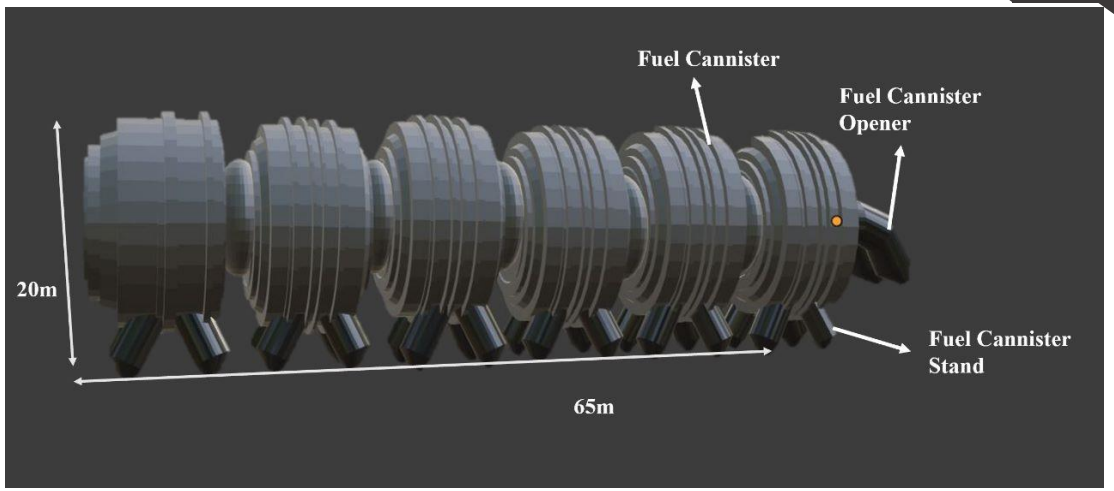
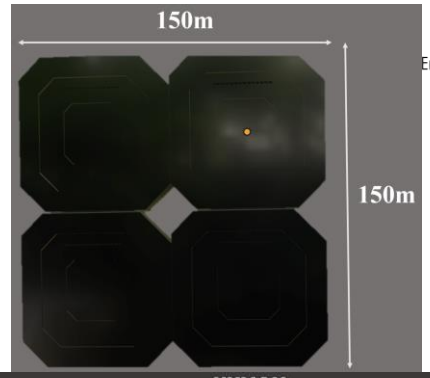


Fig 3.4.3 (Aadvik, Blender)

Fig 3.4.1 (Soumik, Blender)

Fig 3.4.1 (Soumik, Blender)



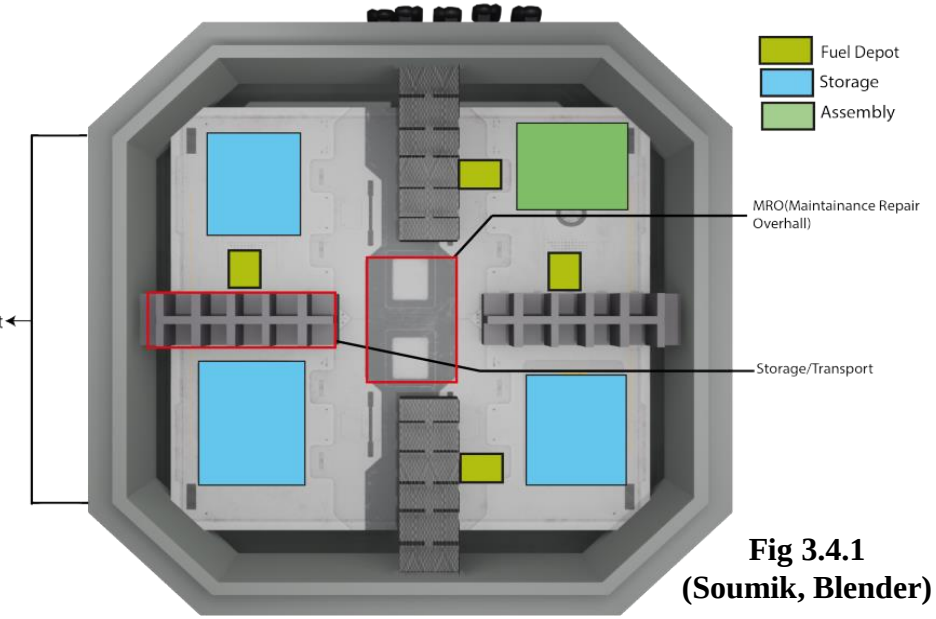
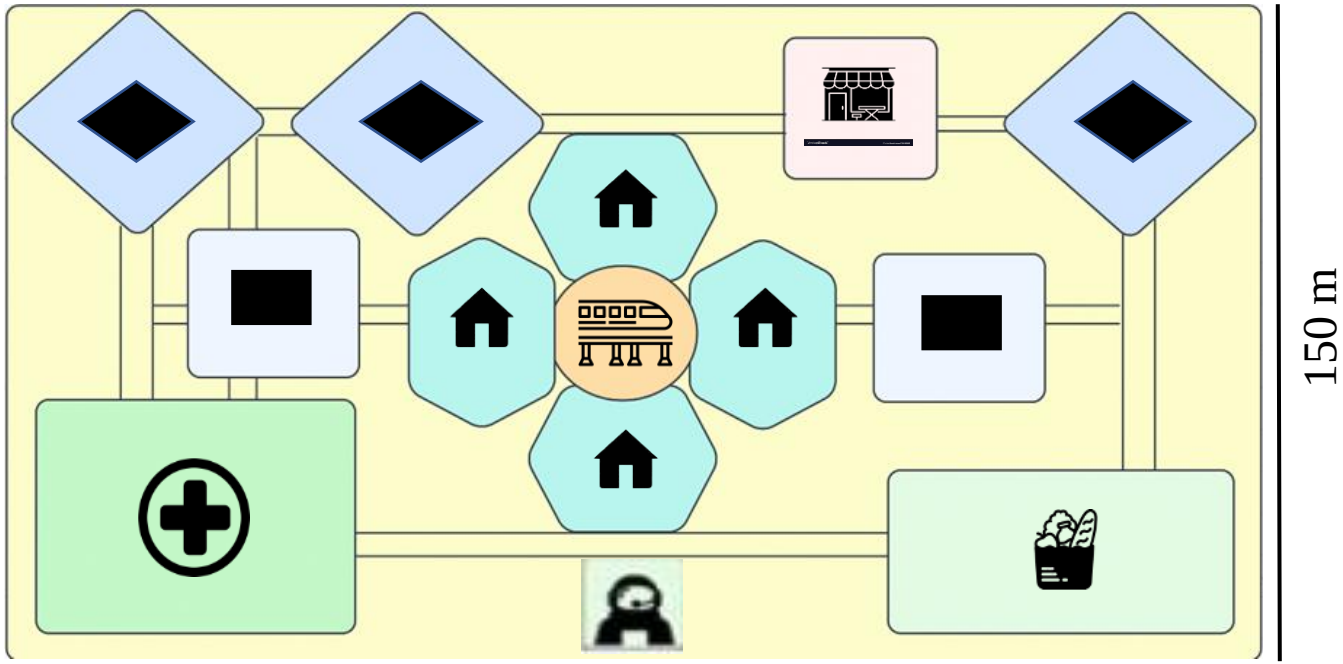


Fig 3.4.1 (Soumik, Blender)

4.1.1 Community Layouts

KEY	REPRESENTATION
	Geminorum
	Arietis
	Leonis
	Cafe
	Health care
	Grocery store
	Transportation
	Pathway

Table 4.1.1 Residential Module Community Design Key (Samara, Powerpoint)



Scale - 1cm:100m

Fig 4.1.1 Residential Module Community Design (Samara and Yash, Powerpoint)

4.1.2 Community Layouts

KEY	REPRESENTATION
	Retail store
	Cafe
	Health care
	School
	Hotel
	Arcade
	Office complex
	Transportation
	Space center
	Pathway
	Toss it to me

Table 4.1.2 Commercial/Recreation Module Community Design Key (Samara, Powerpoint)

