
ATLAS
DOUGLEDYNE ASTROSYSTEMS
& FLECHTEL CONSTRUCTORS

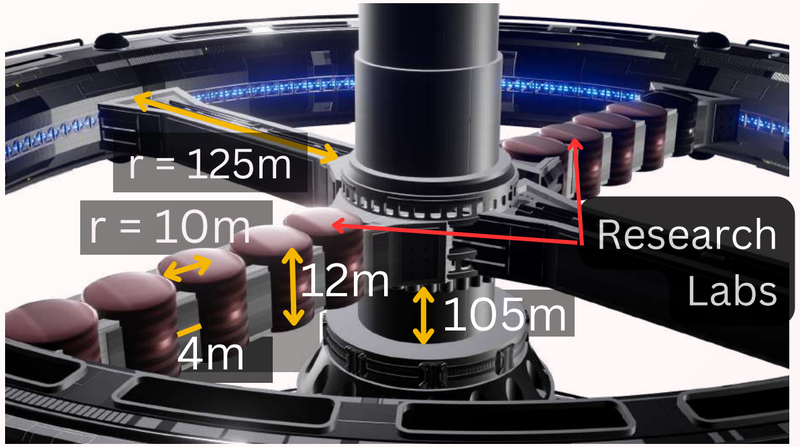
Dimension and Use of Volumes

Major Enclosed Volumes

- **Central Axis:** Storage, Transportation, 0-g activities
- **Manufacturing Torus:** Manufacturing, Agriculture
- **Residential Torus:** Residential Area
- **Research Labs:** Facilitate research in various environments

Major Additional Structures

- **The Umbrella:** Solar Panel, Location of Thrusters, Spaceport Dock
- **Tether Module:** Stowage and deployment of asteroid retention/ capture system; Facilities movement of CASSSCs and bots to asteroid surface



Research Labs
Fig 2.1.1
Sharvil S. - Blender

Structure of Atlas
Fig 2.1.2
Sharvil S. - Blender

Major Features and Thruster Interface

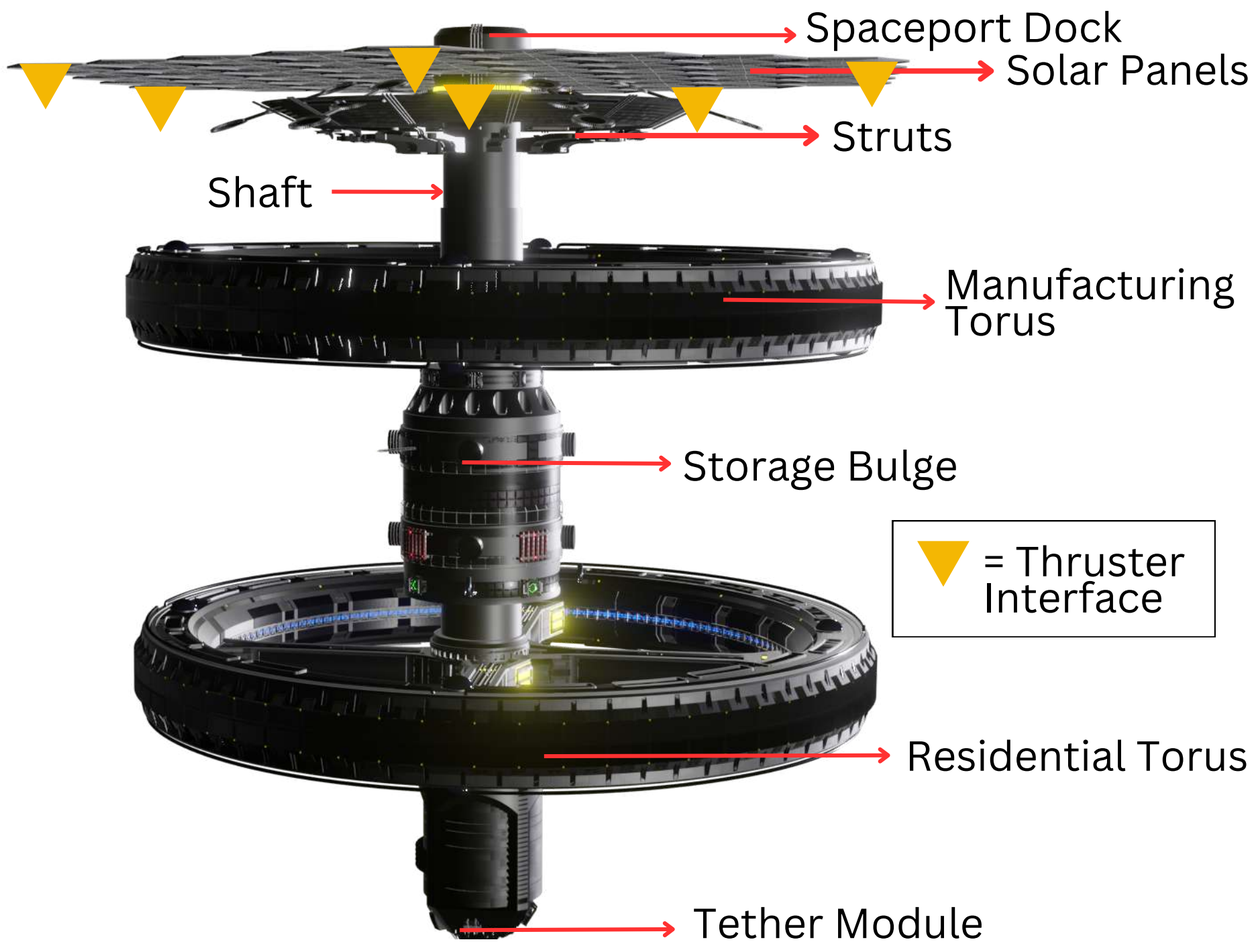


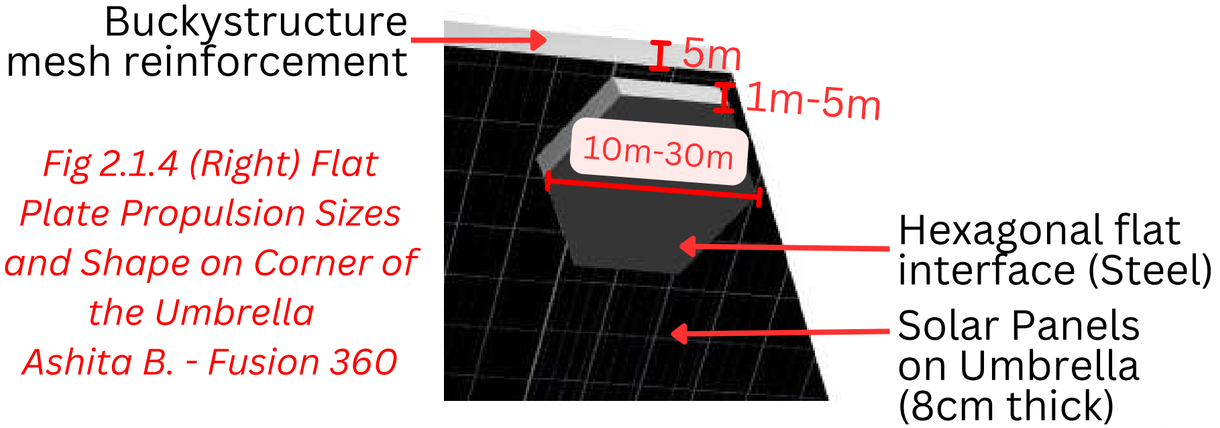
Fig 2.1.3 Structure of Atlas [Made by Sharvil S. - Blender]

Mass of settlement: 6,882,000 tonnes

Size of asteroid	Diameter of asteroid/miles	Total estimated mass /tonnes	Thrust required/lb
Small	1-4	6.12×10^{11}	1.35×10^{14}
Medium	4-7	3.3×10^{12}	7.4×10^{14}
Large	7-10	9.63×10^{12}	2.16×10^{15}

Table 2.1.3: Thrust requirements [Made by Kcavyan A on Canva]

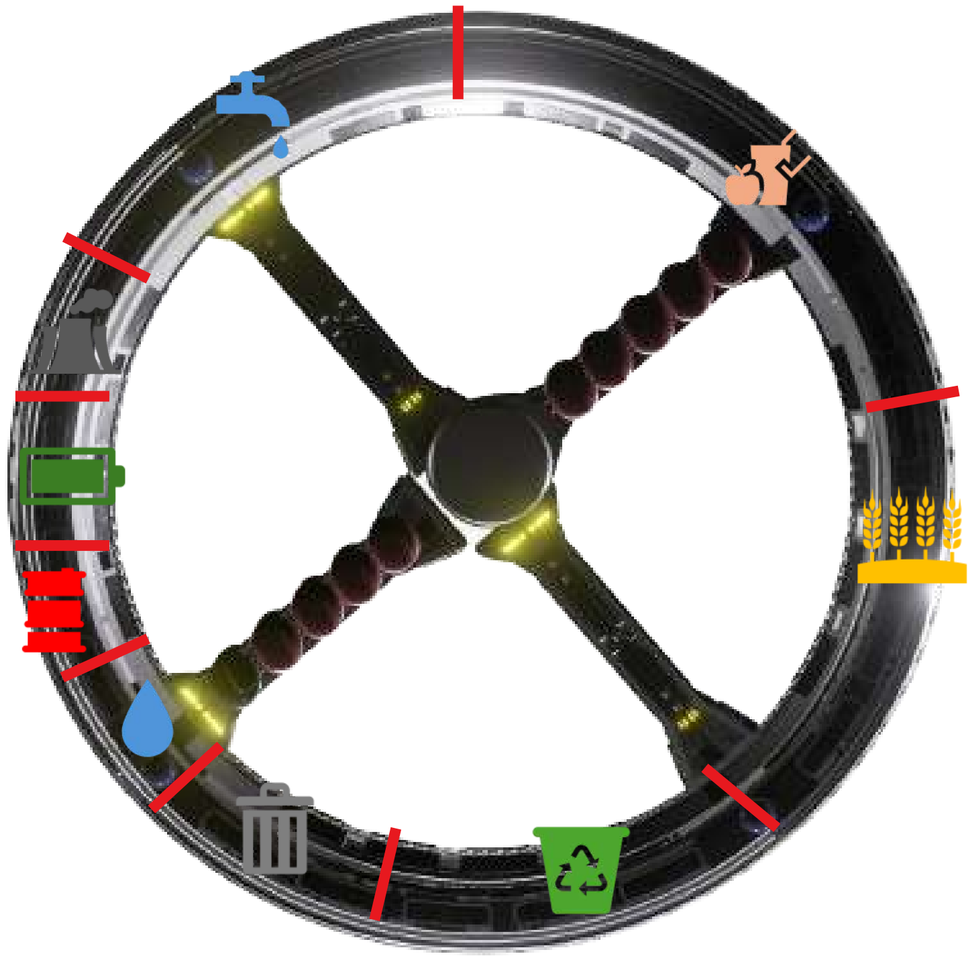
Fig 2.1.4 (Right) Flat Plate Propulsion Sizes and Shape on Corner of the Umbrella Ashita B. - Fusion 360



RFP Point 2.1, 3.4

Interior Layout and Location of Facilities

Icon	Facility
	Research facility
	Recycle facility
	land fill
	Water Storage
	Fractional Distillation
	Gas Storage
	Electricity Storage
	Electricity Generation
	Food processing/storage
	Agricaltural Farm



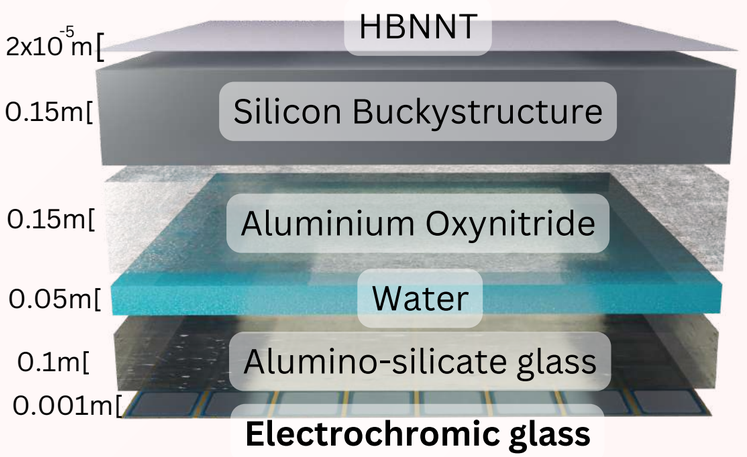
RFP Point 2.1, 3.4

Hull and Window Materials

Windows

Materials	Properties	Purpose	Source	CASSSCs
HBNNT	Neutron shielding	Radiation Protection	Earth and Stuff of Life	1
Silicon Buckystructure	High Strength; Impact Resistance; Radiation Absorption	Prevents penetration of space debris; Radiation Protection	Subcontracted: Dirtbuilders	1776
Aluminum Oxynitride	Ultraviolet Absorption	UV Protection	Subcontracted: Alaskol	1776
Water	Radiation Absorption	Radiation Protection	Asteroid/ Subcontract: Stuff of Life	1189
Alumino Silicate	High Strength; Resist Pressure	Pressure Difference resistance	Subcontracted: Hard Roll	1207
Electrochromic Glass	Change Transmittance	Adapt Different Area's Illumination Requirement	Earth	12

Table 2.1.1, Hull Materials [Made by Steve G. & Mark W.]

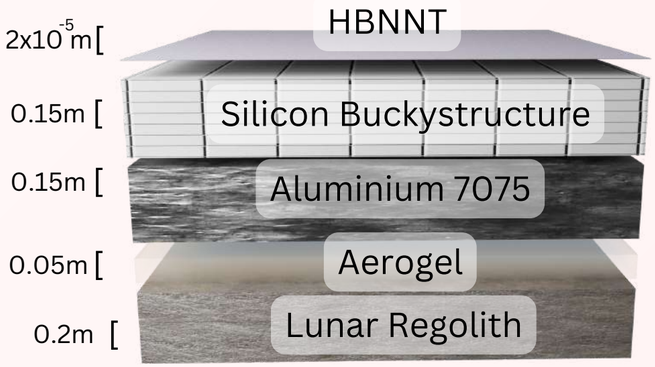


Hull (above) & Window (below) Materials
Fig 2.1.5, 2.1.6
[Barak G. & John Z. in Blender]

Hull

Materials	Properties	Purpose	Source	CASSSCs
HBNNT	Neutron shielding	Radiation Protection	Earth and Stuff of Life	1
Silicon Buckystructure	High Strength; Impact Resistance; Radiation Absorption	Prevents penetration of space debris; Radiation Protection	Subcontracted: Dirtbuilders	3625
Aluminum alloy	High Formability; High Hardness	Proved Strength	Subcontracted: Alaskol	3625
Silica Aerogel	Ultralight; Extremely Low Thermal Conductivity	Insulator of heat	Subcontracted: Hard Roll	1253
Lunar regolith	Insulation, Secondary Radiation	Foundation of Construction	Subcontracted: Holey Moley	2221

Table 2.1.2, Window Materials [Made by Steve G. & Mark W.]



Asteroid Retention System

SOLID

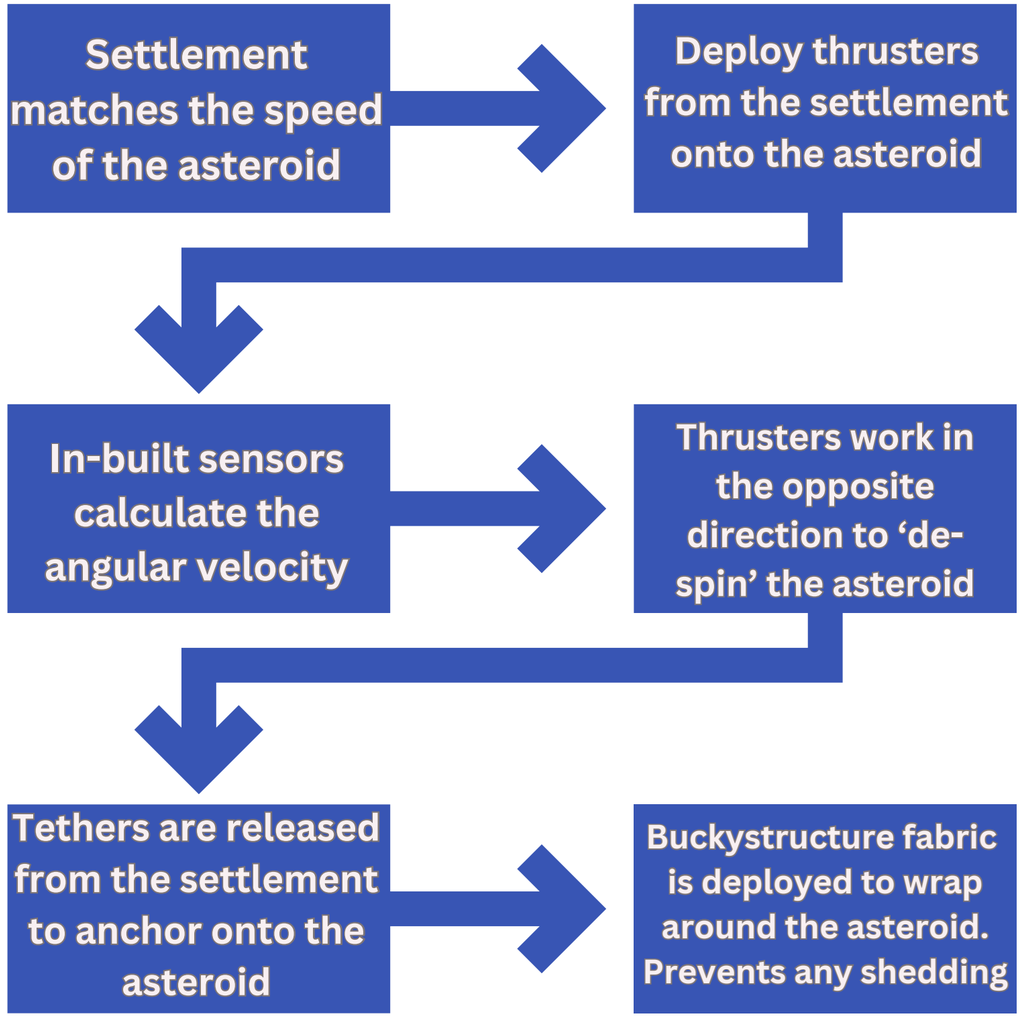


Fig 2.4.1 Solid Asteroid Retention [Made by Anisha G. on Canva]