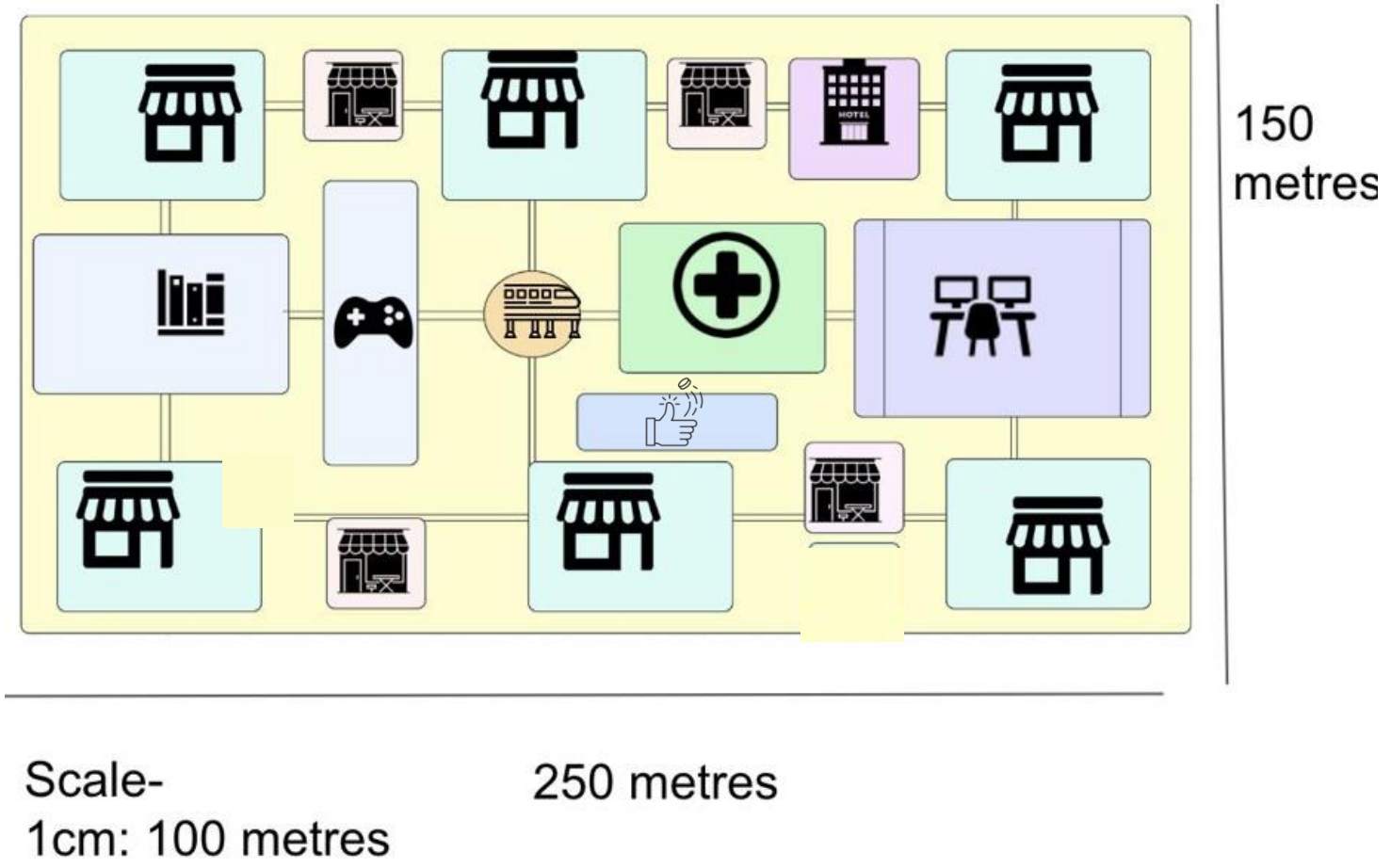


Fig 4.1.2 Commercial/Recreation Module Community Design (Samara and Yash, Powerpoint)

4.1.2 Consumables :

Item	Amount Per Day
Water	2000 Grams/ 2 L
Rice	150 Grams
Wheat/flour	85 Grams
Corn Products	250 Grams
Nuts	30 Grams
Legumes	250 Grams
Vegetables	450 Grams
Fruits	180 Grams
Oil	50 Grams
Butter	40 Grams
Milk	480 ML
Eggs	150
Whole grain Bread	115
Chicken	80 grams
Beef	40 grams
Fish	60 grams
Sugar	36 grams
Salt	5 grams

Table 4.1.2 Food Consumables (Yash, MS Excel)

Items	Quantity Used (Per Month, Per Person)
Dental:	663 grams
Toothpaste	113 grams
Mouthwash	500 grams
Dental Floss	10 m
Shampoo	150 ml
Body lotion	95 ml
Shaving cream/gel	35 ml
Razors	4
Sanitary Pads	10
House Ware	2
Electric Appliances	12
Stationary Ware	25
Shower gel	300 ml
Toilet Paper	7
Menstrual Cup	1 (per year)
Tampons	10
First AID	2

Table 4.1.2 Toiletries Consumables (Yash, MS Excel)

4.2.1 Interior Plans

Fig 4.2.1 Arietis (Namya, Floorplanner)

Table 4.2.1 Arietis furniture (Namya, MS Excel)

Item	Quantity
Bed	1
Nightstand	1
Wardrobe	1
Curtain	1
Painting	1
Couch	1
Table	1
Bookshelf	2
Kitchen unit	1
Shower	1
Mirror	1
Bathmat	1
Basin	1
Toilet	1
Towel rack	1
Table lamp	1
Bathroom lighting	3
Overhead lighting	5

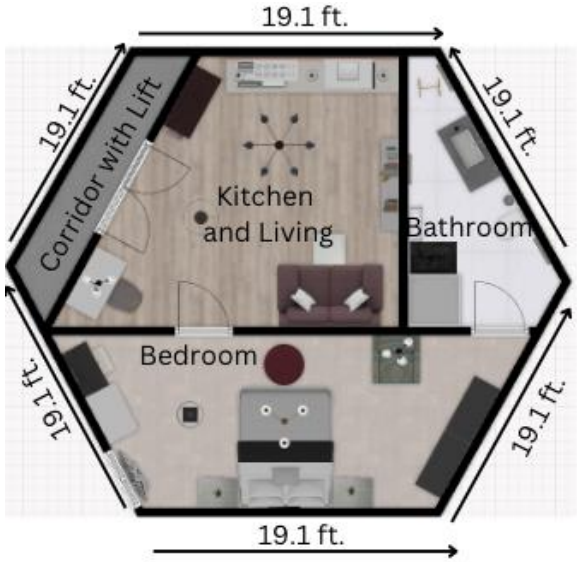


Fig 4.2.2 Geminorum (Namya, Floorplanner)

Table 4.2.2 Geminorum furniture (Namya, MS Excel)

Item	Quantity
Bed	1
Nightstand	2
Wardrobe	3
Curtain	1
Painting	1
Couch	1
Table	1
Bookshelf	1
Kitchen unit	1
Shower	1
Mirror	1
Bathmat	1
Basin	1
Toilet	1
Towel rack	1
Flower pot	2
Bathroom lighting	3
Overhead lighting	5
Floor lamp	1
Desk	1
Desk Chair	1

Fig 4.2.3 Leonis (Namya, Floorplanner)

Table 4.2.3 Leonis furniture (Namya, MS Excel)

Item	Quantity
Bed	2
Nightstand	4
Wardrobe	2
Curtain	2
Dining Set	1
Couch	1
Table	2
Bookshelf	1
Kitchen unit	1
Shower	1
Mirror	1
Bathmat	2
Basin	1
Toilet	1
Towel rack	1
Flower pot	1
Bathroom lighting	4
Overhead lighting	7
Floor lamp	2
Table Lamp	2
Desk	1
Desk Chair	1
Armchair	1

4.2.2 Exterior Designs

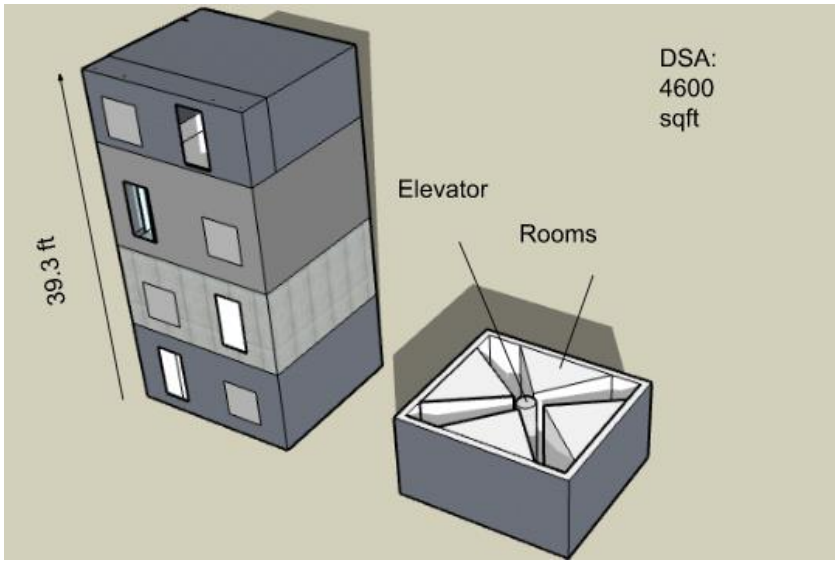


Figure 4.2.4
Arietis (Jaikrit, SketchUp)