RUBBLE

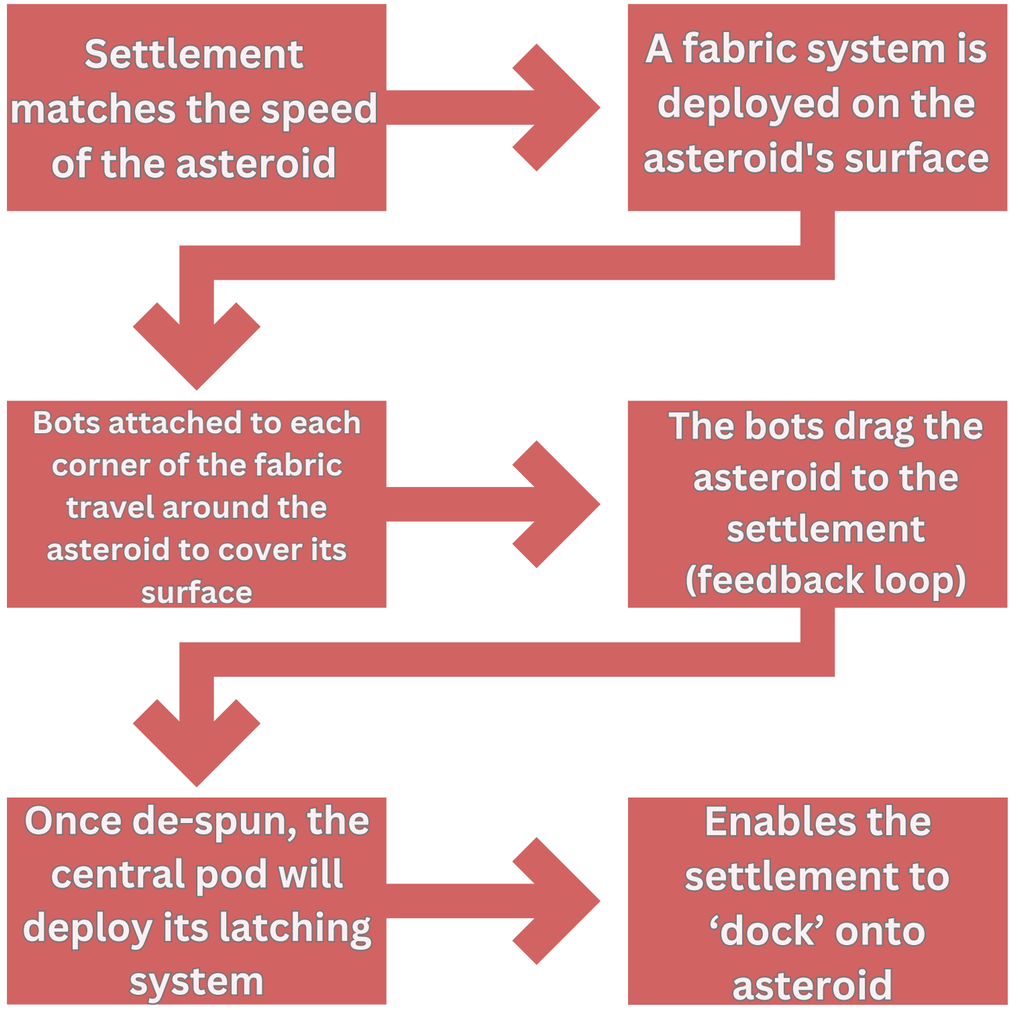


Fig 2.4.2 Rubble Asteroid Retention [Made by Anisha G. on Canva]

RFP Point 2.4, 5.4

Solid Asteroid De-spinning System

Asteroid De-spinner Bot

Bots equipped with thrusters will first counteract the angular velocity of the target asteroid to capture and retain the body

Devices	Function
Gyro Sensor	Measure and record changes in angle as the asteroid rotates
Radio Antenna	Send and receive radio waves to calculate doppler shift
Processing Unit	Perform all calculation and control the bots
Thrusters (360 degrees in freedom)	Provides the angular velocity required to counteract the asteroid's rotation
Material	**Purpose**
Stainless Steel	Shields against lunar dust and provides general strength
Silicon Buckystructure **(BuckyBreakthrough)**	Shields against lunar dust and provides general strength

Table 2.4.1 Solid Asteroid De-spinner [Made by Aakash Z., Alleena O. on Canva]

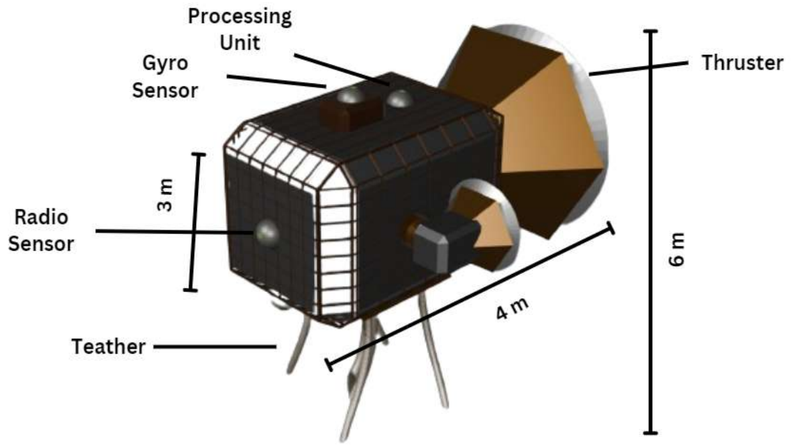


Fig 2.4.3 Solid Asteroid De-spinner Bot [Made by Arinjay G. on Blender]

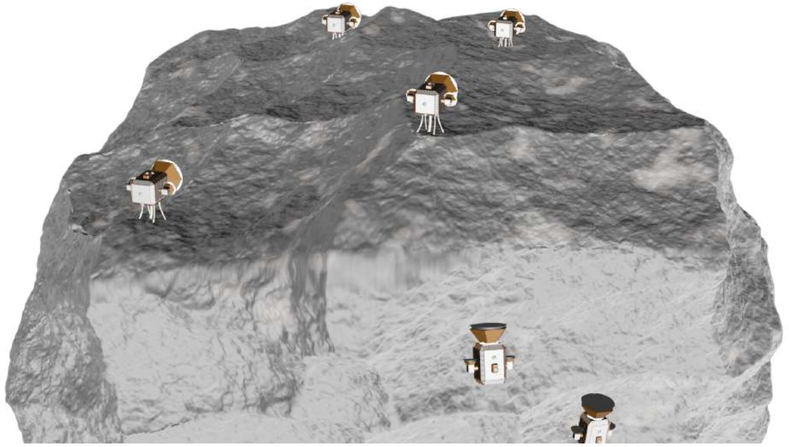


Fig 2.4.4 Solid asteroid de-spinning system [Made by Arinjay G. on Blender]

RFP Point 2.4, 5.4

Rubble Asteroid Capture System

Fabric System Bot

- Bots attached to corners of the fabric, travel around the asteroid to cover its surface

Device	Purpose
Gyro Sensor	Measure and record change in angle as the asteroid rotates
Radio Antenna	Send and receive radio waves to calculate doppler shift
Processing Unit	Perform all calculation and control the bots
Thrusters (360 degrees in freedom)	Provides the angular velocity required to counteract the asteroid's rotation
Fabric Capture system	Deploys the fabric and allows the settlement to latch onto the asteroid

Both Stainless Steel and Silicon Buckystructure are also used to construct the bot

Table 2.4.2 Fabric System used for Rubble Asteroids [Made by Aakash Z. , Alleena O. on Canva]

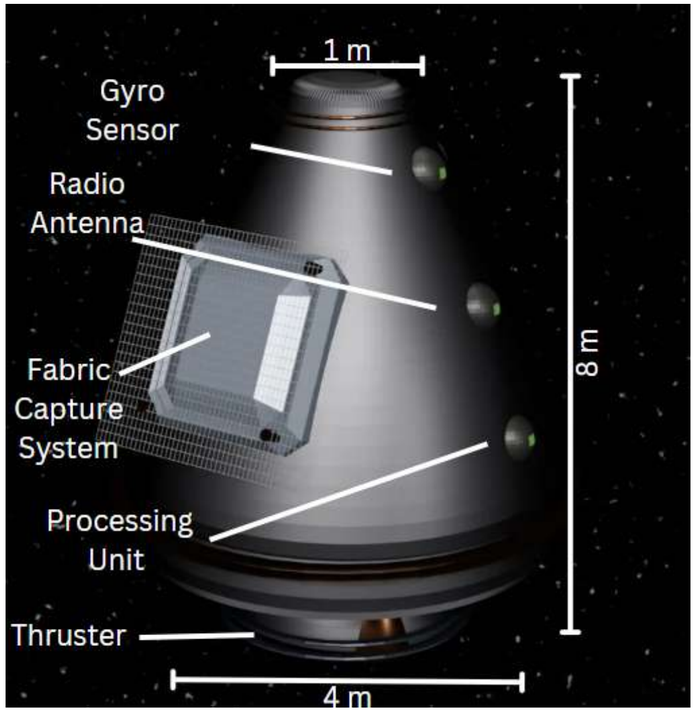


Fig 2.4.5 Rubble Asteroid De-spinner (Fabric Structure) [Made by Arinjay G. on Blender]

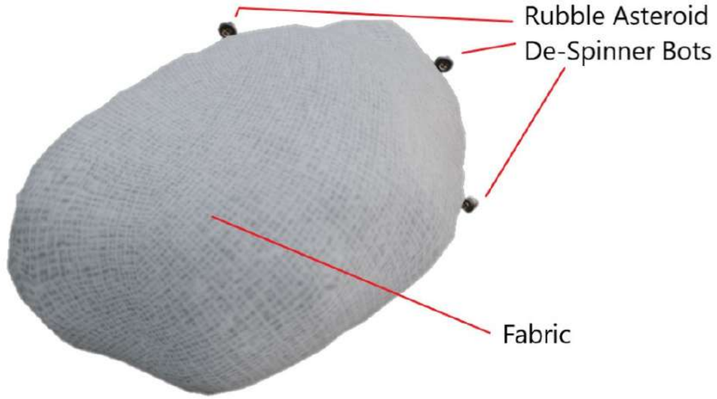


Fig 2.4.6 (Left) Rubble Asteroid De-spinner [Made by Raja Q. in Blender]

RFP Point 2.4, 5.4

LOCATION AND OPERATIONAL MATERIALS

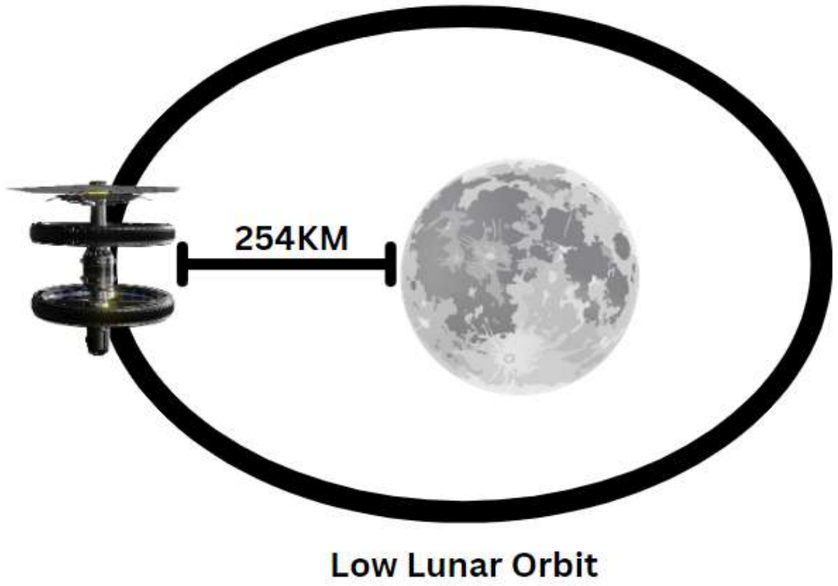


Fig 3.1.1, Constructional Orbit, [Made by Kabir on Canva]

- Access to Alaskol and Alexandriat for materials
- Low Orbital Speed for docking
- Earth’s satellites can be used for communication

Operational Material	Use	Sources	Quantity of CASSSCs
Silicon Buckystructure	Autonomous Robots	BuckyBreakthroughs	1
Stainless Steel	Autonomous Robots	Hard Roll	3
Stone	Housing	Asteroid Mining	150
PVC-O	Piping	Carbon Creations	3
Lithium Ion Batteries	Power Storage	Earth	1
Wire Harnesses	Power Distribution	Zap Industries!	2

Table 3.1.1, Operational materials, [Made by Noufil on Canva]

Micro G Docking Facilities

Views of Dock Configuration

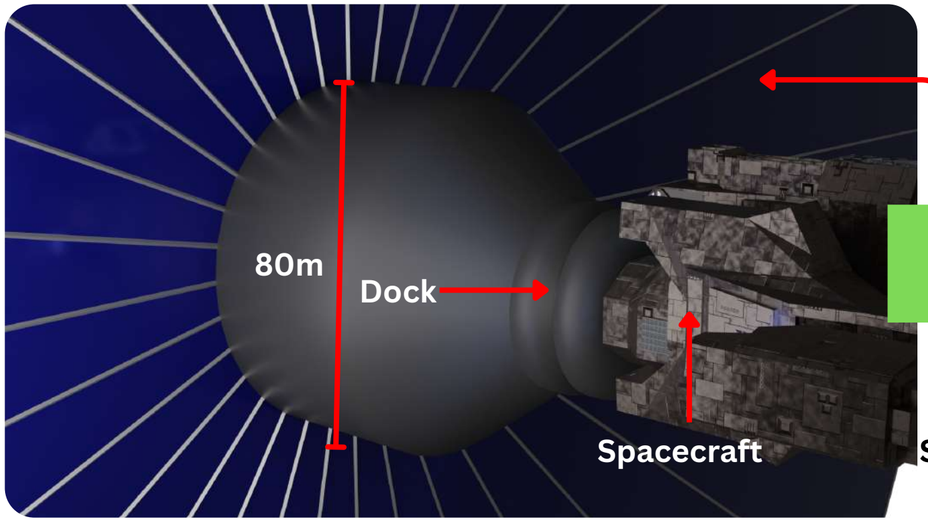


Fig 7.1 Actual Dock View [Shiv K, Blender]

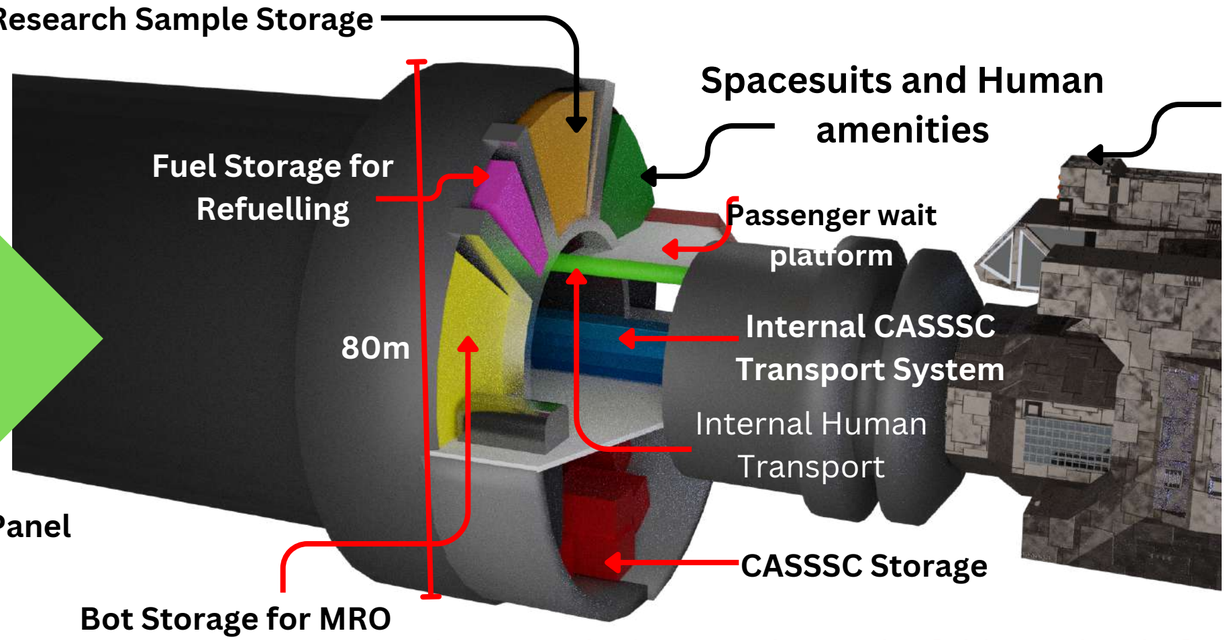


Fig 7.2 Dock View Candy Render [Shiv K, Blender]

- The dock will be located above the solar panels and will have 0g.
- Docks will allow only 1 spacecraft to dock at a time
- Docks will connect directly to internal CASSSC and Human Transport Systems.
- Docks will have refeulling, MRO and storage capabilities. Area allocations are given in Fig 7.2

- Sandy bots for exterior repair will be repurposed and used for Maintainance Repair and Overhaul of Docked Spacecraft.
- A platform for humans to wait during arrival or departure is present adjecent to the Human Transport System
- Humans will be able to access spacesuits and human amenities at the waiting platform