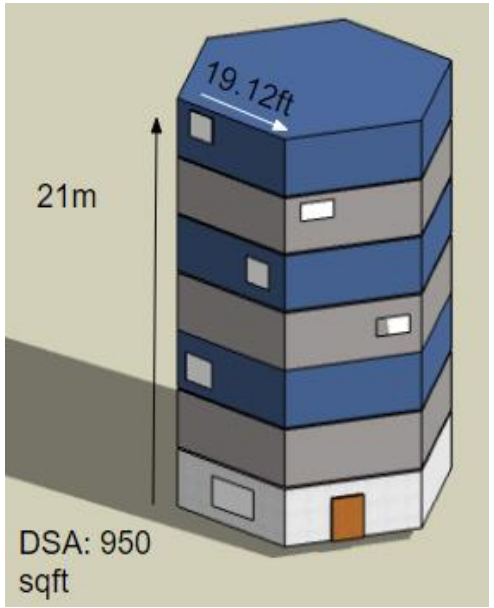


Figure 4.2.5
Geminorum (Jaikrit, SketchUp)

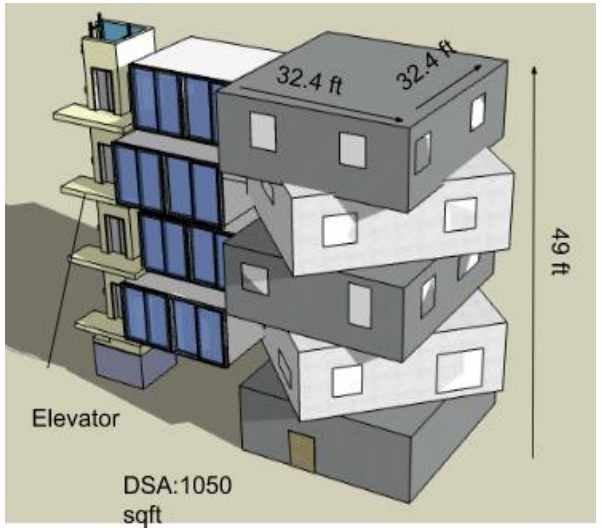


Figure 4.2.6 Leonis (Jaikrit, SketchUp)

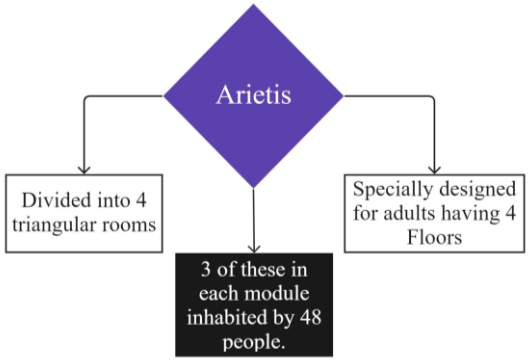


Fig.4.2.4 A Arietis (Yash, Lucid Charts)

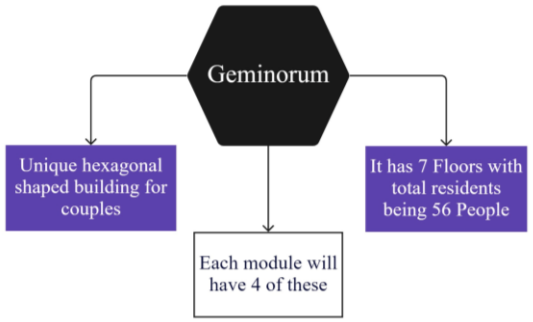


Fig.4.2.5 A Geminorum (Yash, Lucid Charts)

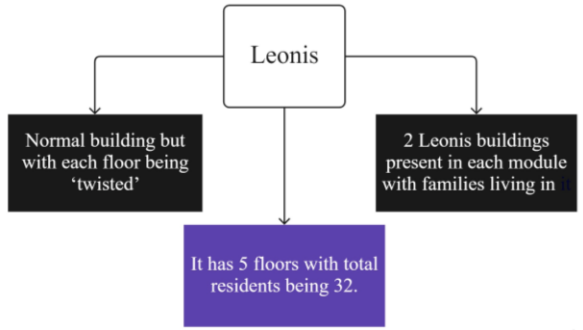


Fig.4.2.6 A Leonis (Yash, Lucid Charts)

4.2.3 Modules

Residential Module				
Number per Module	**Type of building**	**Dimensions (ft)**	**Down Surface Area (Sq.ft.)**	**Height (ft)**
4	Geminorum	19.12 per side	950	68.8
4	Leonis	32.4 x 32.4	1050	49.2
1	Café	80 x 75	6000	18.3
1	Health Centre	90 x 85	7650	31.1
1	Grocery Store	100 x 85	8500	19.3
4	Arietis	70	4600	39.3

Table 4.2.4 Residential Module (Yash, Powerpoint)

Commercial/Recreational Module				
Number per Module	**Type of building**	**Dimensions (ft)**	**Down Surface Area (Sq.ft.)**	**Height (ft)**
6	Retail Store	95 x 90	8550	7.2
4	Café	80 x 75	6000	5.6
1	Health Centre	90 x 85	7650	9.5
1	School	150 x 145	21750	6.7
1	Aquilae (Hotel)	60*45	2700	22.86
1	Arcade	30 x 100	3000	6
1	Office Complex	200 x 185	37000	13.1

Table 4.2.5 Commercial/Recreational Module (Namya, Powerpoint)

4.3 Spacesuits

4.3.1 SPACESUITS

- Automated AI- Gives data to astronauts, makes spacewalks easier.
- Microphone and speakers within helmet are more comfortable instead of snoopy caps.
- Solar flare and radiation protection - Van Allen belts don't provide solar flare protection
- Thermal Insulation - Allows spacesuits to handle extreme temperatures
- Automated AI - Gives data to astronauts

All spacesuits will be subcontracted to **Extreme Survival Technologies**. We will also be subcontracting portable evacuation shelters, to be used in case of contingencies.

Space Suit Specifications		
Types / Needs	Description	Amount
EVA/Construction/ Recreational/ Evacuation	•Radiation and Solar Flare Protection •Thermal Insulation •Suitport	600
Internal Repair (IVA)	•No radiation protection •No insulation •Pressurized	50

Table 4.3.1 Spacesuit Specifications (Taarak, MS Excel)

4.3.2 RETENTION AND SAFETY SYSTEMS

Tether

Made of Braided Steel and Braëon - highly flexible – ensure reach and safety.

Handrails

Constructed on the exterior of modules within EVA range near doffing areas – made of Aluminium Alloys.

4.3.3 Airlock And Spacewalk Centers

•The storage area and changing room will be in one place and they will be made from repurposed CASSCS's.

•8 EVA spacesuits will be stored in a singular storage area.

•1 EVA spacesuit will be provided to each resident

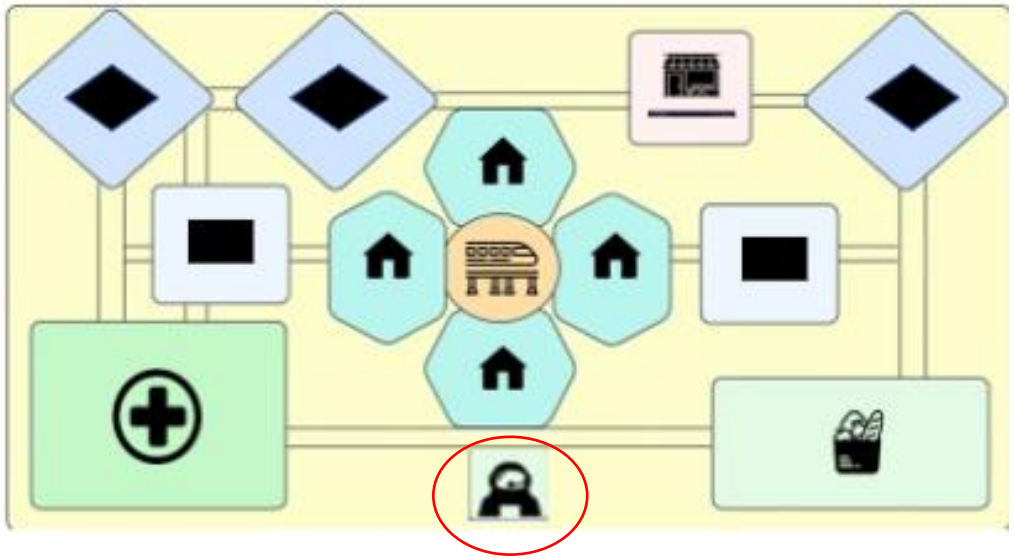


Fig 4.3.1 Airlocks (Taarak, Powerpoint)