Rotational Interface and Rotating Volumes

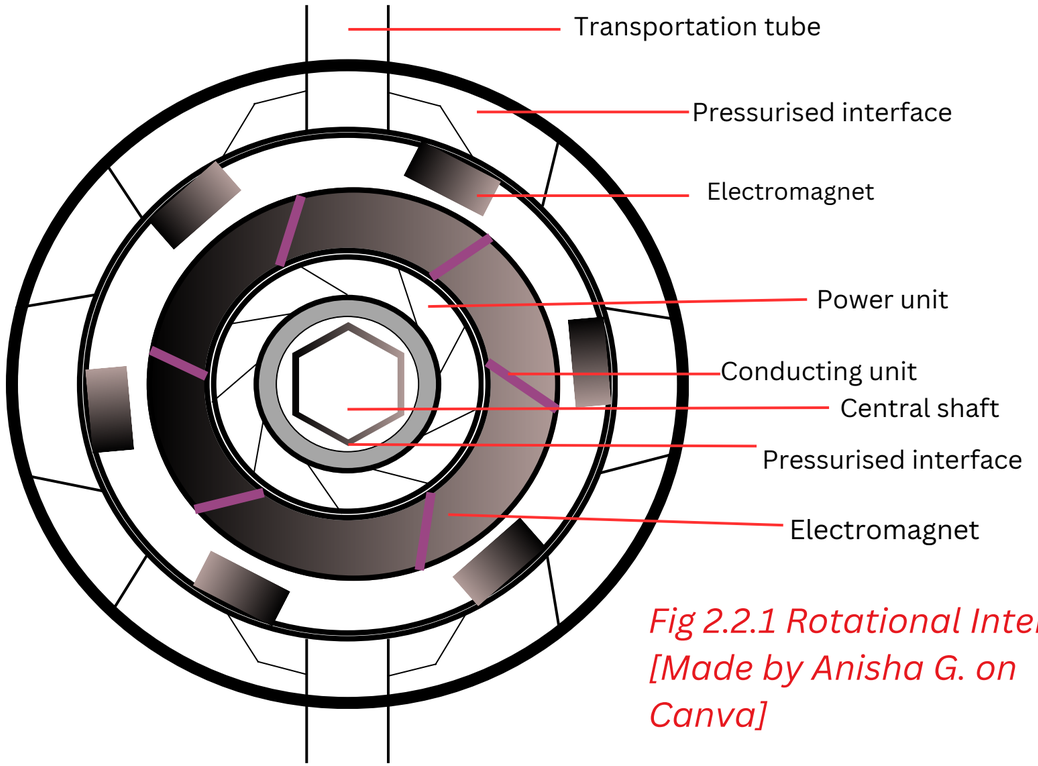


Fig 2.2.1 Rotational Interface [Made by Anisha G. on Canva]

- The rotational interface connects the non-rotating shaft to the rotating spokes
- Electromagnets prevent contact between volumes
- Ball bearings can be used if electromagnets are affected by asteroids

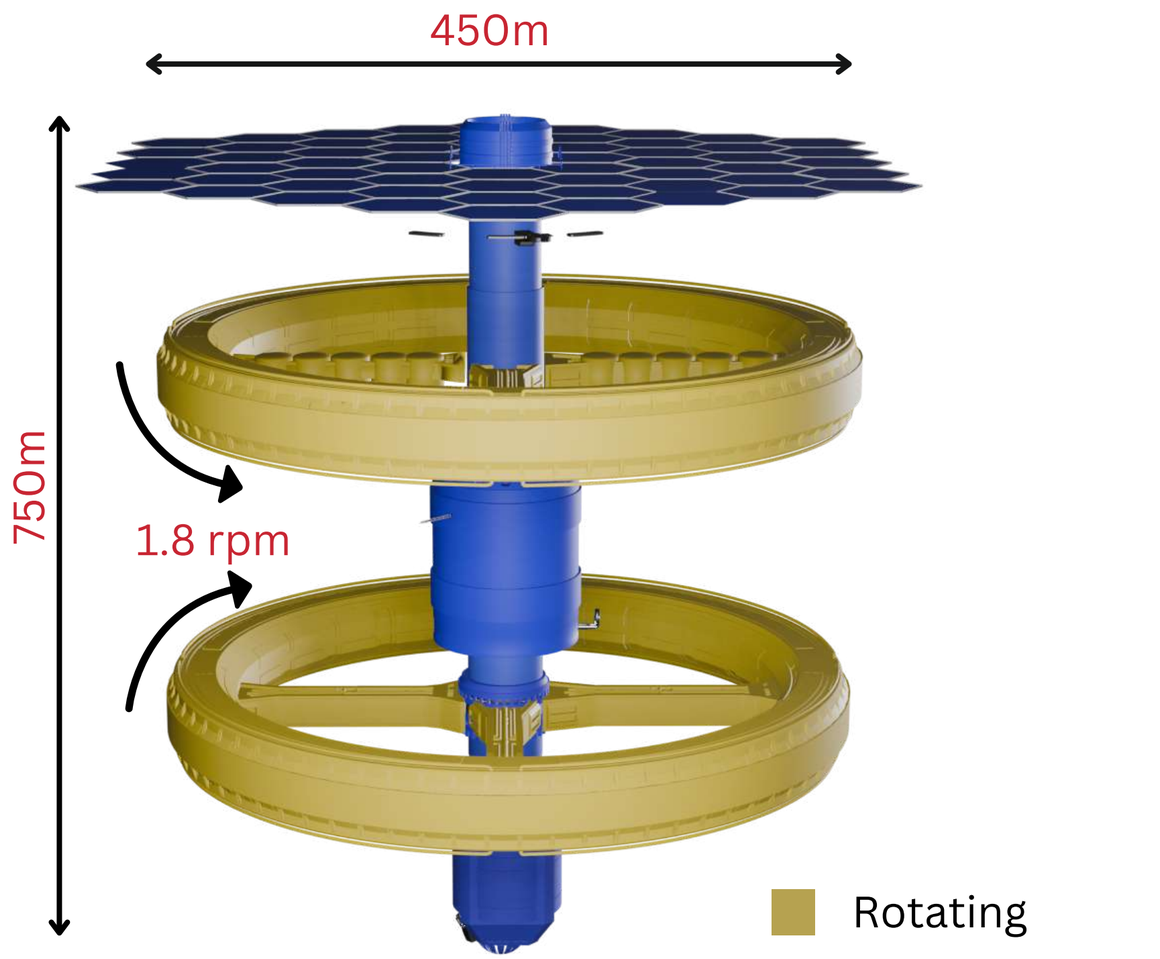


Fig 2.2.2 Rotating & Non-Rotating Volumes [Made by Sharvil S and Vidit B in Blender]

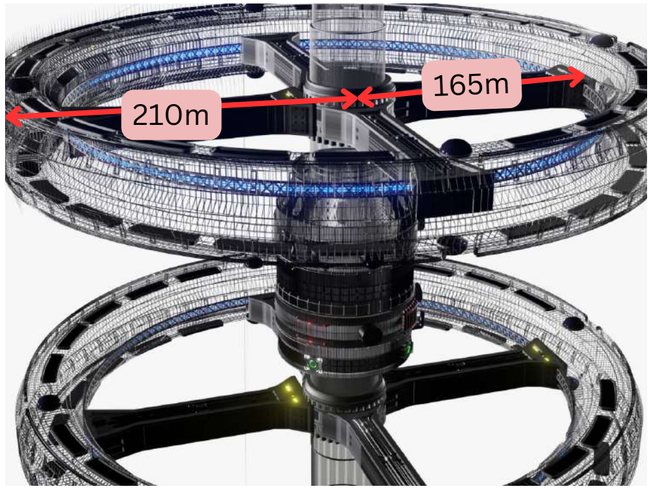
RFP Point 2.1

Construction Sequence

Phase 1: Construction shack is subcontracted to Blown Away and populated. Facilities like specialised spacesuits and rest areas are provided within. Jigs are assembled
Jan.2062-Apr.2063

Phase 2: Solar Panels laid out, port constructed and made operational

Phase 3: Wireframe constructed (subcontracted to BeamBuilders) of the central shaft, rotational interfaces and spokes.



Phase 4: 0-g Module Wireframe is constructed and the panels of the Tori are laid out.

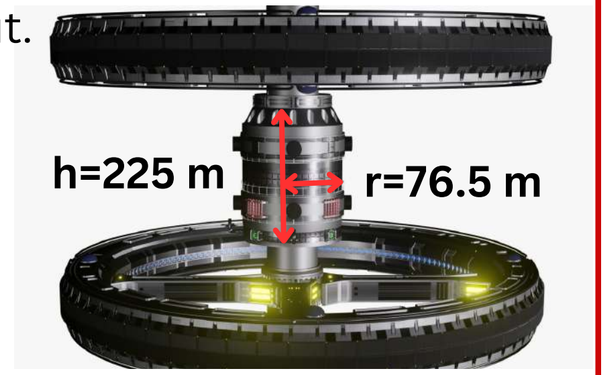
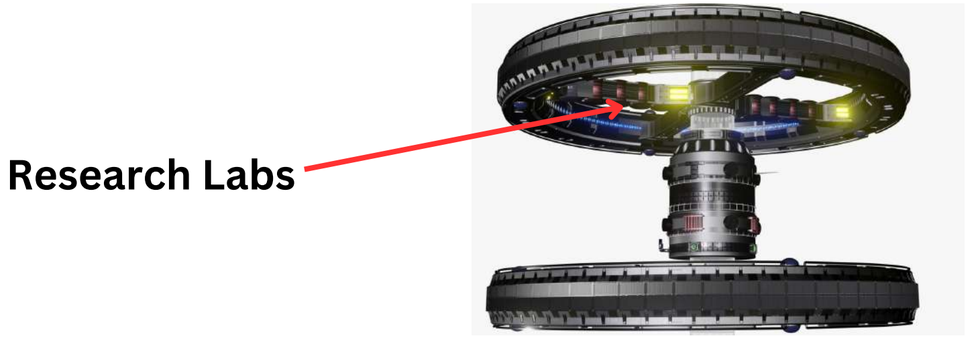


Fig 2.3.1, 2.3.2, 2.3.3, 2.3.4 [made by Sharvil S. on Blender]

Construction Sequence

Phase 5: Residential and industrial Tori are made operational.

Phase 6: The Research Lab Spokes are now constructed which can slide for variable ‘g’.

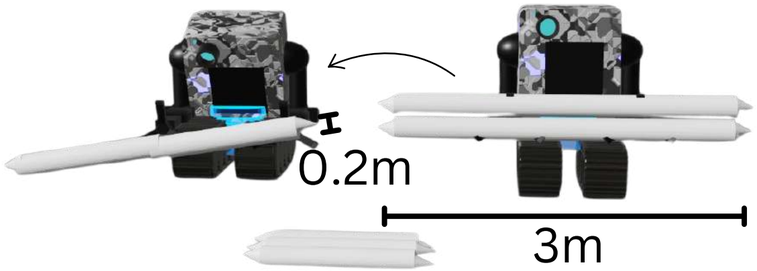


Phase 7: Research labs are pressurised. Manufacturing Torus is variably pressurized. 0-g module is made operational. Solettas subcontracted to LightWorks are implemented.

Phase 8: Tether module is constructed and made operational. Settlement is complete.

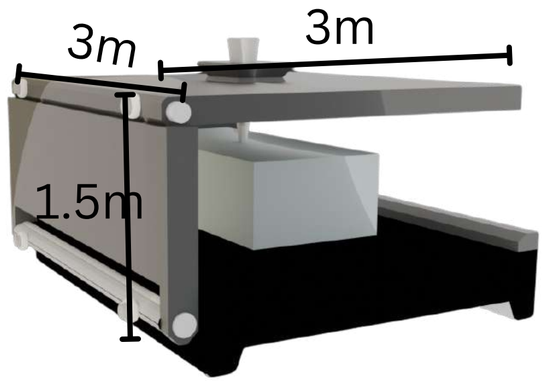
Fig 2.3.5, 2.3.6, 2.3.7, 2.3.8 [made by Sharvil S. on Blender]

Description of Jigs



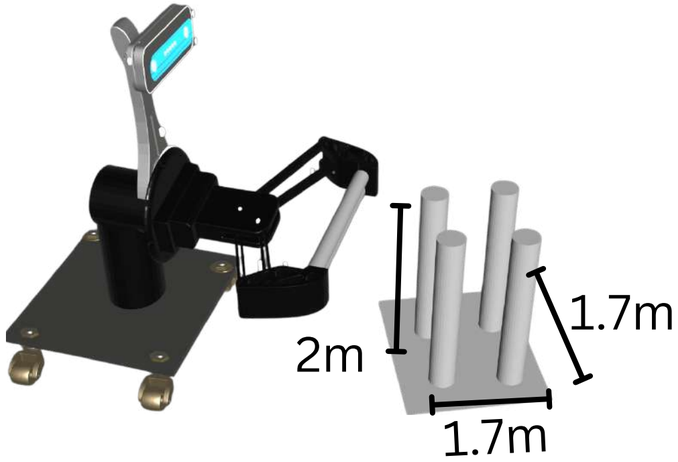
Moth hooks jigs:
Preliminary Jigs which will be utilized for molding low-profile jigheads designed (arrive hinged)
Quantity: 10 Jigs

Figure 3.3.1: Unfolding Jigs by Moth [Vedant N. on Blender]



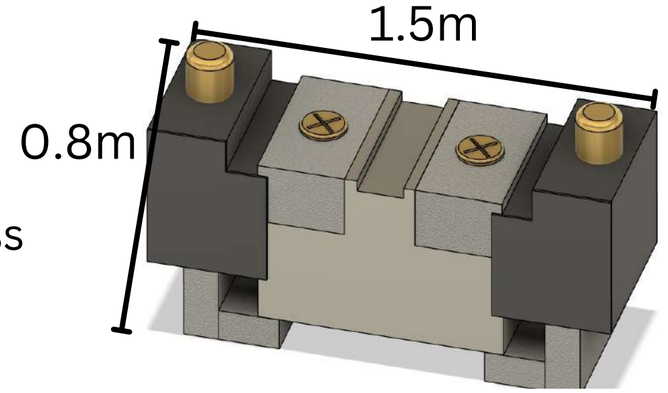
Drilling Jigs:
Jigs which are utilized to locate and clamp the component firmly.
Quantity: 250 jigs

Figure 3.3.1: Drilling Jigs [Xinrui L. on Blender]



Assembly Jigs:
A type of jig which holds, supports and locates the workpiece in order to guide one or more tools or process operations.
Quantity: 300 jigs

Figure 3.3.1: Assembly Jigs [Vedant N. on Blender]



Ring Jigs:
Jigs which are utilized to drill holes or guide machine tools on circular flanged parts.
Quantity: 150 jigs

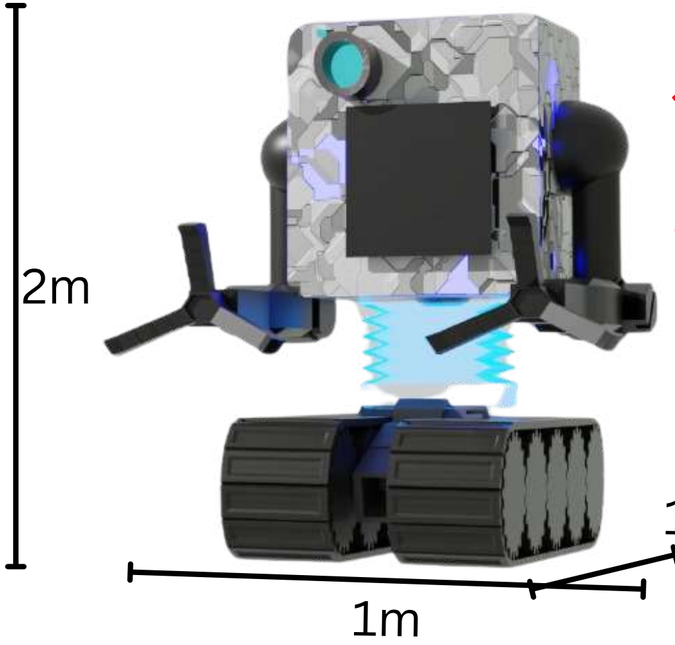
Figure 3.3.1: Ring Jigs [Ashita B. on Fusion 360]

Construction Robots

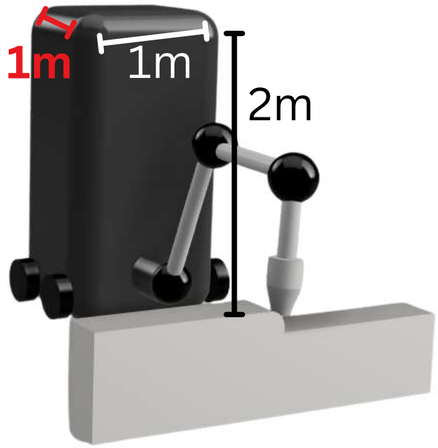
Internal Construction Bot:

Bot name	Function	How?	Quantity
Squidward	• Makes internal building structures. • Arms, storage, and welding	• Places walls using arm. • Welds or cements using arms.	500
Plankton	• Makes walls within structures such as between rooms in apartments	• Uses lunar regolith filament from Alexandriat • Pumps filament through nozzle attached to an arm	250
SquidwardX	• Makes furniture for apartments • Arms for placing furniture.	• Uses arm with nozzle to 3D print furniture. • Arms place furniture based on layout sent to bot.	500

Table 5.1.2: Internal Costruction Bots [Made by Taher K on Canva]



Squidward Fig 5.1.4: [Vedant N. Blender]



Plankton Fig 5.1.5 [Ashita B - Fusion 360]

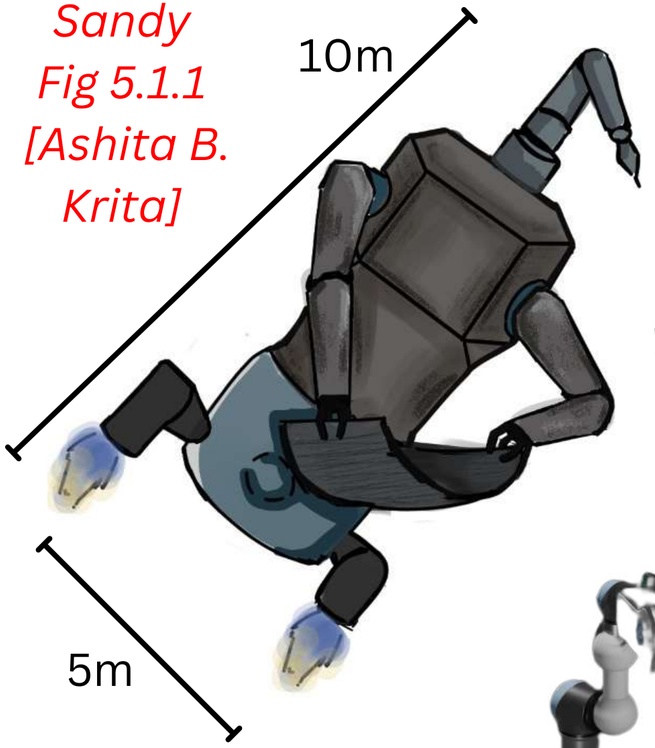
Construction Robots

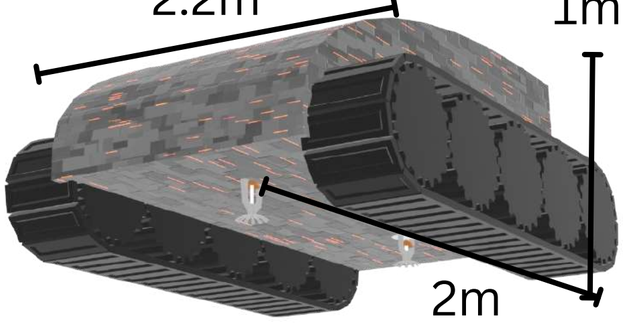
External Construction Bot

Bot name	Function	How?	Quantity
Sandy	Curving panels	Heat and Pressurise the material into shape.	150
	Welding	Utilizes a welding torch	
	Wireframing	Use arms to organize the wires and install them	
	Panel Placing	Press the plate into position and stabilize.	
	3D printing	Use a mounted 3D printing machine to print out the designated item.	
Pearl	Moving large objects	Mobile arm to pick, transport, place materials, CASSSCs, etc.	100
Gary	Sealing	Use nozzle and squirt the gel	400
	Painting	Spray paint/brush paint to the plate.	