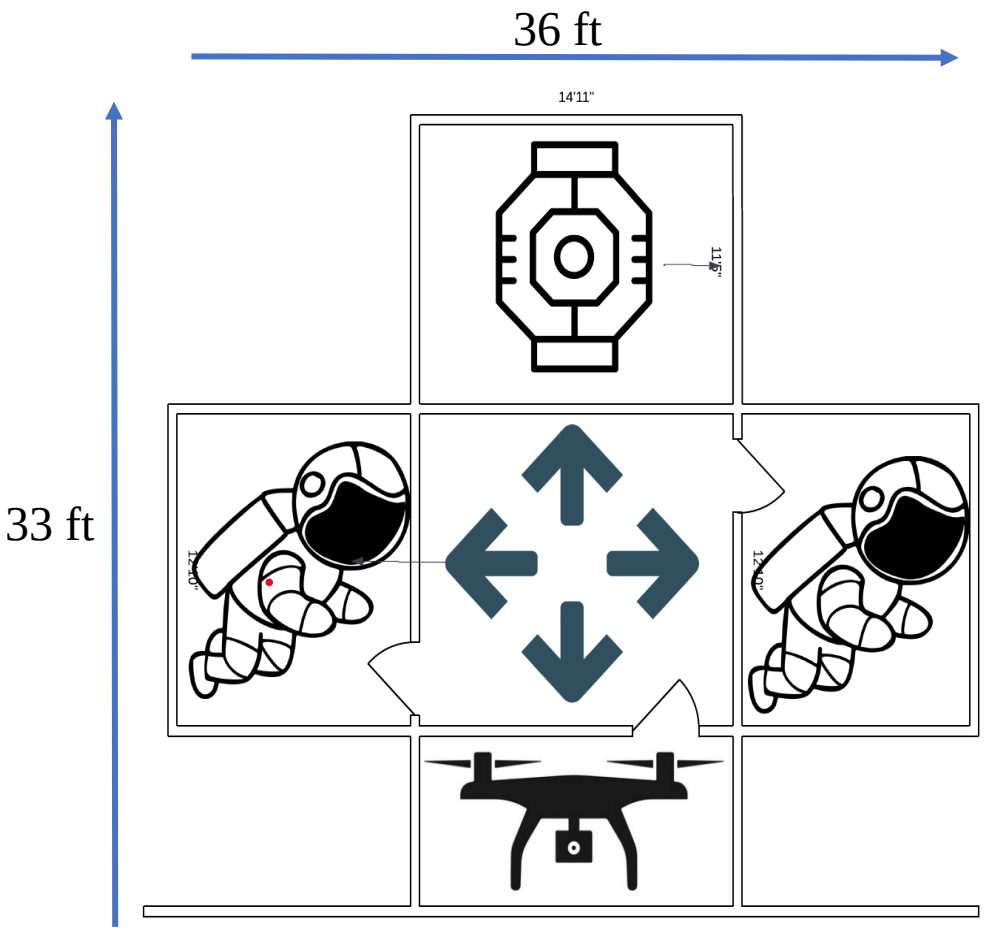


Fig 4.3.2 Spacesuit Storage

4.4 Transient Residents (Accommodations and Recreation)

4.4.1 Aquilae

- We will provide a hotel made from repurposed CASSSCs for transient visitors
- Each room has capacity of 2 people, there are 30 rooms = 60 initial capacity
- Repurposing CASSSCs means that it is easily expandable vertically, and replicable.
- Located in commercial/recreation community module (refer 4.1.1)
- Hotel Reception will be at the transportation station (refer 4.1.1)

Fig. 4.4.1 Interior Design of Aquilae Hotel (Naavya, Floorplanner)

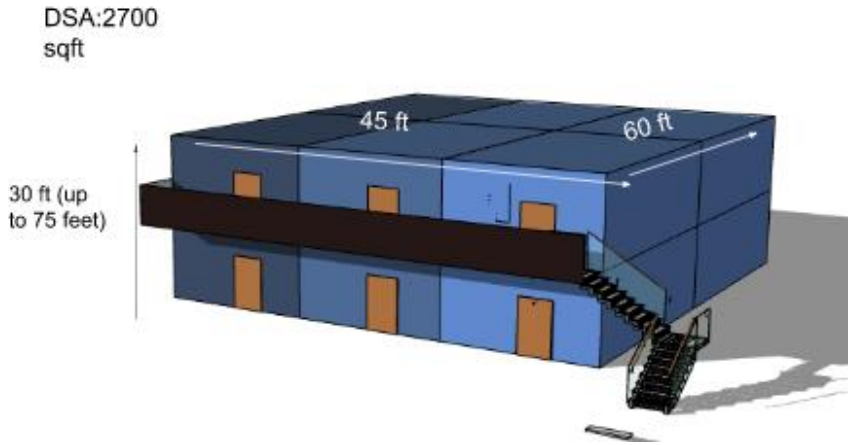


Fig. 4.4.2 Exterior Design of Aquilae Hotel – 2 floors shown (Jaikrit, SketchUp)

Recreation

Recreation options will be provided in 2 ways:

- Community amenities:
  - Amenities in the commercial module
  - Personal Devices (refer to 5.3)
- 0G facility located in the warehouse with:
  - Space walks
    - Visor HUD creates AR information display
  - Lost in Labyrinth: 3-Dimensional Labyrinth
  - Shifting Reality: VR Facilities

Expansion Plans:

- Electrical Muscle Stimulation and Mind Reading Controls will make VR even more immersive
- A 0G museum, depicting science exhibits only possible in 0G environment and interactive exhibits of other space stations and space vehicles, can be added later when we have a bigger transient population

Fig 4.4.3 Shifting Reality (Yash, Lucid Charts)

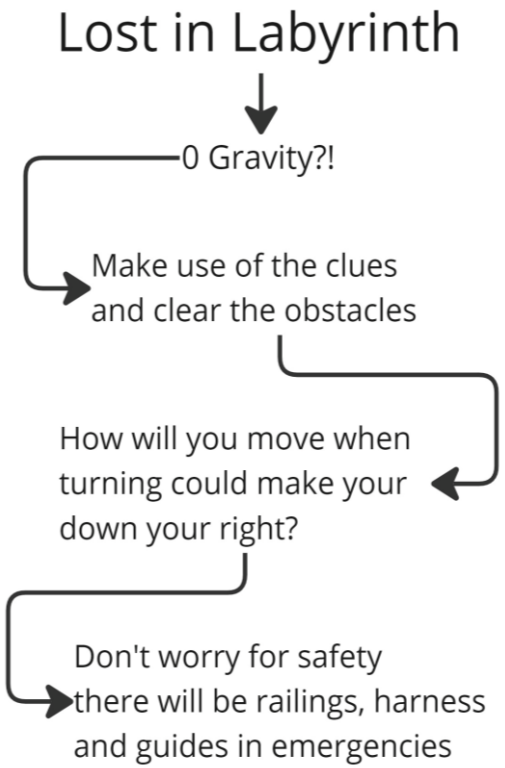


Fig 4.4.4 Lost in Labyrinth (Yash, Lucid Charts)

Data Servers

5.0.1 Eir Robot

- Eir is the server maintenance robot used in the server room for care, backup, and repair.

5.0.2 Control Room

- The control room will be in the community center.
- Contains supercomputers for remote processing of all robots.
- Residents can contact the control room incase of a malfunction.

5.0.3 Data Encryption

- Data transferring between devices and robots is encrypted by an algorithm C.C.T.A.
- It is algorithm to use color code to encrypt data
- If any suspicious transmissions are found, the location is tracked down and reported to the server rooms.

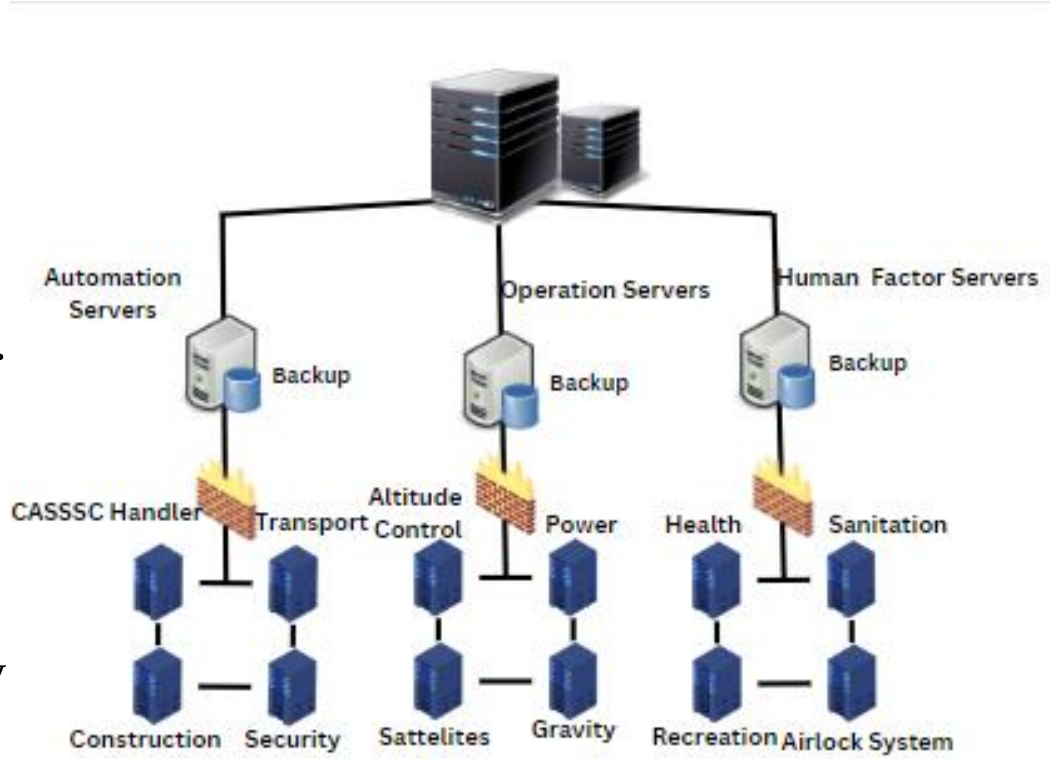
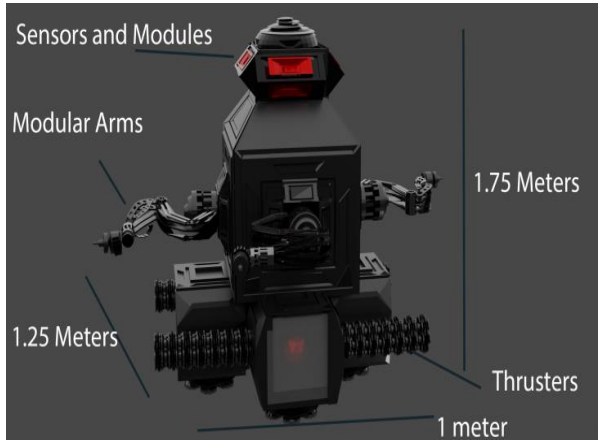


Fig 5.0.1 : Data Server Web Chart (Aaditya, Canva)

Automation for Construction, Transportation

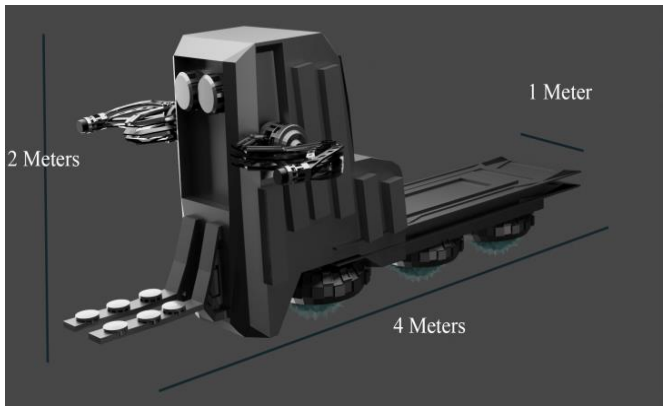


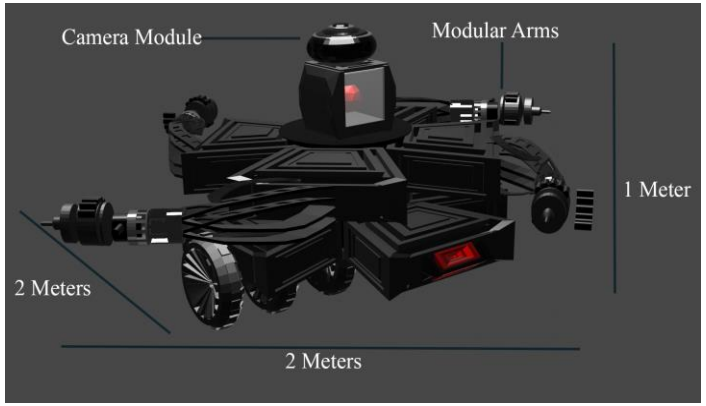
5.1.1 Brokkr (Exterior)- (building and repair)

- Multi-utility hands that contain all important and required tools from **3D Logistics**
- Thrusters and wheels for movement in and out of the settlement
- 3D printer and lasers at the top
- Jigs for stable control in zero gravity zones
- Specialized AI for self-control
- Solar panels are being used for energy, It also has a battery back up

5.1.2 Meili-

- Heavy robot capable of transporting CASSSCs around
- Suction port in front to attach itself to the CASSSC
- A Storage station at the back side to store goods or another CASSSC
- Robotic arms to move the goods in and out the CASSSC and to load itself





5.1.3 Svadilfari(Interior)- (local building, repairing and maintenance)

- Rotatable body with multi-utility arms and required tools from **3D Logistics**
- 3D printer and lasers at the top for assistance.
- An advanced engineering AI that allows the user to select from Different building options
- Residents can contact the server room for the robot.

Fig 5.1.1-3 Construction and Transportation Bots (Aadvik, Blender)

5.2: Maintenance, Repair & Safety Robots

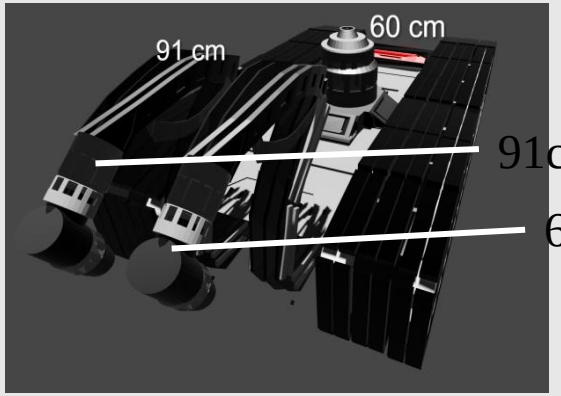
Robot Name	Description	Visual
Mini Rover Bot	• A small car-like robot with a vacuum on the bottom, this vacuum would help it climb up walls. • It would have a laser built into the bottom of the car.	
Rover Bot	• This will have a magnetic conveyor belt with soft carbon fiber suspension, multiple compact tools, good for maintenance on both small and large scale. This will provide the maintenance all year round.	

Table 5.2.1 (Aditya, PowerPoint)

5.2: Maintenance, Repair & Safety Robots

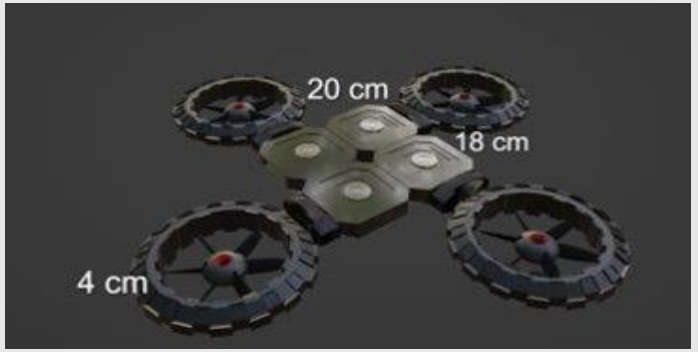
Robot Name	Description	Visual
Thruster Repair bot	• A medium sized drone with 5 small thrusters, multiple compact tools and laser tips. The thruster in the front powers in the robot and the multitude of arms help this bot. • On top of this bot there will be 1 spider bot to help with any minor damages that the thruster bot can't reach. This bot is only for larger repair jobs.	
Mini Drone	• Small drone with visual sensors, the bot is small and compact so it can move around the port easily. • The bot has 4 small propellers, and the body is mostly a battery. • It has visual sensors in the front.	

Fig 5.2.1 – 5.2.4 MRS Bots (Aadvik, Blender)

5.2.1: Automation Server for Operation of Robots

- Any maintenance or repair requests will be sent to the Operating System.
- Rover bots will then be released to ascertain which bot to send based off the situation.
- Authorized personnel can not only go over data but also command bots manually and shut them down.
- If there is any failure of storage or servers, Backup server is present to store data and keep system going
- We will have a specialized GUI for our server rooms and computers