Table 5.1.1: External Construction Bots [Made by Taher K on Canva]

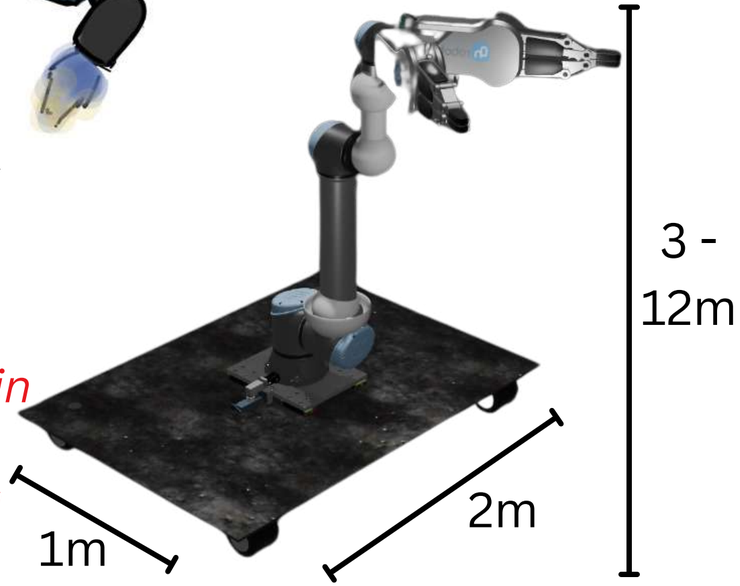
Sandy
Fig 5.1.1
[Ashita B. Krita]





Gary
Fig 5.1.3
[Vedant N. on Blender]

Pearl
Fig 5.1.2
[Yashaswin M. on Blender]



Jigs

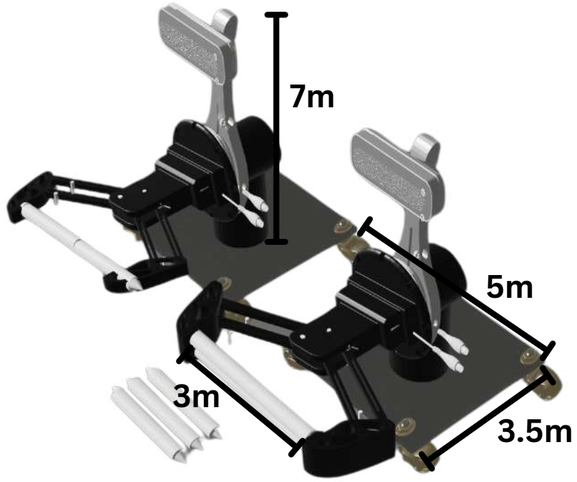
Assembly of Jigs

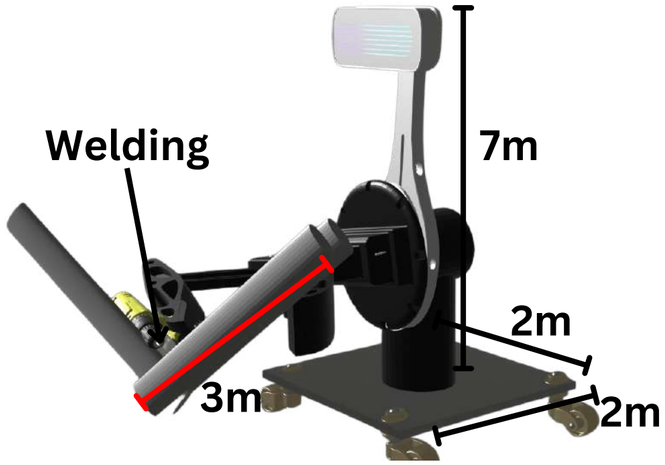
1

- Transported from Earth in CASSSCs.
- They will be folded around hinge joints.

2

- The construction bots will unload the jigs
- Unfolding of jigs will also be done by external construction bot.





Flowchart 3.3.1: Assembly of Jigs; [Vedant N. on Blender]

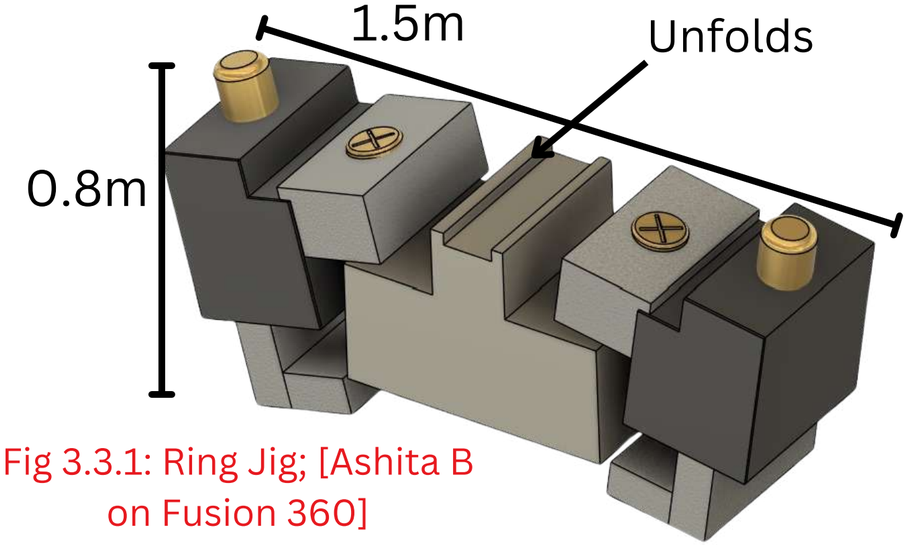


Fig 3.3.1: Ring Jig; [Ashita B on Fusion 360]

3

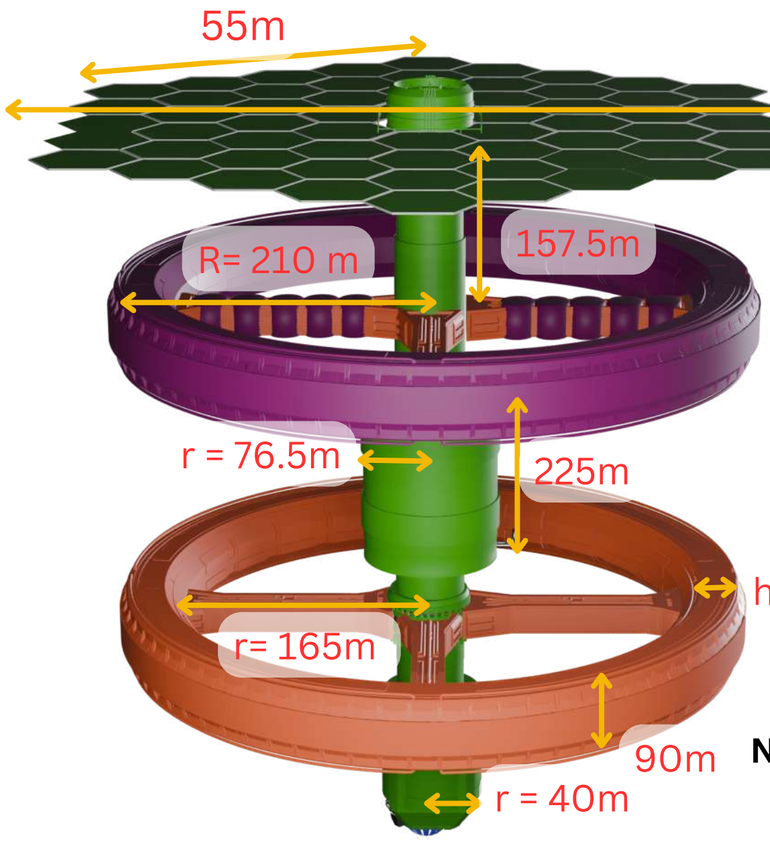
- Welding the hinge joints will be done for strengthening of the jigs

4

- The construction bots will assemble the jigs to form the framework of the structure.

Flowchart 3.3.2: Assembly of Jigs; [Naman K. on Canva]

Pressurisation of Volumes



Pressurisation of Volumes
Fig 2.2.2
[Made by Sharvil S. on Blender]

Pressurized Volumes
- Residential torus and trusses
- Manufacturing trusses
- Control center in both tori

Variably pressurized volumes
- Manufacturing/Industrial torus
- Research facilities

Non-pressurized volumes
- Spaceport dock
- Central shaft
- Control center in the central shaft

Pressurized Non - Pressurized Variably pressurized

AIR COMPOSITION

Gases	Industrial	Residential	Agriculture
Nitrogen	80%	78%	71%
Oxygen	18%	21%	21%
Carbon-dioxide	2%	1%	8%

Table 2.1.3: Air Composition; [Made by Shivanjali S. on Canva]

- Liquid air supplied by **Stuff of Life**
- Fractional distillation of air done at Distillery [industrial tori] into its components
- Revitalization and purification subcontracted to **Clean Up Your Act** using HEPA-17 filters
- Thermal regulation at 18-23 ℃ using Thermal Control System
- Humidity regulation at 30-50% using ultrasonic and impeller (de/)humidifiers
- Pressure regulation at 11 psi using Pneumatic Pressure Regulators
- Maintenance of regulators subcontracted to **Stuff of Life**
- 65 inital CASSSC's of air required

RFP Point 2.1, 2.2, 3.2

Community Plan

Residents can access natural sunlight from all points of the residential torus through the silicon buckystructure.

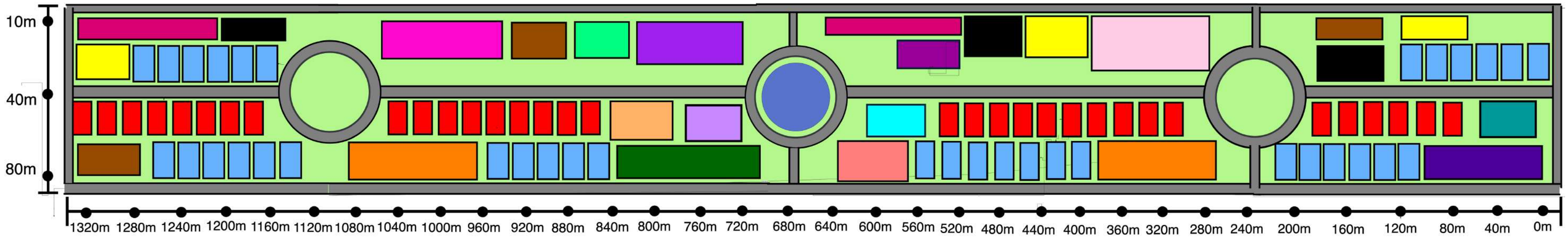
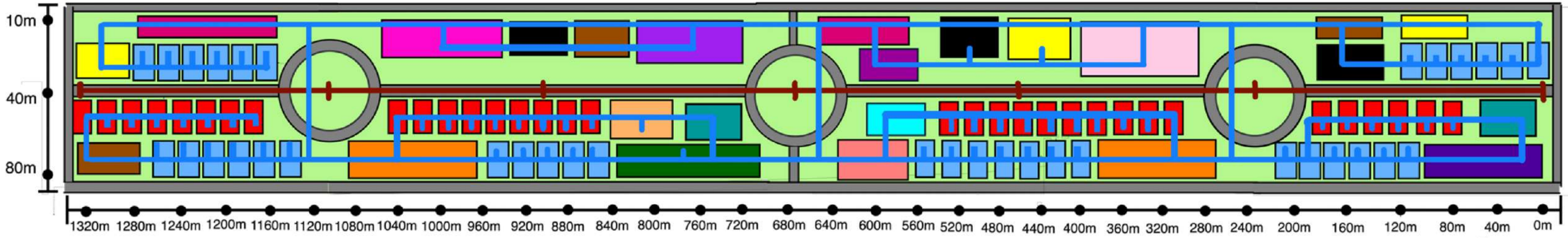


Fig 4.1 Community Plan [Made by Human Factors team on Diagrams Net, Canva]

- Clinic
- Eatery
- Hospital
- Sports Hub
- Robot-Human Funzone
- 1.5 BHK Apartment
- 2 BHK Apartment
- Theatre
- Mall
- Police station
- Hotel Zoning
- 0.5 BHK Apartment
- 1 BHK Apartment
- Donning and Doffing Location
- Supermarket (point of distribution)
- Restaurants
- Control centre
- Green spaces
- Roads
- Community centre

Utility Routings



*refer to fig 4.1

Fig. 3.2.1: Utility routings; Made by Xinrui L. on Prodrafts

Transportation

Water pipelines

Fig 3.2.3 View of Utility Routes in Atlas [Made by Raja K on Blender]

Fig. 3.2.2: PVC-O pipes; Lawrence Q

- The Underground Tram System will be used for transportation within the tori.
- For inter-tori movement of CASSSCs or humans, the CASSSC elevator will be used.
- Water pipelines will be comprise PVC-O pipes

Consumables & Other Supplies

Commodities	Quantity per person per year	Total quantity per year	CASSSCs
Toothbrush	4	37400	17
Toothpaste	8	74800	
Toilet paper	standard-size 15 rolls	140250 rolls	
Soap bars	13 bars	121550 bars	
Skin and hair products	25 shower gel bottles, 5 face wash bottles, 11 shampoo bottles, 5 moisturiser bottles, 1 comb	233770 shower gel bottles, 46750 face wash bottles, 102850 shampoo bottles, 46750 moisturizer, 9350 combs	
Medical Kits	4 (basic medication, bandaids, gauze, ahdesive tape, etc)	37400	1
Stationary Kits	3 (pen, pencil, eraser, notebook, etc)	28050	1
Clothing	40 (general clothing items)	374000	23
	Total	1252920	42

Table 4.1.1: Non-consumables [Krisha Rastogi on Canva]

Types	Per year (in kg)	CASSSCs Unit
Whole grains	764,088	60
Pulses	160,440	12
Fruits	913,308	72
Greens	150,348	12
Nuts	116,688	12
Sugar	242,352	16
Salt	242,352	16
Chocolate	100,980	7
TOTAL (including surplus)	**2,690,556**	**207**

Table 4.1.2: Consumables [Vandita Sharma on Canva]

Internal Transport

Private Transport

- Private transport vehicle for each resident in the settlement

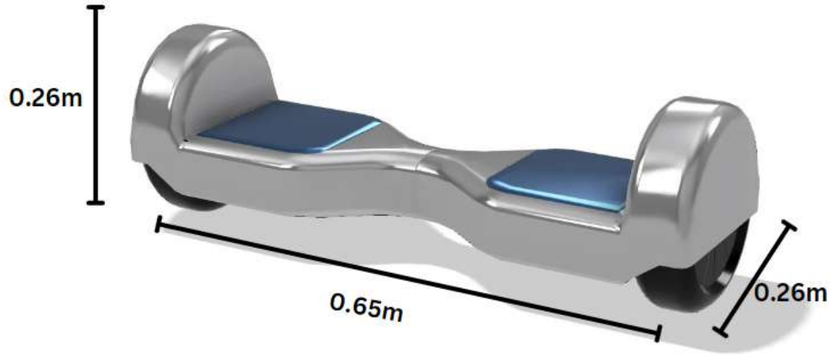


Fig. 3.2.7: Segway, Private transport; [Made by Aakash Z. on Fusion 360]

Public Transport

- Underground Tram System will have 255 driving units as **repurposed CASSSCs** with each having capacity of 12 people.
- People can reach the Underground Tram System using elevators.
- CASSSCs can be transported from the central cylinders to anywhere on the tori using the Underground Transport System