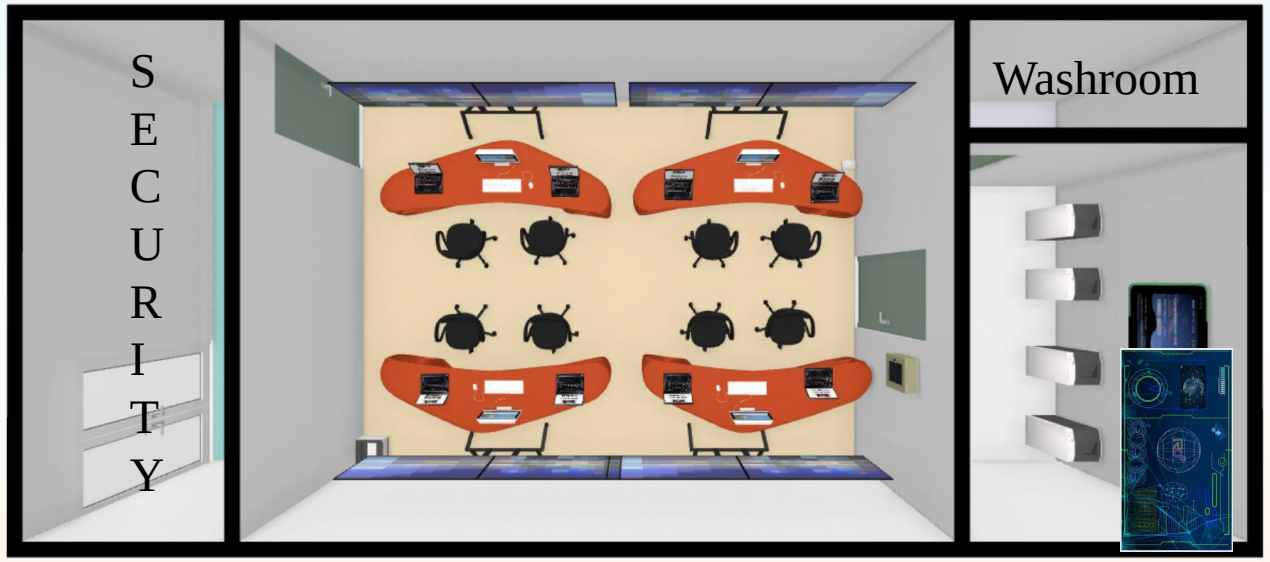


Fig 5.2.2: Server and Control Room (Aaditya, Blender)

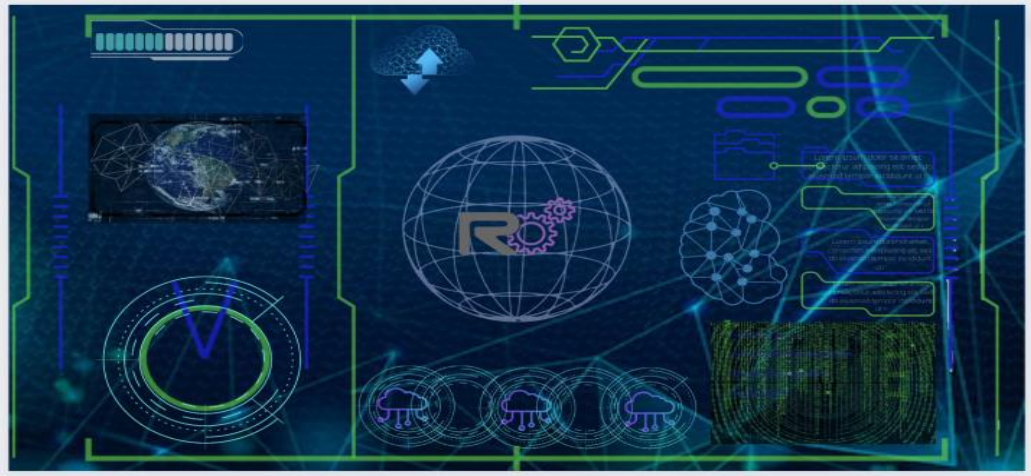


Fig 5.2.3 GUI (Naavya, Google Images)

5.2.2: 4 Level OS Security System

This 4-level security system is built in contingency that there are any malfunctions, corruptions or hack attempts to the space sport safety system; it is protected by different programs , encryption systems and safety bots.

Server Security Levels	Personnel Levels	Threat Levels
Green - These bots act on the very first level, where they report to the OS and the system about the condition of the situation. . These mini drones are the eyes of the OS and the entire space-port.	The general-public also has the lowest level of access to the surveillance system. Since they do not need the information for their day-to-day life and safety or security.	**Green** is when the server room is normal and faces no imminent threat, danger or any sort of issues.
Yellow- Bots act on the second level; they are security bots with defense mechanism to ensure the safety of the floor.	The maintenance staff of the building will have access to the washroom without limitation. However, to clean the surveillance room and the server racks they will always be supervised by Engineers.	**Yellow** is a threat of a server components failing or any minor issue such as an issue in power delivery or storage failure.
Blue- There are security procedures for the authorized personnel, like iris scan, to make it harder for hackers, therefore assuring the safety of accessing the OS room	Engineers will have full access to the Server its data and the surveillance room.	**Blue** is when the building faces issues such as a fire or unauthorized personnel entering the building.
Red- This is the last level, it ensures the safety of the supercomputers used for the operation of the OS, AES(Advanced Encryption System) is used to ensure the safety of it and the OS.	This level of access is reserved for the Head Engineer. They will have the rights to control the bots manually and the shut down whenever they deem necessary. They also have access to all parts of the building.	**Red** is only when large amounts of data are lost without a recovery route.

Table 5.2.2 Security Level (Akkshat, Powerpoint)

5.3: Heimdall

- A personal device will be provided to all the residents, which will help increase productivity in the workspace and be a source of entertainment.
- The user will be able to access only the systems assigned to him/her by the control centre.
- All communication in and out of the device will be encrypted by AES 256. All data kept securely .
- This personal device will be able to keep track of the basic vitals of the resident.
- The band will be flexible and it with have a flexible touch-sensitive OLED display. The display will use capacitance technology.
- The band will be protected using Veri-hand technology.
- The band can also connect to a variety of other bots and create accounts exclusive to the user.

Fig 5.3.1 Heimdall (Aadvik, Blender)

5.3.1: Assistance Robots

Cleaning:

- Robots will be provided to clean the entire facility.
- These robots will be small and mobile.
- They will be able to scale walls.

Cooking:

- Robotic arms will be used to prepare and heat/cool meals.
- These arms will use the help of other IOTs that will all be linked to a central system to prepare the food.

Drone:

- It manages delivery of goods as well as security. It will have magnets onto which good packages can be attached and so can other modules.

Medical Robots:

- They will be on standby to rush to help residents if a medical emergency is detected by the POD.

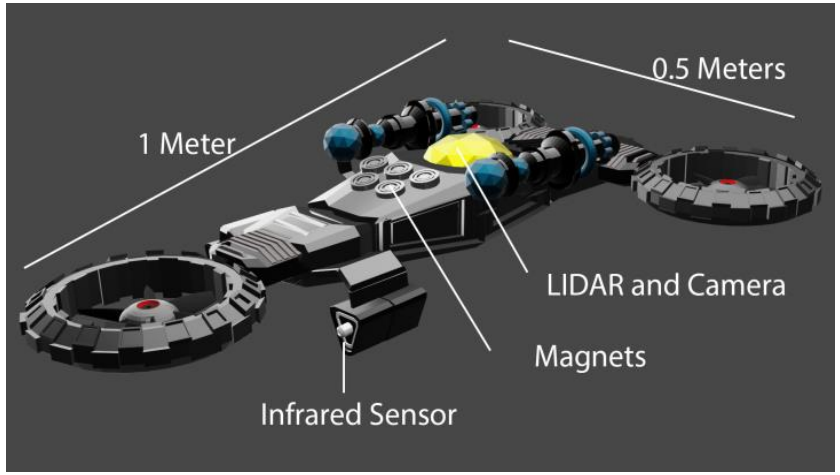


Fig 5.3.2 Drone (Aadvik, Blender)

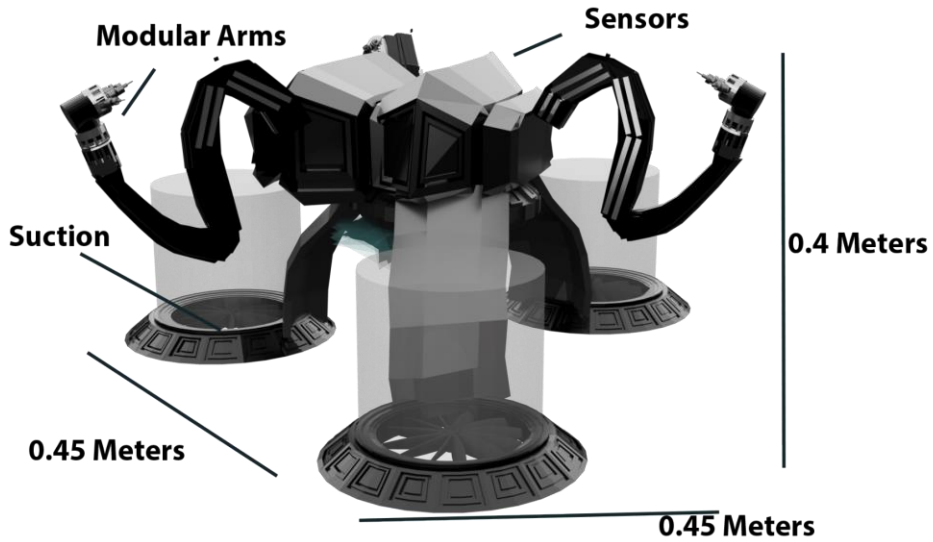


Fig 5.3.3 Cleaning Robot (Aadvik, Blender)

5.3.2: Pet and MRO Robot

Personal Pet

- A robotic pet will be provided to residents who may need one for help or emotional support.
- It can also be used as an entertainment and communication device. This will be linked to the POD.

Fig 5.3.4 Pet Robot (Aadvik, Blender)

MRO Robot

- It has a minimalistic design. The robot has arms with modular attachments, and these are used to perform the maintenance of the settlement.
- Claws can be extended on the outsides of the MRO bot so it can attach to the exterior of the settlement to perform repair tasks.
- This robot can also be used for manual labour.

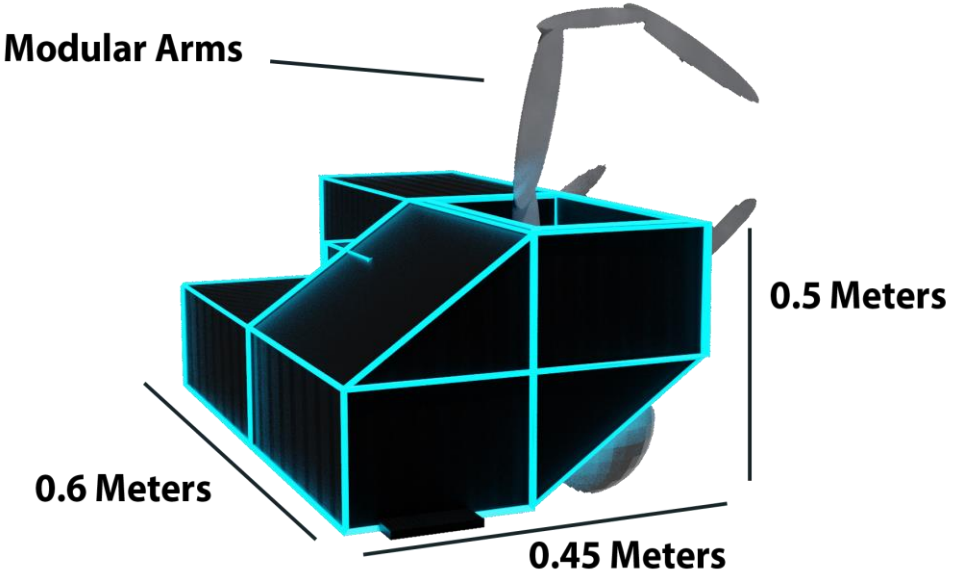


Fig 5.3.5 MRO Robot (Aradhya, Blender)

5.4.0: Aesir

- This robot would be loading, unloading and transporting CASSSC.
- The robot will be using thrusters for movement in Zero G
- Robot will have 2 industrial arms and pressure plate which will measure the weight and pad the surface
- The plate has strap belts which can move in or out it will use the strap belts to bound the CASSSC in place the
- C.R will also use these 2 arms and attachable micro thrusters to load the CASSSC onto ships moving out.
- After loading CASSSC onto itself it will redock and depressurize the CASSSC.
- It will later deploy wheels and store it into the warehouse.
- It will also be connected to the spaceport systems and get a notification when a CASSSC will be arriving.
- 10 of these robots would be present 2 at each docking port
- It will be powered by solar energy and carbon fuel provided by **Carbon Creations**

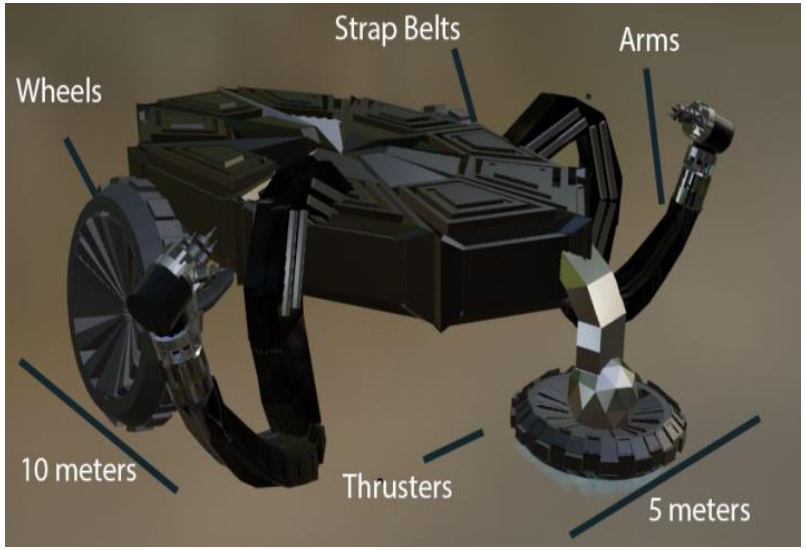


Fig 5.4.1 Aesir (Aadvik, Blender)

5.4.1: CASSSCs Storage

The storage will be segregated based on the type of cargo. An X-Ray will be present at the storage area gates and will scan the CASSSCs. The colour coded separation will be based on:

Blue- Manufacturing Materials (raw materials needed for construction)
Red- Sustenance Resources (basic amenities such as food, water etc.)
Green- Finished Products (readymade goods such as robots, furniture etc.)

The transportation robot will then come into the warehouse and transport material from CASSSC.

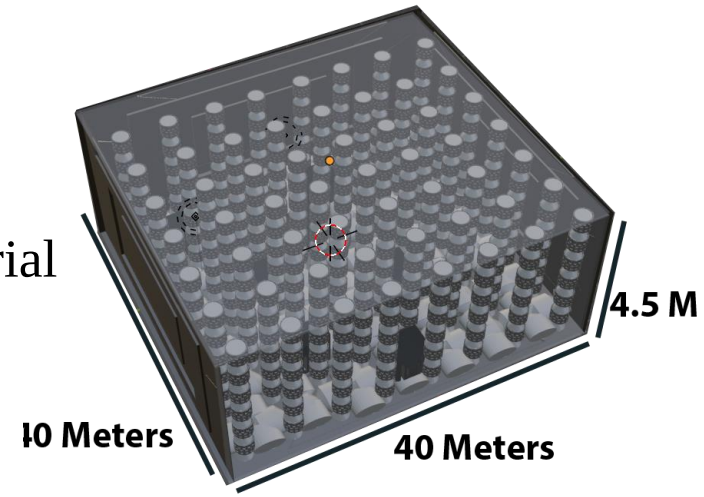


Fig 5.4.2 CASSCs Storage (Aadvik, Blender)