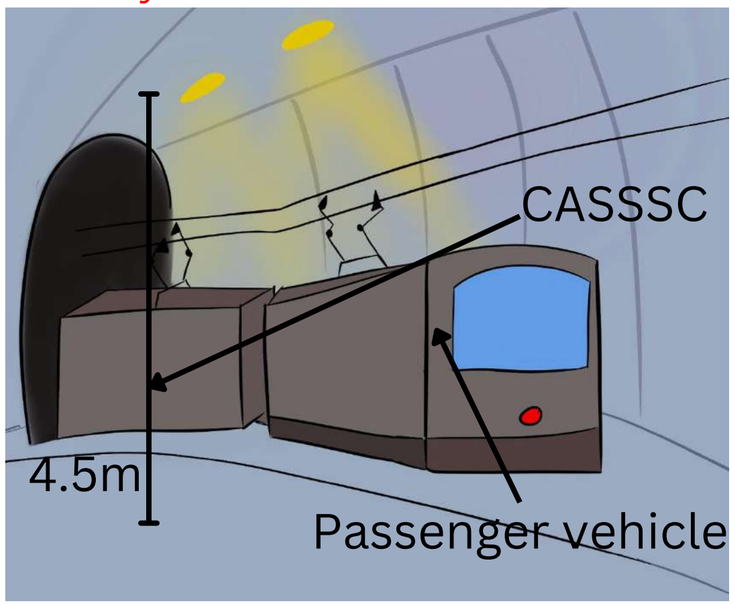


Fig. 3.2.8: Underground tram; [Made by Inaya S. in Procreate]

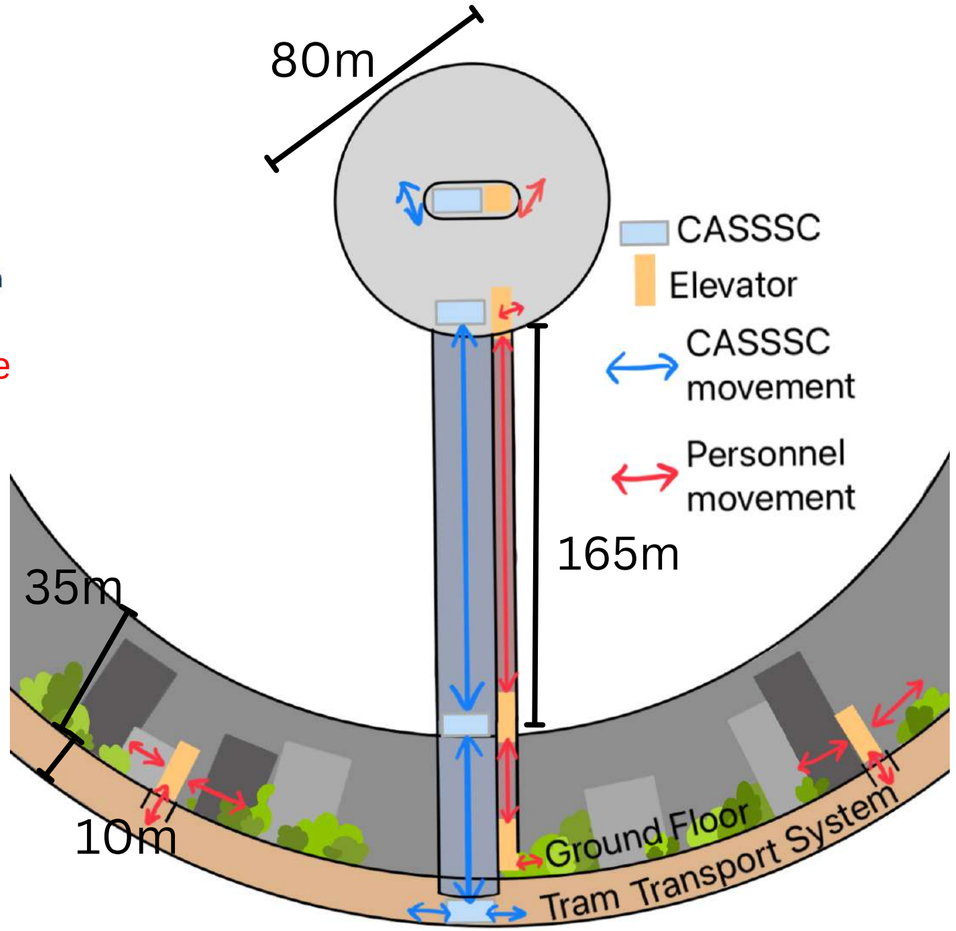


Fig. 3.2.9: Diagram of cargo & public transport system; [Made by Xinrui L. in Prodrafts & Huashijie]

Movement of Asteroid Material

Suffix X used for repurposed bots

Asteroid Resource, Harvesting and Shipping

- Ore will be broken down by MothX
- PearlX with a robotic arm will place it in the CASSSC.
- The CASSSCs will be transported using thrusters that are repurposed from de-spin systems with an additional gripper

Bot name	Function	**How?**	Quantity
MothX	Drill and collect materials to bring back to settlement	• Drill used to obtain materials • A scooper gathers materials and stores it in unit.	5
PearlX	Moving ores from asteroids into CASSSCs	• Collects ores from the asteroid and loads it onto CASSSCs using arm	10

Table 7.0.1: Asteroid surface Bot and Function [Made by Taher on canva]

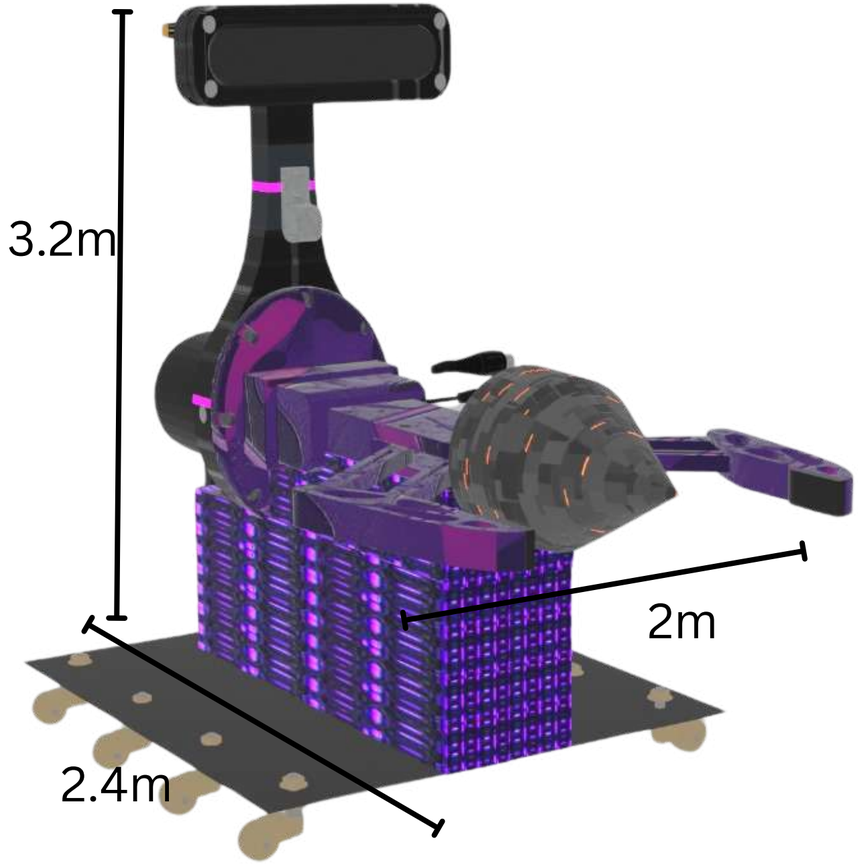


Fig 7.0.1:
MothX [by Vedant N. - Blender]

Movement of CASSSCs from Asteroids

Repurposing of Solid Asteroid De-spinner

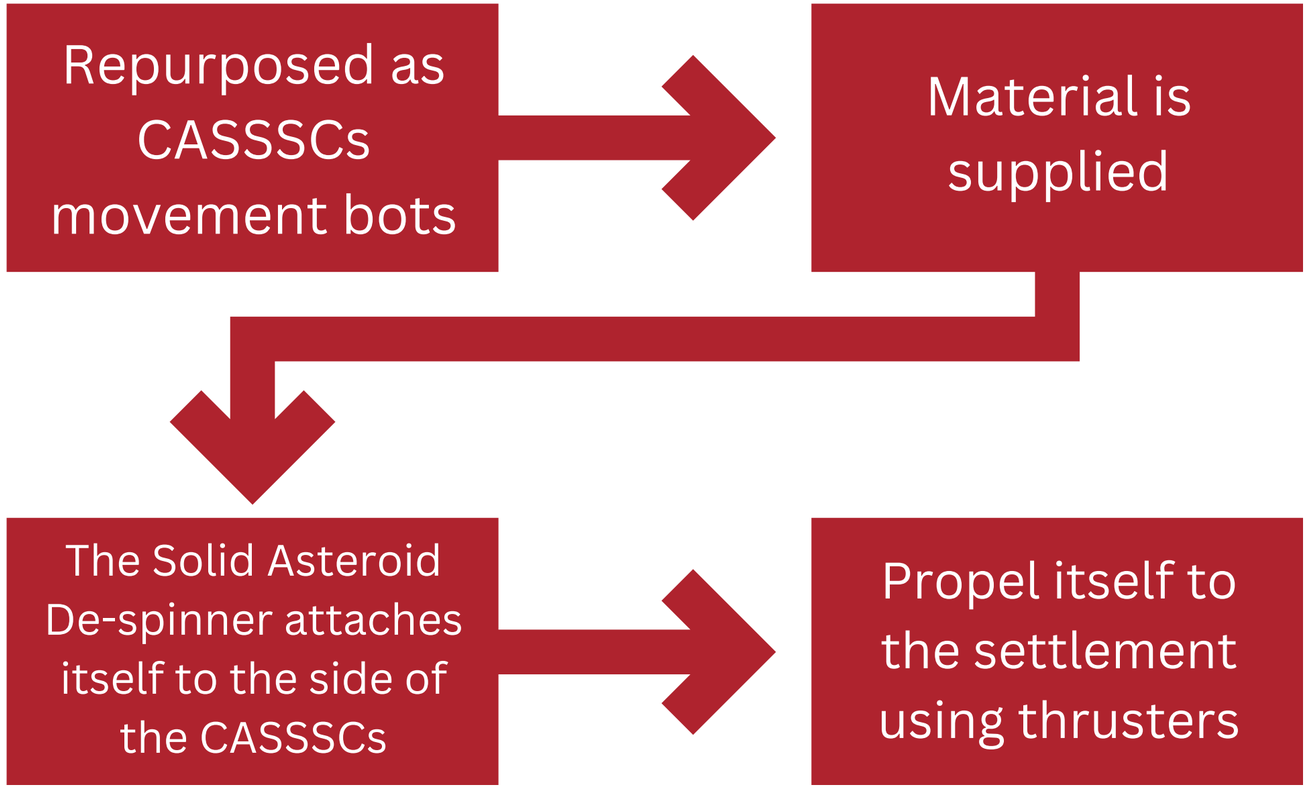


Fig 7.3: Moving to settlement [Made by Inaya on Canva]

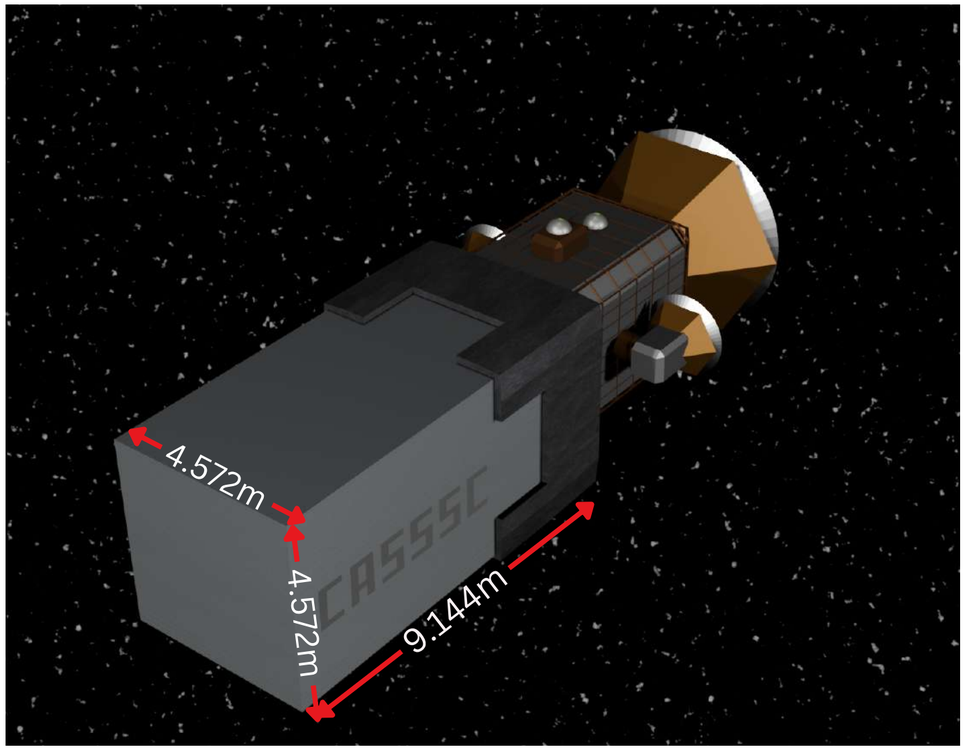


Fig 7.4: CASSSCs [Made by Arinjay G. on blender)]

Asteroid Capture and Retention Systems

Preventing Material Shedding

- Incorporate containment nets that are durable, flexible and resistant to space environment conditions .
- The nets will be made of Silicon Bucky structures.
- The openings in the mesh are designed to be 0.02 by 0.02 m in diameter.
- Implement active surface stabilization techniques using sprayed-on adhesives or fast-hardening foams that bind surface materials before movement.

Dust Mitigation

- Samples and ores of asteroids extracted.
- Sent near the tethers.
- Nitrogen showers.
- Loaded into CASSSCs and sent to research facilities via internal CASSSC transport system.

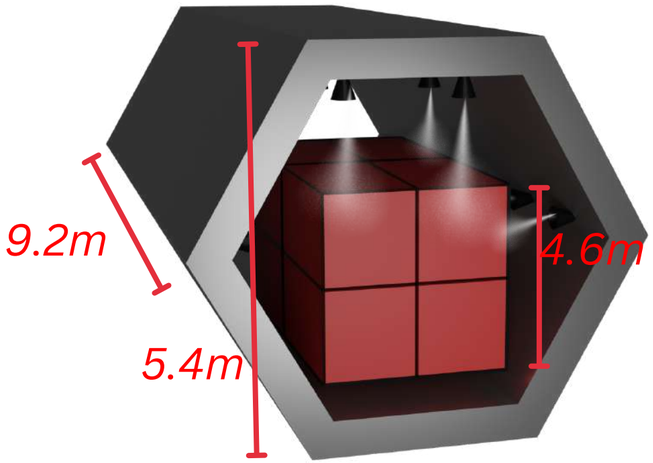


Fig 7.5 Nitrogen Shower, Shiv K, Blender

Radiation Protection and Research Labs

1

DOSIMETERS

SpongeBob has built in dosimeters to keep residents notified of radiation balance.

2

DETECTORS

Particle detectors will be installed along with the smoke detectors to detect radiation particles - any imbalance will send an alert to SpongeBob

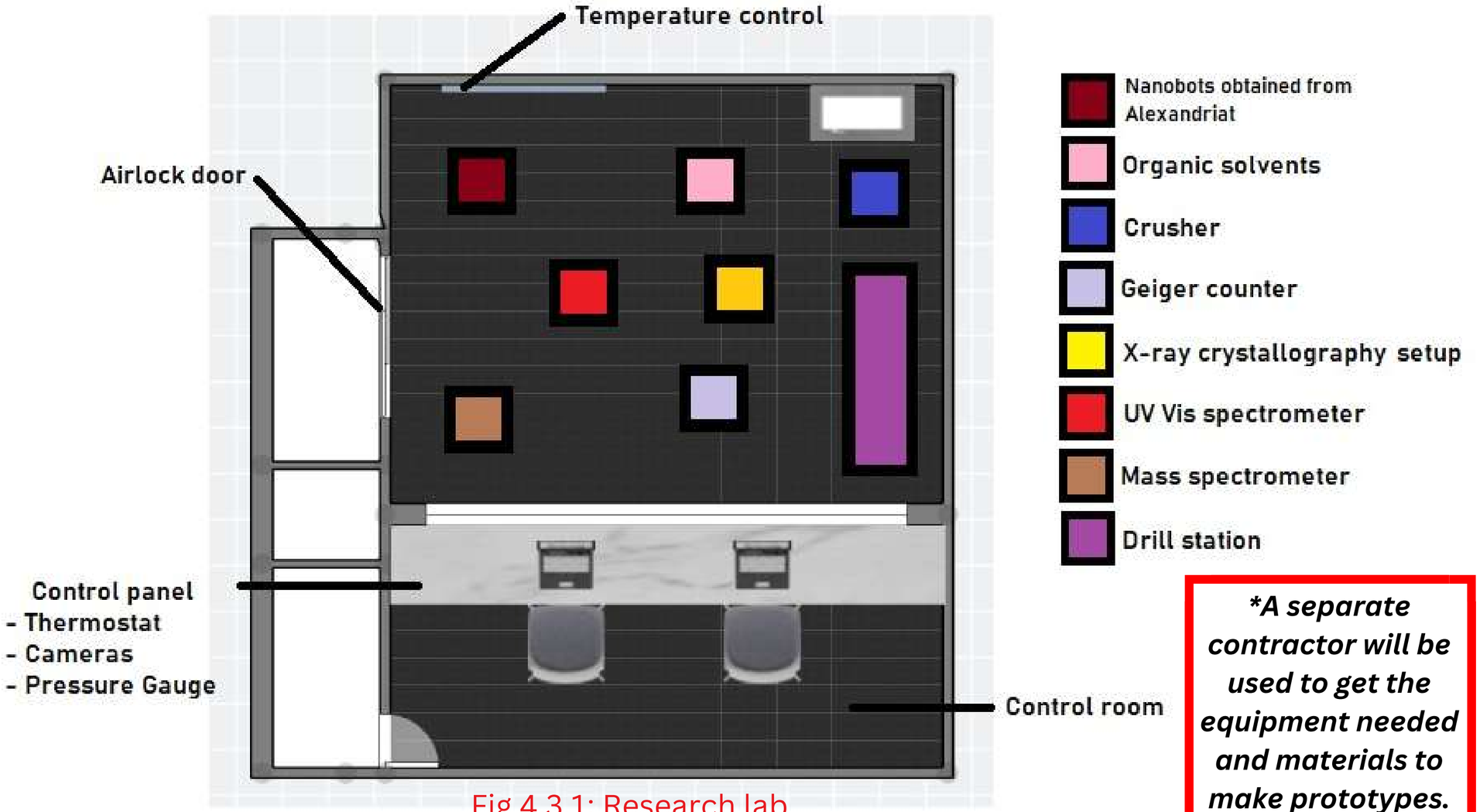


Fig 4.3.1: Research lab
[Made by Ananya P. on MS Paint and Coohom]

A separate contractor will be used to get the equipment needed and materials to make prototypes.

Machine Equipment in Laboratories

Type of Analysis method	Equipment	What it does
Metal separation using nanobot	Nanobots obtained from Alexandriat	Separates metals so easier to observe
Organic compound separation	Organic solvents	Separates organic compounds so they are easier to observe
Mechanical intervention	Drill and crusher used based on purpose	Allows the breakdown of external surfaces to find the internal composition
Radioactivity detection	Geiger counter	Helps find whether radioactive materials are present in samplee
UV-vis	UV Vis Spectrometer	Helps get chemical identity on organic molecules in asteroid
X-ray crystallography	MicroMax-007 HF X-ray generator. VariMax mirrors. Hybrid photon counting (HPC) X-ray area detector. Oxford Cryosystem. Crystallography equipment for crystal transport to synchrotrons.	Chemical identity of metals present in sample
Mass spectroscopy	Mass spectrometer	Identify unknown compounds by molecular weight determination and find structure and chemical properties of the compounds.

Table 4.4.1: Machine Equipment in Laboratories
[Made by Hridank G]

Food Production and Processing

Type	Monthly (in kg/person)	Monthly (by all in kg)	Initial quantities(in CASSSCs)
Whole Grains	6.81	63,674	4
Pulses	1.43	13,370	3
Fruits	8.14	76,109	5
Greens	1.34	12,529	2
Nuts	1.04	9,724	1
Meat	6.41	60,000	4
Total	**25.17**	**235,406**	**19**
Total + 25% surplus		**294,257.5**	**23**

Table 3.2.1: Food Production; [Naman K on Canva]

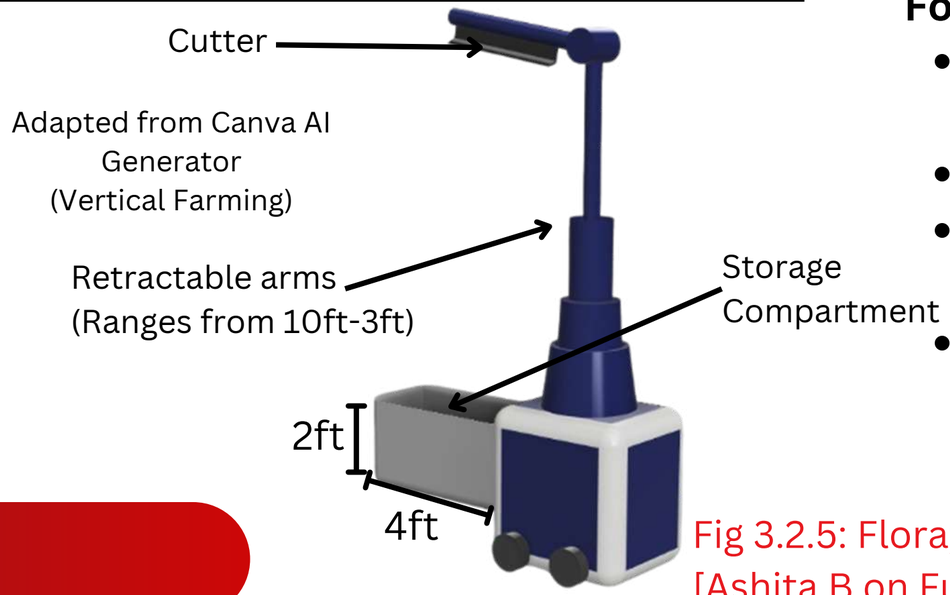


Fig 3.2.5: Flora; [Ashita B on Fusion 360]

Storage and Delivery

- Storage will be done in **repurposed CASSSC's.**
- Hermetic bags will be used for storage and will maintain optimal temperature and humidity
- **Drone and Delivery** used for delivery.

Growth

- 21% of produce is cultivated in edible landscapes as vertical orchards on residential buildings, while the remaining 79% is grown on farms.

Food Production and Processing:

- **Garden A Go-Go** will be subcontracted for farms in the Industrial Tori
- Vertical Farming and Aeroponics will be used
- Meat will be produced using stem cell culturing in the industrial tori
- Food will be canned and heated in the Food Processing Plant [industrial tori] to avoid growth of microorganisms.

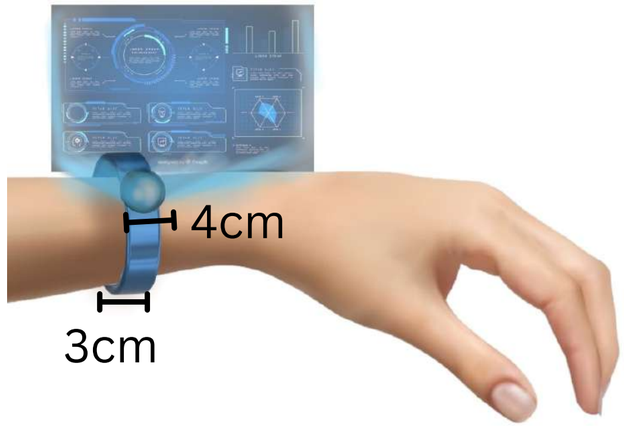
Communications

Internal Communication

- Mode: LiFi, there will be LiFi modulators placed throughout the settlement, each with a range of 150 feet.
- Speed- 220 Gb/s
- Personal Communication Device - SpongeBob

Access Key to rooms

Holographic projector



Health and Productivity tracker

Integrated into settlement ecosystem

Fig 3.2.6 Spongebob [made by Ashita B. in Krita, Fusion 360]

Emergency alarm

Voice assistant

External Communication

- Antennas present on the settlement will be subcontracted to **OrbitLink Communications**
- Relay Satellites will be subcontracted by **Dougledyne Astrosystems** through **Litigation Limiters**
- Placement of Relay Satellites - In Medium Earth Orbit

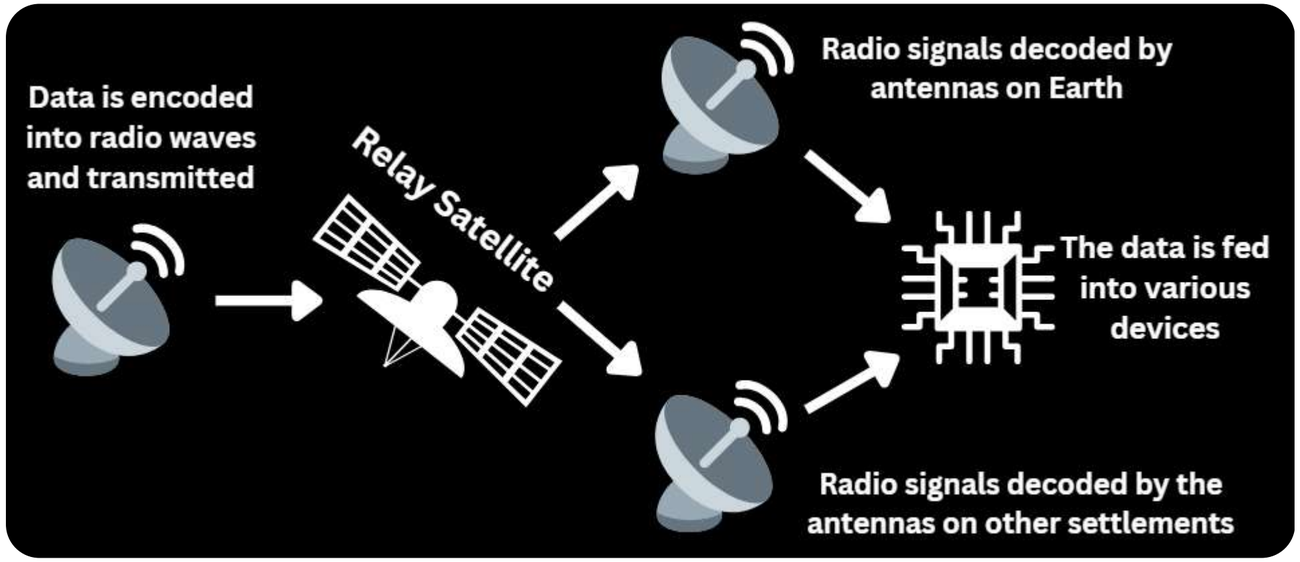


Fig 3.2.7 ; External Communication [made by Kabir B on Canva]

Control Rooms

Control room functions

Control Room	Function
Manufacturing Torus	Air composition control
	Emergency and repair bots commanded here
	Manufacturing data backed up every day
	Waste, electricity, water level monitoring
Residential Torus	Bot control for personal interaction and recreational monitoring
	Control of Dr.Krabs, Karen
	Controlling airlocks
	Communications inter/intra-settlement
Central Axis	Control of data management and storage provided by labs
	Control of deployment of robots performing tasks on asteroids.

Table 5.2.1: Control Room Functions [Made by Taher K on Canva]

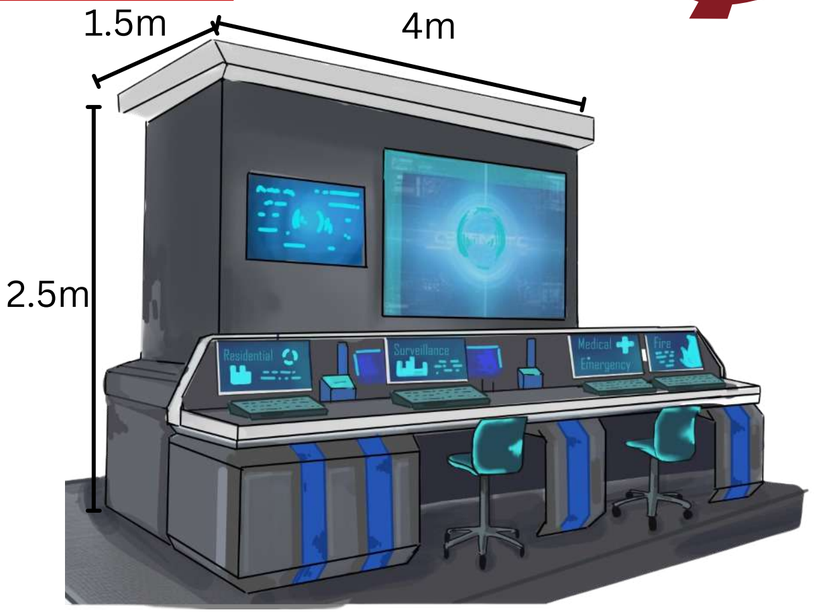


Fig 5.2.1: Control Room
[made by Ashita B. on Krita]

Network devices made of **germanium buckystructure** to reduce energy consumption

CONTIGENCY PLANS AND ACCESS LEVELS

Contingency	Prevention	Measure
Water leak	• Water pressure sensors in pipes • Interfaced automatic leaking taps	Turning water supply off → Pipe repair by SquidwardX
Fire	• Visual image smoke detection sensors.	Ultra-sound extinguisher. -Failure of sound extinguishers → Karen bot deployed to extinguish any fires Evacuation and depressurization if too large
Power Failure	• Self Healing Grid. • Temperature sensors.	• Prioritizing essential tools • Back-up power
Data corruption/ Hacking	• Daily data backups to redundant databases using **Grumbo Aerospace's** data storage systems • Weekly software updates and bug fixes	Live server sent offline → Secure physical location.→ Fix the hack/corruption by engineers →Reuse data from previous backup

Table 5.2.2: Contingencies [Made by Yashaswini M.]

Karen
Fig 5.2.2
Aakash Z. - Fusion360

Fig 5.2.2: Access levels [Made by Mokksh S. with Canva]

RFP Point 5.2, 4.3

Contigency Plans and Repurposed Bots

Contingency	Prevention	Measure
Medical Emergency	• SpongeBob keeps track of personal health history and vitals.	• Deploying Dr.Krabs • Transporting patient to hospital.
Bot Malfunction	• Regular checks. • Performance Monitoring.	• Kill switch. • Taken to bot maintenance for repair
Hull damage	• Pressure detection sensors • collision avoidance systems	• DoodleBob system-deploy structure-temporary fix • SandyX

Table 5.2.3: Contingencies [Made by Taher K. on Canva]

Fig 5.2.3: DoodleBob [Made by Ashita B on Krita]

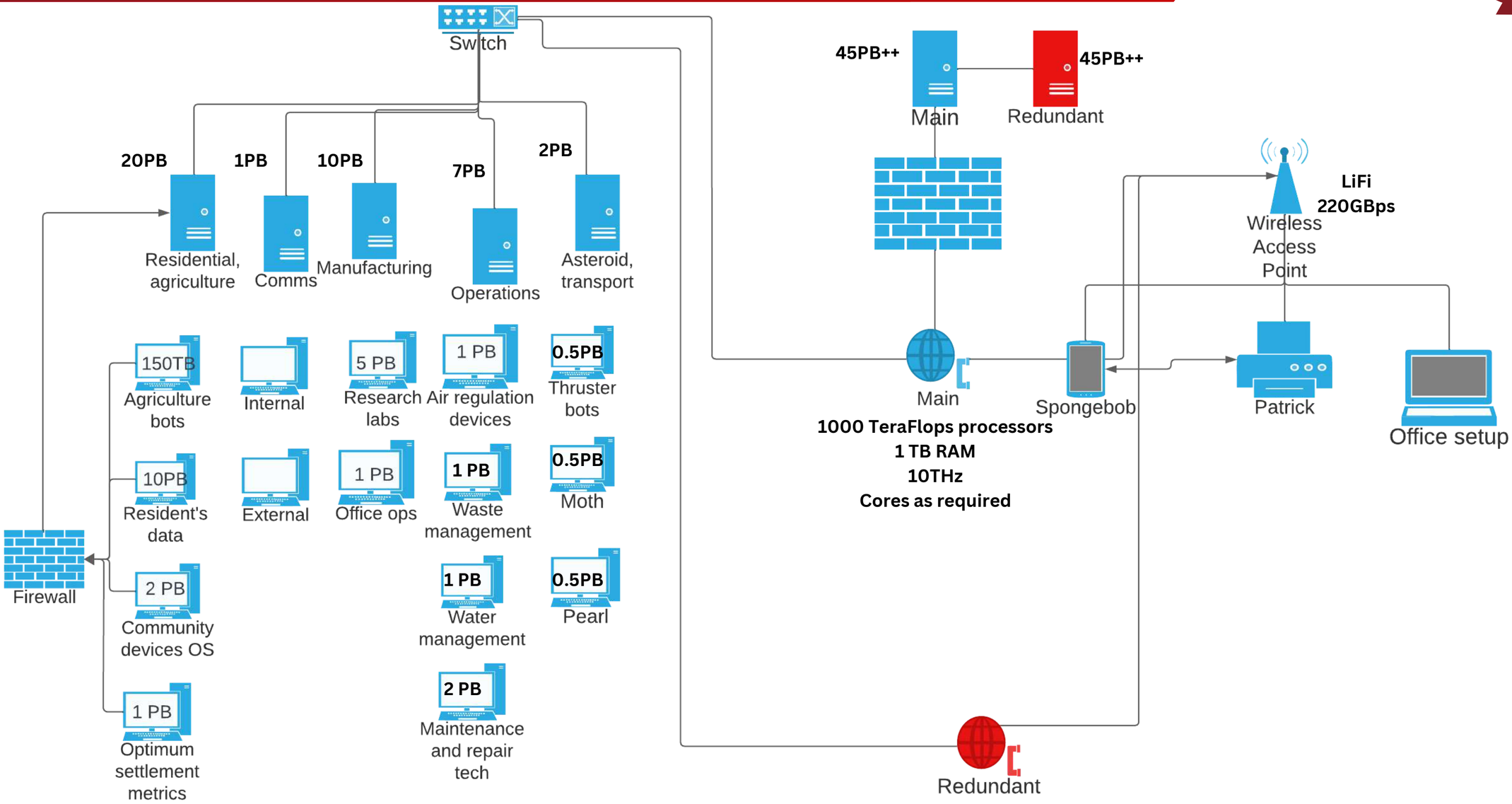
Silicon buckystructure fabric from **BuckyBreakthroughs** to withstand internal pressure

Repurposed Functions for bots

Bot name	Function	How?	Quantity
SquidwardY	Acts as a service robot for maintaining, repairing settlement and robots, as well as triggering kill switch on rogue bots	• Uses arm with nozzle to 3D print furniture. • Arms place furniture based on layout sent to bot.	500

Table 5.2.4: Repurposed [Made by Taher K. on Canva]

Network Chart



RFP Point 5.3

Table 5.3.1 [Made by Mokksh S in LucidCharts]

Emergency Situations

Evacuation Plan:

EMERGENCY BRACELETS
‘SpongeBob’ will be used to notify residents of emergency situations

EXTREME SURVIVAL TECHNOLOGIES
Subcontracted pods will be used as emergency shelters after evacuation

DAMAGE REPAIR
Affected part of the settlement will be locked by airlocks and bots will regulate damage and clear debris

Safety within the Settlement:

EMERGENCY LIGHTING
In case of evacuation, illumination strips along the floor will guide residents to the nearest exit

TRAINING AND EDUCATION PROGRAMMES
Residents will be re-educated on evacuation and usage of fire alarms every six months