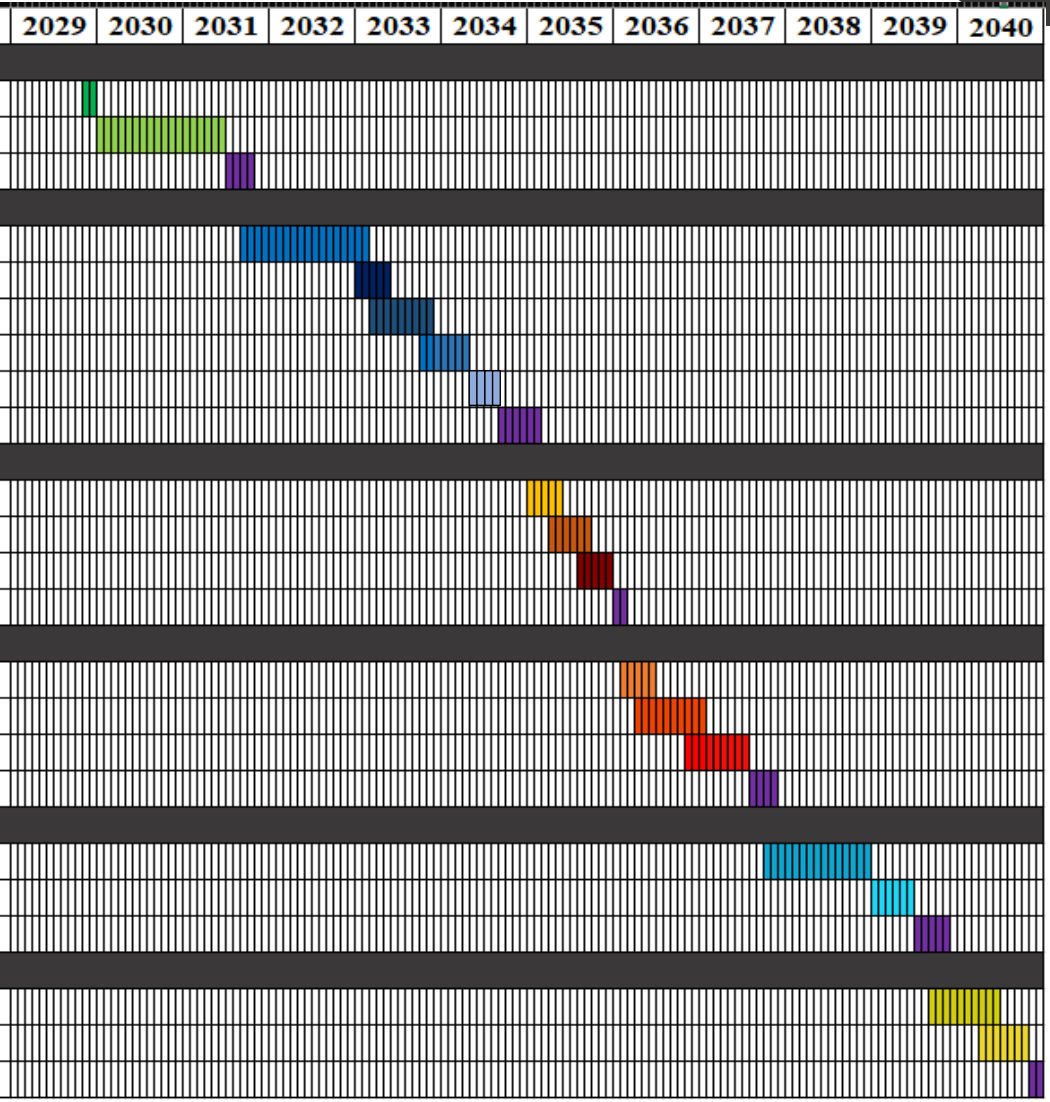
Storage Plan-

- The CASSSC storage center will contain multiple rack with holes in them.
- CASSSCs will slide into these spaces and will be held in place by lock mechanisms in the rack.
- CASSSC Robots will be able to manage held CASSSCs, and they will be given authorisation to manage them by giving proof from the colour code given to them at segregation.

6.1 Scheduling

Fig 6.1 Scheduling (Bhavya, Excel)

S. NO	TASK	START	END
	PHASE 1		
1.1	Contract Awarded	Nov-29	Dec-29
1.2	Research and Development	Jan-30	Jun-31
	Buffer Period (Hofstadter's Law)	Jul-31	Oct-31
	PHASE 2		
2.1	Assembly of Construction Shack with Automation Facilties	Sep-31	Feb-33
2.2	Construction of Initial Set of Solar Panels	Jan-33	May-33
2.3	Construction of Warehouse on Earth and Installation of 0g facilities	Mar-33	Nov-33
2.4	Construction of Docking Mechanism and Antennas	Oct-33	Apr-34
2.5	Collection and Loading of Residential Supplies	May-34	Aug-34
	Buffer Period (Hofstadter's Law)	Sep-34	Feb-35
	PHASE 3		
3.1	Construction Site Analysis and Launch of Construction Shack	Jan-35	May-35
3.2	Systematic Launch of all components 2.2 - 2.4 and connection to Spaceport	Apr-35	Sep-35
3.3	Launch and Docking of Residential Supplies	Aug-35	Dec-35
	Buffer Period (Hofstadter's Law)	Jan-36	Feb-36
	PHASE 4		
4.1	Assembly of Spokes on all 4 Poles	Feb-36	Jun-36
4.2	Construction of Residential Modules	Apr-36	Jan-37
4.3	Initialisation and Maintenance of Warehousing	Nov-36	Jul-37
	Buffer Period (Hofstadter's Law)	Aug-37	Nov-37
	PHASE 5		
5.1	Setting up of Operational Facilities in the Construction Shack	Oct-37	Dec-38
5.2	Production of Agricultural Food	Jan-39	Jun-39
	Buffer Period (Hofstadter's Law)	Jul-39	Nov-39
	PHASE 6		
6.1	Residents arrive at the spaceport	Sep-39	Jun-40
6.2	Residents Settle and Full Capacity Reached	Apr-40	Oct-40
6.3	Buffer Period (Hofstadter's Law)	Nov-40	Dec-40



The settlement will be handed over to the Foundation Society and will be fully operational by **1 January 2041**.

Costing

SUBCONTRACTORS CONTRACTS	
NAME	**FACILITIES PROVIDED**
Litigation Limiters	Procuring commodities, Radiators and Windows from Vulture, External comms from DougleDyne
Vulture Aviation	Radiators and Windows
Stuff of life	Atmosphere and Water procurement
Extreme Survival Technologies	Spacesuits
Clean Up Your Act	Water and waste management
Toss it to me	Recycling waste
Waste products	Recycling waste and water
Dirt builders	SuperAdobe Casings, Recycling waste
DougleDyne Astrosystems	External Communications & Satellite Constellation
Bots4u	Automations for bots (security, electromagnetic jigs)
Carbon Creations	Waste management
TRUE/GRIT	Food preserving (may be removed)

Table 6.2.1 Subcontractors Tasks (Bhavya and Vyom, PowerPoint)

STRUCTURAL COSTS		
NAME	**QUANITY (m^3)**	**COST (IN US$)**
MATERIALS		
Radiators	169,385.8	7,272,438
Windows	169,385.8	1,766,164
Borosilicate Glass	84,692.9	44,155
Nickel Alloy	84 692.9	18,844,193
Titanium	211,732.25	3,895,949
Silica Aerogel	450.00	16,560
Aluminium Silicate	84,692.90	228,562
CONSTRUCTION, LAUNCH AND DEPLOYMENT		
Construction		7,500,000
Launch and Deployment in LEO		106,297,008,600
Total		**106,336,788,353**

Table 6.2.2 Structural Costs (Bhavya and Vyom, PowerPoint)

COST OF HUMAN RESOURCES		
CATEGORY	**NUMBER OF EMPLOYEES**	**SALARIES (IN US$)**
R&D Scientists	150	22,500,000
Testing Engineers	50	3,750,000
Structural Engineers	200	20,000,000
Management Staff	100	9,000,000
Inspection Staff	75	6,000,000
Community Area Staff	50	4,250,000
Communications Staff	125	12,500,000
Maintenance Staff	40	3,800,000
TOTAL		**81,800,000**

Table 6.2.3 Cost of Human Resources (Bhavya and Vyom, PowerPoint)

OPERATIONAL COSTS	
CATEGORY	**COST (IN US$)**
Electrical Power Generation	10,080,000
Food Production	1,161, 685
Atmosphere and Climate	18,349,127
Thrusters	78,400
Water Management	3,145,000
Machinery	23,052,900
Total	**55,867,112**

Table 6.2.4 Operational Costs (Bhavya, PowerPoint)

AUTOMATION COSTS		
CATEGORY	**QUANITY**	**COST (IN US$**
Personal device	450	450,000
Cleaning robot	160	240,000
Pet robot	450	675,000
Drone	20	200,000
Medical Robots Small	125	375,000
Medical Robots Big	10	500,000
Aesir	10	1,000,000
Servers		3,000,000
Total		**6,440,000**

Table 6.2.5 Automation Costs (Bhavya and Vyom, PowerPoint)

COST OF HUMAN FACTORS AND SAFETY			
COMPONENT	**CATEGORY**	**COST (IN US$)**	
RESIDENTIAL MODULE	Arietis	1,200,000	4,000,000
	Geminorum	2,200,000	
	Leonis	600,000	
COMMERCIAL MODULE	Retail Store	1,100,000	2,840,000
	Cafe	300,000	
	Health Centre	150,000	
	School	400,000	
	Hotel and Arcade	140,000	
	Office	750,000	
TOTAL			**6,840,000**

Table 6.2.7 Cost of Human Factors and Safety (Bhavya, PowerPoint)

MAINTENANCE COSTS	
CATEGORY	**COST (IN US$)**
Maintenance of Operational System	160,000
Structural Maintenance	20,000,000
Maintenance of Bots	3,436,250
Maintenance of Community Layout	15,000,000
Total	**3,436,250**

Table 6.2.6 Maintenance Costs (Bhavya and Vyom, PowerPoint)

TOTAL COSTS	
CATEGORY	**COST (IN US$)**
Structural Costs	106,336,788,353
Human Resources	81,800,000
Operations	55,867,112
Automations	6,440,000
Human Factors and Safety	6,840,000
Maintenance Costs	3,436,250
Total	**106,491,171,715**

Table 6.2.8 Maintenance Costs (Bhavya and Vyom, PowerPoint)

TOTAL COST – 106.5 Billion USD

RFP POINT	TITLE	PAGE NO.
2.1	External configuration	2
2.2	Internal configuration	7
2.3	Construction process	8
2.4	Expansion of IOC	10
3.1	Materials and Thrusters	11
3.2	Community Infrastructure	13
3.3	Construction Machinery	21
3.4	Port Infrastructure and MRO docking	22
4.1	Community Layout and consumables	23
4.2	Interior Plans, Exterior Designs and Modules	26
4.3	Spacesuits, Airlock and Spacewalk Centers	29
4.4	Aquilae and Recreation	31
5.0	Data Servers	33
5.1	Construction and Transportation robots	34
5.2	Maintenance, Repair and Construction robot	36
5.3	Hemidall and Assistance Robots	39
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