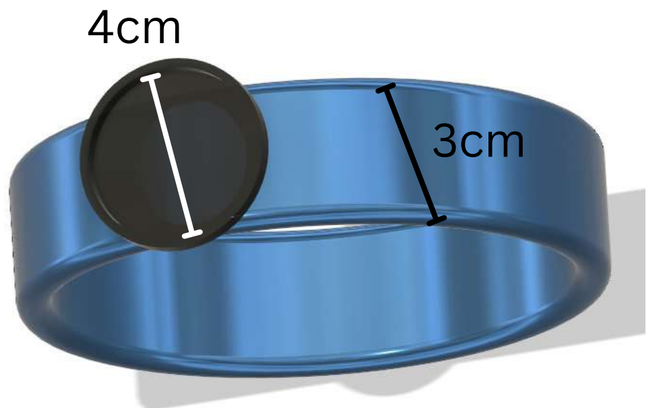


Fig 4.3.1 Design of Spongebob [Made by Ashita B. on Fusion 360]

Spacesuits

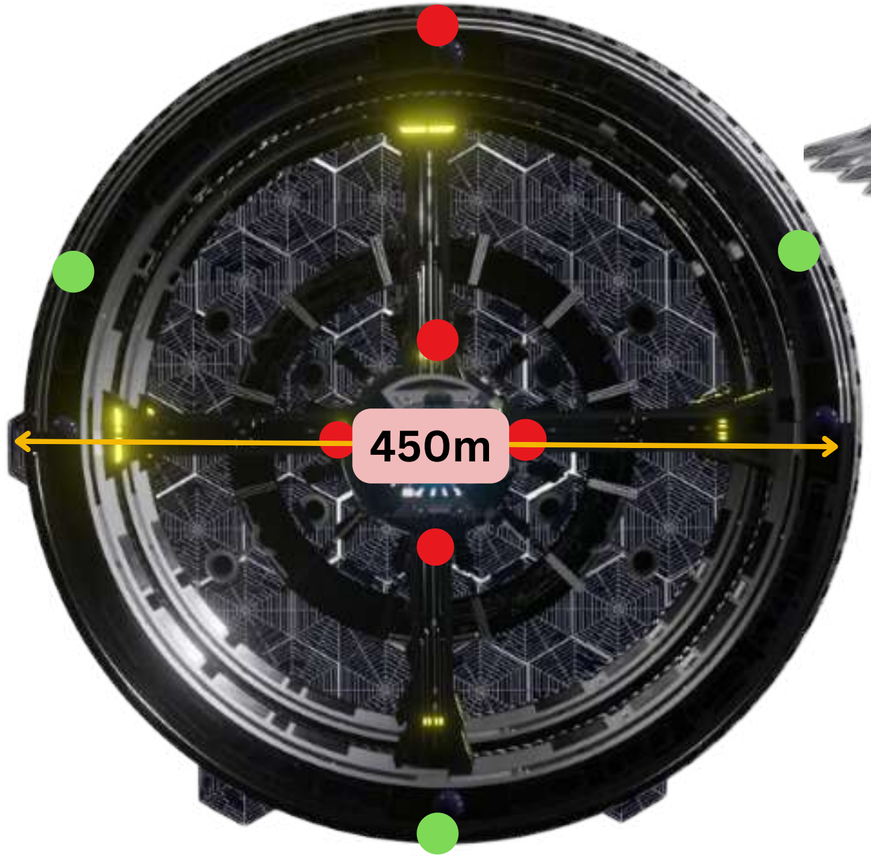
Spacesuits will be subcontracted by **Extreme Survival Technologies (EST)** and **Lunar Adventures.**

Types of spacesuits	Functions	Total Quantity	Features
Recreational	For recreational activities	1500	• Flexible • Basic functions for Low Gravity
Emergency	For unforeseen situations	9500	• Storing oxygen, liquids, compressed food, emergency medicine etc.
Research	Stored in Research Labs to be used by researchers	400	• Extra layer of protective material • Identifies known substances database, available resources database, resource discovery registry system, planet map etc.
EVA	For general extra vehicular activities	1500	• Keeps track of vitals and other body functions at all times. • Cameras will be present on sides of the visor.
Construction	For personnel on site during first phase of construction	75	• Assist in protection from micro-debris.

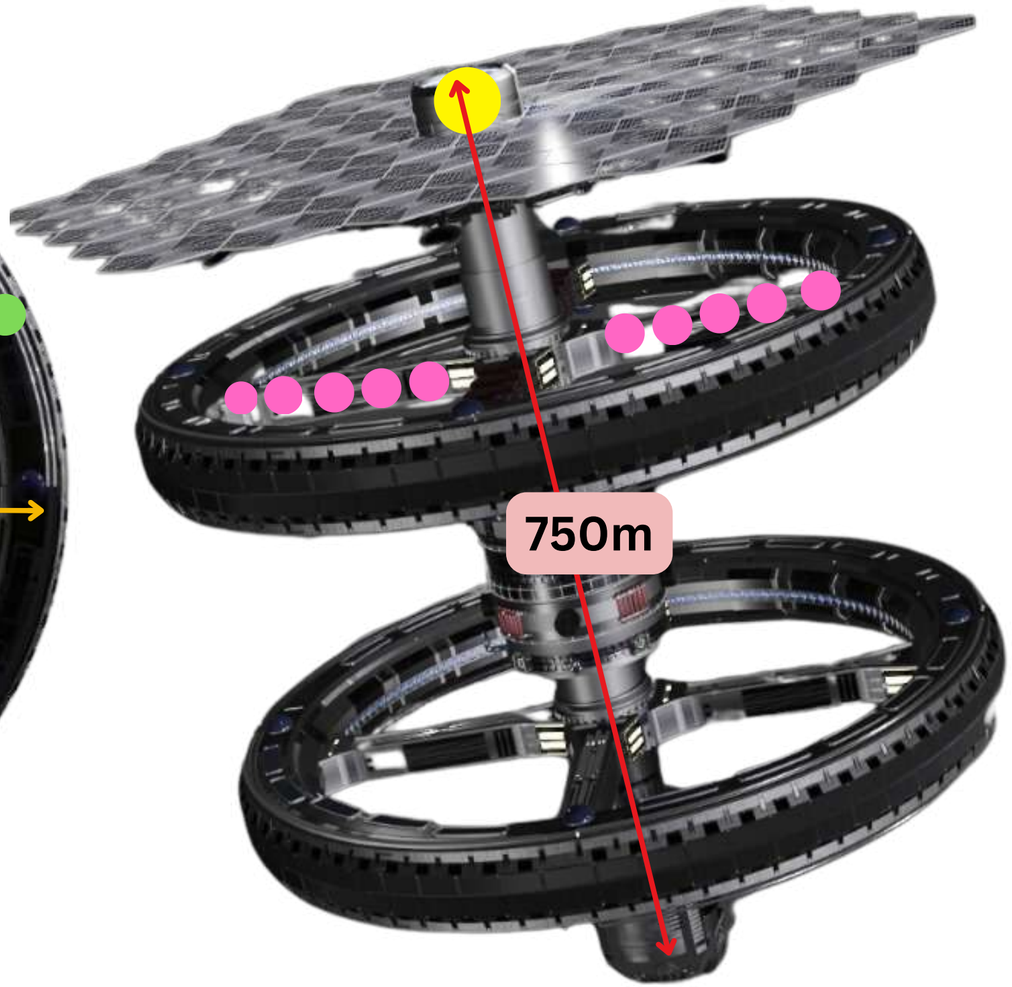
Table 4.3.1: Differentiation Of Spacesuits [Made by Akshat A.& Fiona on Canva]

Location of Spacesuits and Laboratories

Bottom view



3D view



Key	
●	Research Lab and Research spacesuits donning/doffing in airlocks
●	Emergency spacesuits donning/doffing in airlocks
●	Recreational spacesuits donning/doffing in airlocks
●	EVA spacesuits donning/doffing in airlocks

Airlocks will be subcontracted to **Lossless Airlocks.**

Fig 4.3.2: Location of spacesuits and laboratories [Made by Human Factors and Structure team]

Electrical Power Generation

Primary Generation: Photovoltaic Cells

- **ZAP Industries!** provides wire harnesses
- **Light Works** concentrates and reflects sunlight onto panels
- **Electro Protect** used for shielding of circuitry

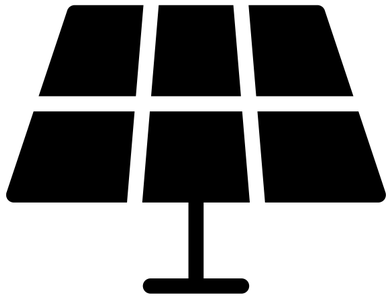


Figure 3.2.1: From Canva

Surface Area: 7479m²

Backup Source: Fuel Cells

- Hydrogen from asteroids utilized in electrochemical reaction
- Produces 1000kW and utilizes 1412kg of Hydrogen

Storage: Li-on Batteries

- Can store up to 20000kW
- 2500 Li-on Batteries

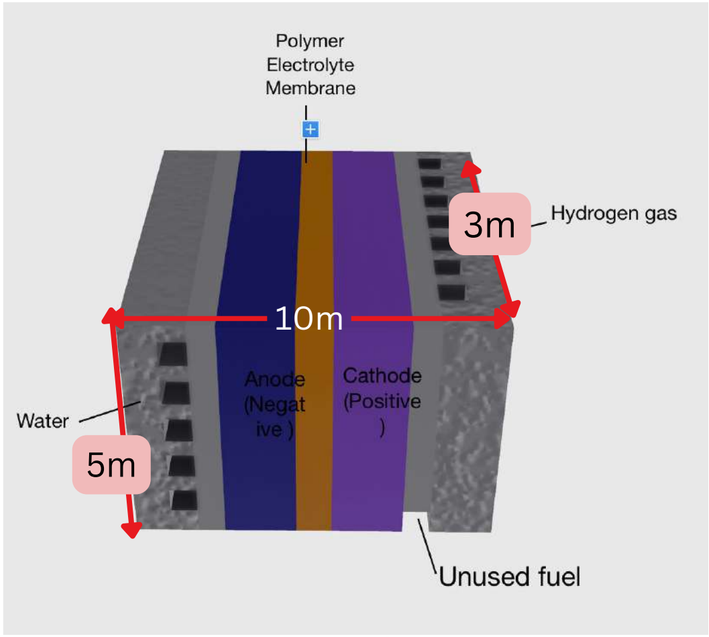
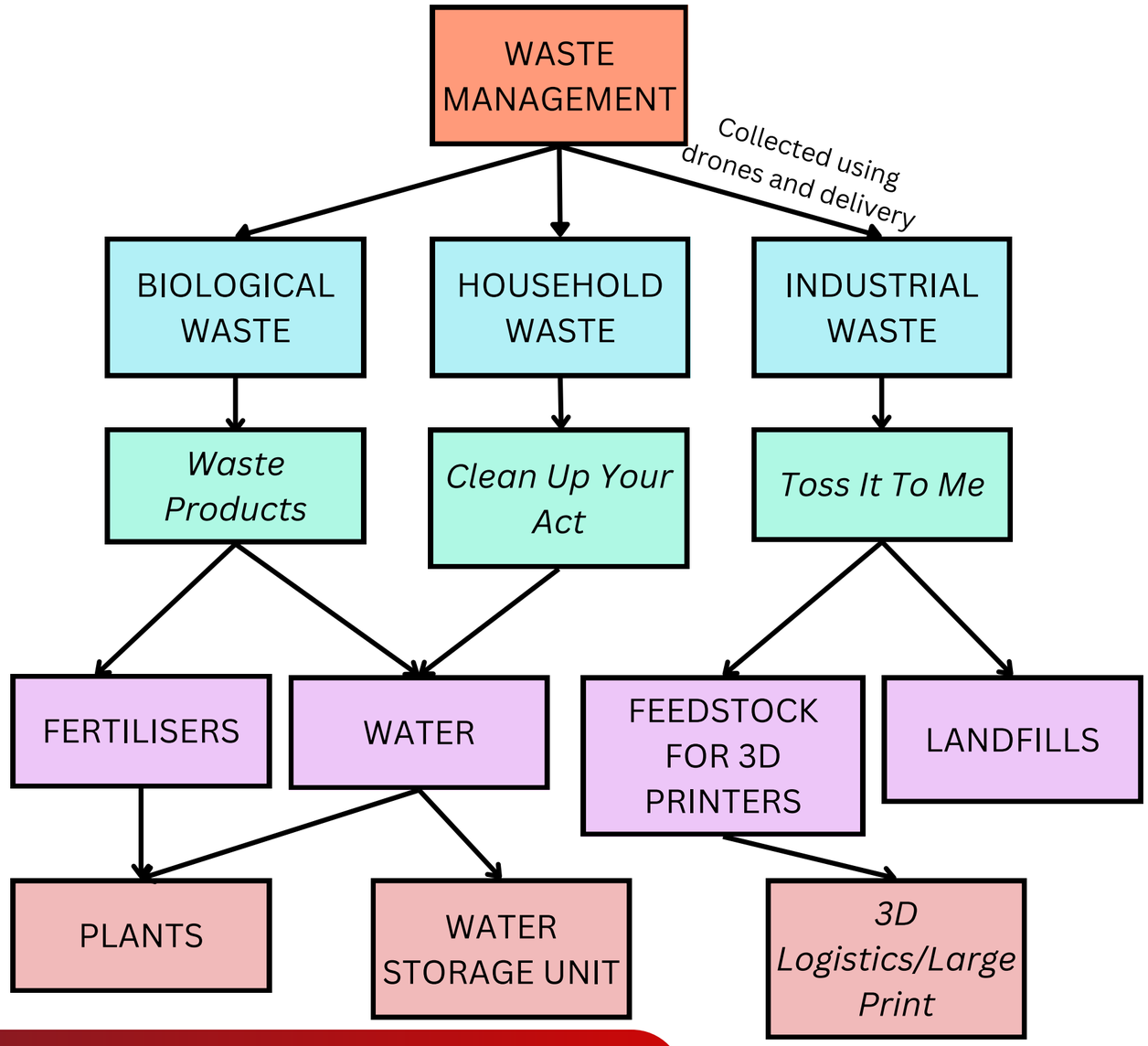


Fig 3.2.2: Hydrogen fuel cell: made by Liyuan Y on Sharp 3D
[Adapted from Fuel Economy]

District	Amount (kW per day)
Residential	3780
Agriculture	1620
Industrial	2225
Commercial	1080
Other	2095
Total	**10800**

Table 3.2.1: District and Usage
[Made by Noufil A on Canva]

Waste and Water Management

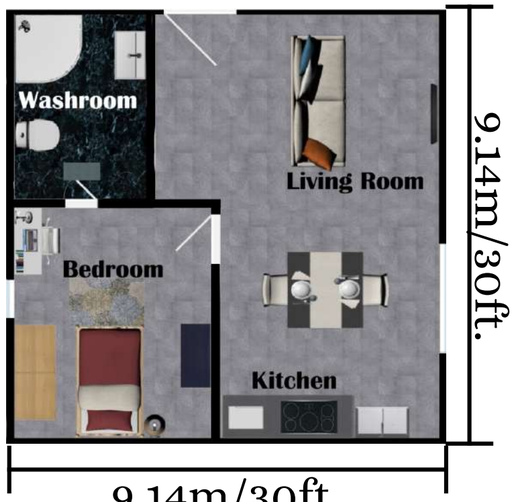


Water Management

Aspect	Method
Source	Subcontracted to Stuff of Life which will extract water from asteroids.
Requirement	358000 gallons per day
Water Treatment (sewer and recycling)	Subcontractor: **Clean Up Your Act; Waste Products** Volume recycled per day: 286400 gallons
Storage	Storage has a capacity of 143200 gallons.
Initial quantity required	71 CASSSCs

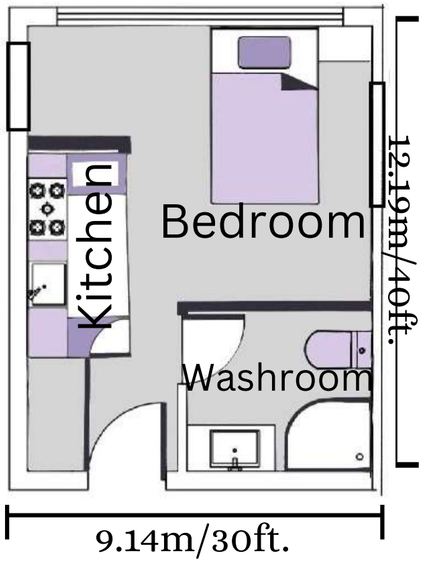
Table 3.2.2: Water Management; [Shivanjali S on Canva]

Room Floor Plans



1 BHK TYPE 1

Fig 4.2.1 Made by Vandita S & Krisha R on Roomsketcher



1 BHK TYPE 2

Fig 4.2.2 Made by Liona on Procreate

2 BHK TYPE 1

Fig 4.2.3 Made by Vandita Sharma & Krisha Rastogi on Roomsketcher

2 BHK TYPE 2

Fig 4.2.4 Made by Ananya Phanse on Coohom

Room Type	No. of buildings	No. units per floor	Floors per buildings	Total no. of units across settlement
1 BHK Type 1	135	2	10	2700
1 BHK Type 2	180	2	10	3600
2 BHK Type 1	9	1	10	90
2 BHK Type 2	9	1	10	90

Table 4.2.1: Quantities of types of rooms [Made by Hridank G. on Canva]

Room Type	Length (in ft.)	Width (in ft.)	Area (in ft.)
1 BHK Type 1	30	30	900
1 BHK Type 2	40	30	1200
2 BHK Type 1	45	30	1350
2 BHK Type 2	45	40	1800

Table 4.2.2: Measurements of the types of rooms [Made by Hridank G. on Canva]

Measurements & Quantities

Fig. 4.2.5: Exterior Design of the different buildings
[Made by Shiv K. on Blender]

Room Type	No. of buildings	No. units per floor	Floors per buildings	Total no. of units across settlement
Regular room	14	2	10	280
Suite room	7	1	10	70

Table 4.2.3: Quantities of hotel rooms [Made by Hridank G. on Canva]

Fig 4.2.6a: Hotel Suite:
[Made by Ananya P on Coohom]

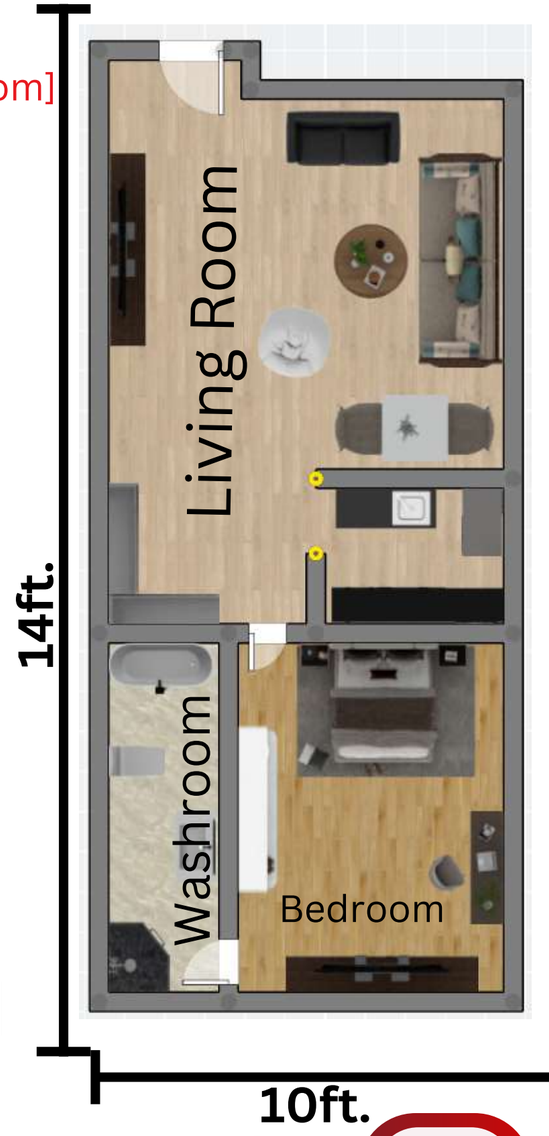
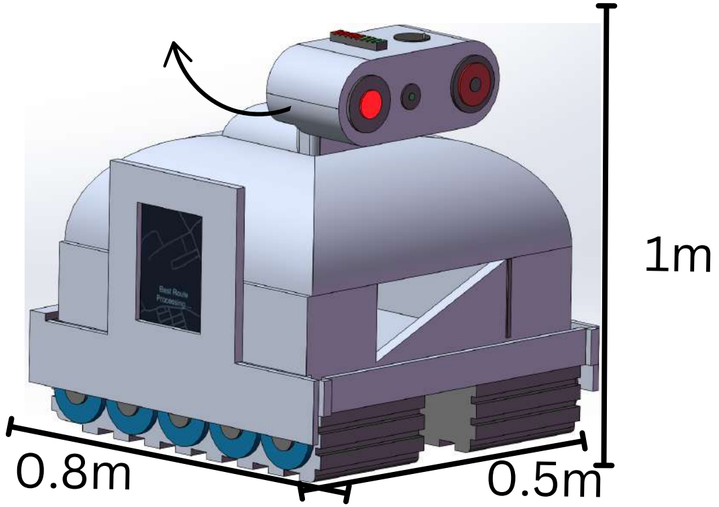


Fig. 4.2.6b: Hotel Room:
[Made by Ananya P. on Coohom]

Community Resources

Patrick

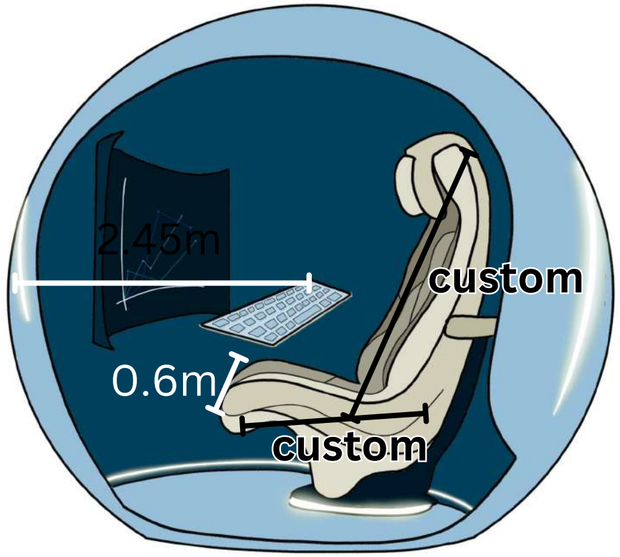
- Converses with residents while updating summaries on work, health, etc
- Built-in entertainment functions like playing music, playing videos, etc.
- Patrick can be accessed by Spongebob and works as yours till connected.
- Has storage for equipment such as footballs, frisbees etc.
  - Plays games and sports with residents
- Available to both residents and transient population (Quantity: 350)



Patrick
Fig 5.3.1
[Joseph - Solidworks]

Drone and Delivery will be used for sending packages and consumables. **Bots4U** will provide its services settlement wide.

- Noise suppressing, speakers to notify of visitors
- Chair with vitals' sensors
- Digital keyboard using finger trackers,
- Sloped desk to increase work comfort

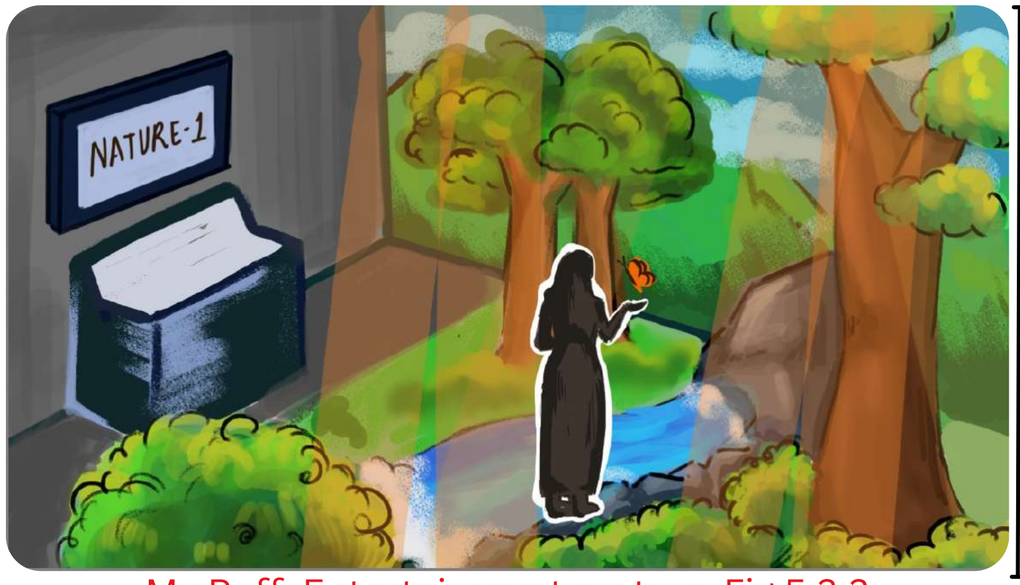


Office Setup: Fig 5.3.2
[Inaya - ProCreate]

Robots to interact with humans

Ms.Puff Entertainment system

The combination of virtual as well as augmented reality to create sceneries and immersive movie experiences within residents' household to provide an entertaining experience



Ms.Puff Entertainment system: Fig 5.3.3
Ashita B. - Krita

Dr. Krabs

- Provides first aid using two arms and toolkit
- Transportation mechanism to carry patients to the hospital
- Screen to display and monitor condition.

Dr. Krabs: Fig 5.3.4
Ashita B - Fusion 360

Recreation

Recreation	Features
Web Swing	Web shooters shoot high tensile polyester filament tubes internally coated with super glue, to swing from one point to another.
Spider Crawl	Spider-like giant legs extending from the back, using vacuum seals to stick to outer walls of settlement and crawl.
Telescope Observatory	Stargazing views of asteroids with telescopes from big windows.
Zero-Gravity Sports Arena	Sports like 3D dodgeball, velcro trampolines, free-flowing parkour courts.
Inner Tube Races	A looped track where residents propel in inflatable tubes for a thrilling ride.
3D Capture the Flag	The game is played at 0 g, with platforms at different heights for players to jump.

Table 4.1.1- Recreational Activities
[Made by Ria C. on Canva]

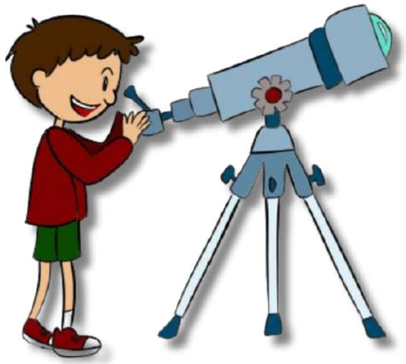


Fig 4.1.2: Telescope Observatory
[Made by Inaya S. on Procreate]

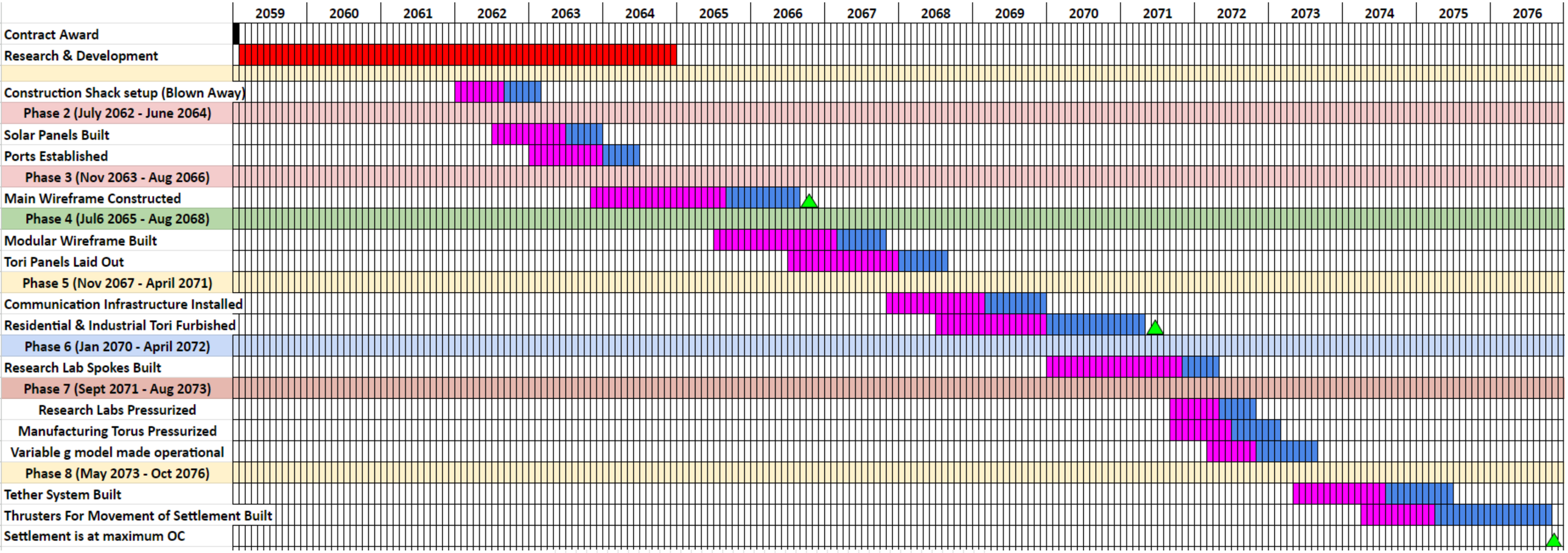
Fig 4.1.3: Zero-Gravity Sports Arena
[Made by Inaya S. on Procreate]

Equipment Materials

Equipment	Source	Quantity
Segway	Earth	9350
Flora	Earth	7360
SpongeBob	Earth	9350
Bot hooking jigs	Earth	10
Emergency Spacesuit	Lunar Adventures	9500
Research Spacesuit	Lunar Adventures	400
Drilling jigs	Earth	250
Squidward	Earth	500
Plankton	Alexandriat, Earth	250
SquidwardX	Earth	500
Sandy	Hard Roll, Earth	150
SquidwardY	Earth	500
Pearl	Earth	100
Gary	Seals-It-All	400
Karen	Earth	100
Patrick	Earth	350
Dr. Krabs	Earth	100
Solid Asteroid Deflector	Dirtbuilders	50
Rubble Asteroid Deflector	Dirtbuilders	4
Doodle Bob	Bucky Breakthroughs, Earth	40
Cleaning Bots	Bots4U	1000
Recreational Spacesuit	Lunar Adventures	1500
Assembly jigs	Earth	300
Ring jigs	Earth	150
EVA Spacesuit	Lunar Adventures	1500
Nanobots	Alexandriat	N/A

Table 3.1: Equipments; [Shivanjali S and Parthiv G on Canva]

Schedule



Total time for construction: 18 years

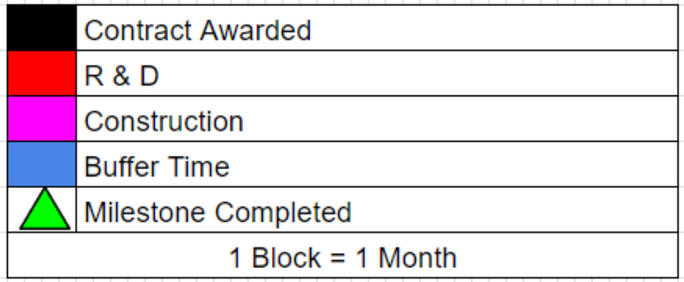


Fig 6.1.1 Gantt Chart
[Ismail Naqi on Google Sheets]

Cost-Materials

Materials	Uses	Amount / CAASCs	Costs
Stainless Steel	Autonomous Robots	3	$1,261,200
Stone	Flooring	150	$16,706,250
Chlorinated Polyvinyl Chloride	Piping	3	$1,215,000
Lithium Ion Batteries	Power Storage	1	$13,853,902.50
Wire Harnesses	Power Distribution	2	$15,121,620
-	-	**Total Cost**	**$48,157,972.5**

Table 6.2.1: Operations [Made by Leena B. on Canva]

Operations Cost	Volume m³
Atmosphere	$5452,500,000
Electricity	$8,002,000,000
Communications	$855,750,000
Food	$532,500,000
Waste Management	$66,000,000
Total	**$14,908,750,000.00**

Table 6.2.1: Operational Costs [Made by Leena B on Canva]

Cost-Automations

Item	Quantity	Total Cost
Spongebob	10,000	$6,000,000.00
Sandy	150	$450,000,000.00
Squidward	500	$187,500,000.00
Patrick	350	$10,500,000.00
Dr Krabs	100	$18,000,000.00
Karen	100	$6,750,000.00
Moth	100	$9,750,000.00
Plankton	250	$18,750,000.00
Pearl	100	$7,500,000.00
Gary	400	$22,572,000.00
Ms Puffs	6500	$6,500,000.00
Server Maintenance	2	$6,000,000.00
Bot Maintenance Employee Salary	5	$525,000.00
Control Room Equipment	3	$15,000,000.00
Control Room Employeee Salary	30	$4,050,000.00
Solid Asteroid deflector	50	$1,000,000.00
Server	2	$33,750,000.00
Bot maintenance	1	$15,000,000.00
Rubble Asteroid Deflector	4	$180,000.00
Total Cost		**$819,327,000.00**

Table 6.2.3: Automations Cost [Made by Leena B. and Vrinda C. on Canva]

Cost-Human Factors

Item	Area	Total cost
Malls	144	$54,000,000.00
Clinic	50	$350,000.00
Hospital	600	$15,500,000.00
Sports Hub	500	$10,615,800.00
Eatery	70	$310,901.00
Laboratories	500	$7,857,950.00
Super Market	350	$582,750.00
Police Station	250	$710,325.00

Item	Area	Total cost
Restaurants	300	$3,894,810.00
Theatres	700	$12,575,640.00
Housing Space	65344.7	$945,270,350.00
Hotels	2280	$52,815,742.00
Robot-human fun zone	300	$806,550.00
Green areas	4000	$35,000.00
	Total Cost	**$1,085,504,768.00**

Table 6.2.4: Human Factor Costs [Made by Rania R. on Canva]

Cost-Structure and Total Cost

Materials	Volume (m^3)	Costs
Lunar Regolith	424617.7	$4,246,177,000.00
Silica Aerogel	239397.3	$21,000,000.00
Silicon Buckystructure	1032319.7	$8,258,557,600.00
Aluminum Oxyntride	693004	$65,000,000.00
Water	227113.6	$340,670.40
Alumino Silicate Glass	230612.6	$115,306,300.00
	Total	**$12,706,381,570.40**

Department	Amount
Operations (Fixed)	$48,157,972.50
Operations (Recurring)	$14,908,750,000.00
Structure	$12,706,381,570.40
Human Factors	$1,085,504,768
Automations	$819,327,000.00
Total Cost	**$29,568,121,310.9**

Table 6.2.1: Structure and Total Department Costs [Leena B.]

Subcontractors

Operations

Subcontractor	Used for
Electroprotect	Insulating circuits
Garden A Go-Go	Growing crops on farms in Atlas
Zap Industries!	Providing wire harnesses
Light Works	Reflecting and concentrating sunlight onto panels
Stuff of Life	Sourcing water on Atlas, air supply
Clean up your Act	Recycling water, purification of air
Waste products	Recycling solid and liquid waste
3d logistics	Printing structures from compacted recyled waste

Subcontractor	Used for
OrbitLink Communications	Antennas present on Atlas
Litigation Limiters	Dougledyne Astrosystems - Relay Satellites
Dirtbuilders	Asteroid de-spin systems, Sourcing the casings
Holey Moley	Sourcing Lunar regolith
Hard roll	Sourcing Alumino Silicate, Stainless Steel
Carbon Creations	Creating pipes
BuckyBreakthroughs	Autonomous Robots
Toss it to me	Treatment of industrial waste

Automation

Subcontractor	Used for
Bots4U	Cleaning of the settlement and carrying household chores
Drone & Delivery	Delivering packages, food deliveries etc.
Bucky Breakthroughs	Hull breach containment
Litigation Limiters	Grumbo Aerospace - Data storage solutions

Table A and B: Subcontractors: Kshitij J on Canva