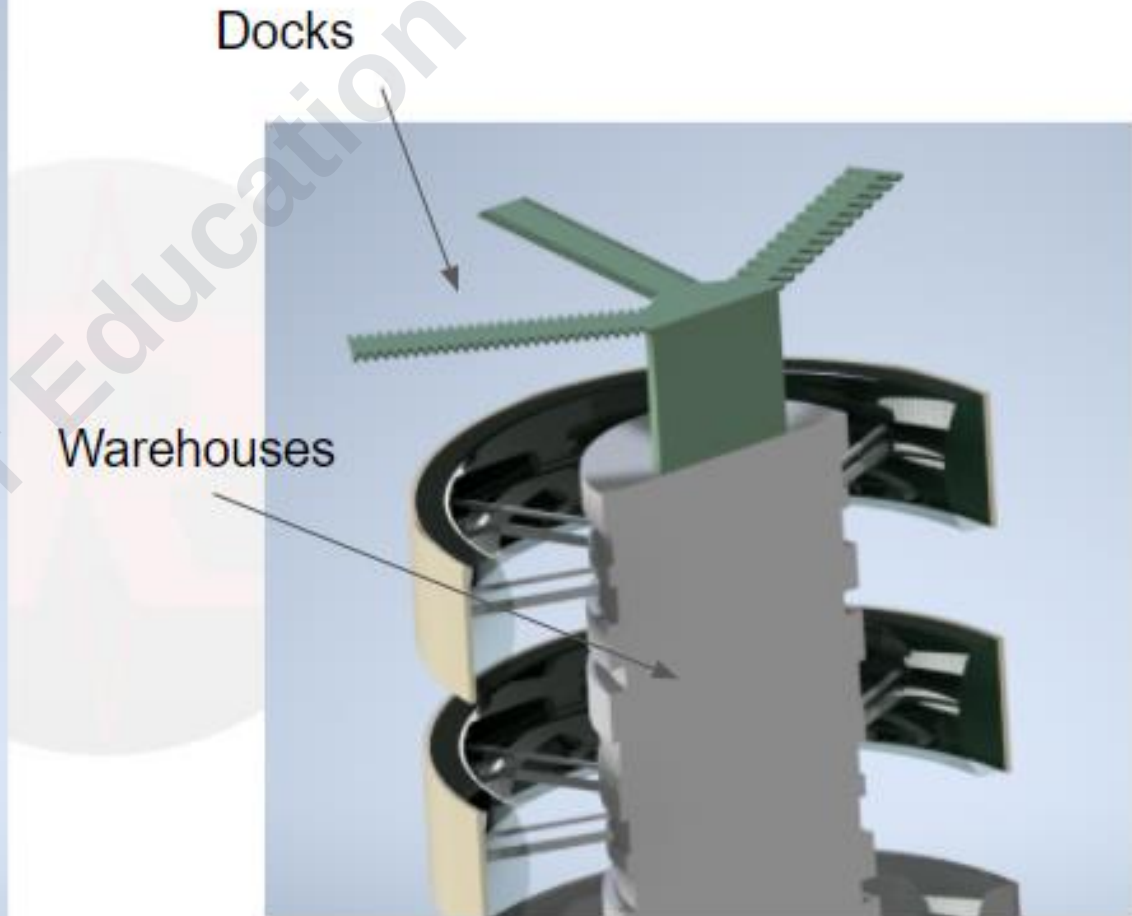
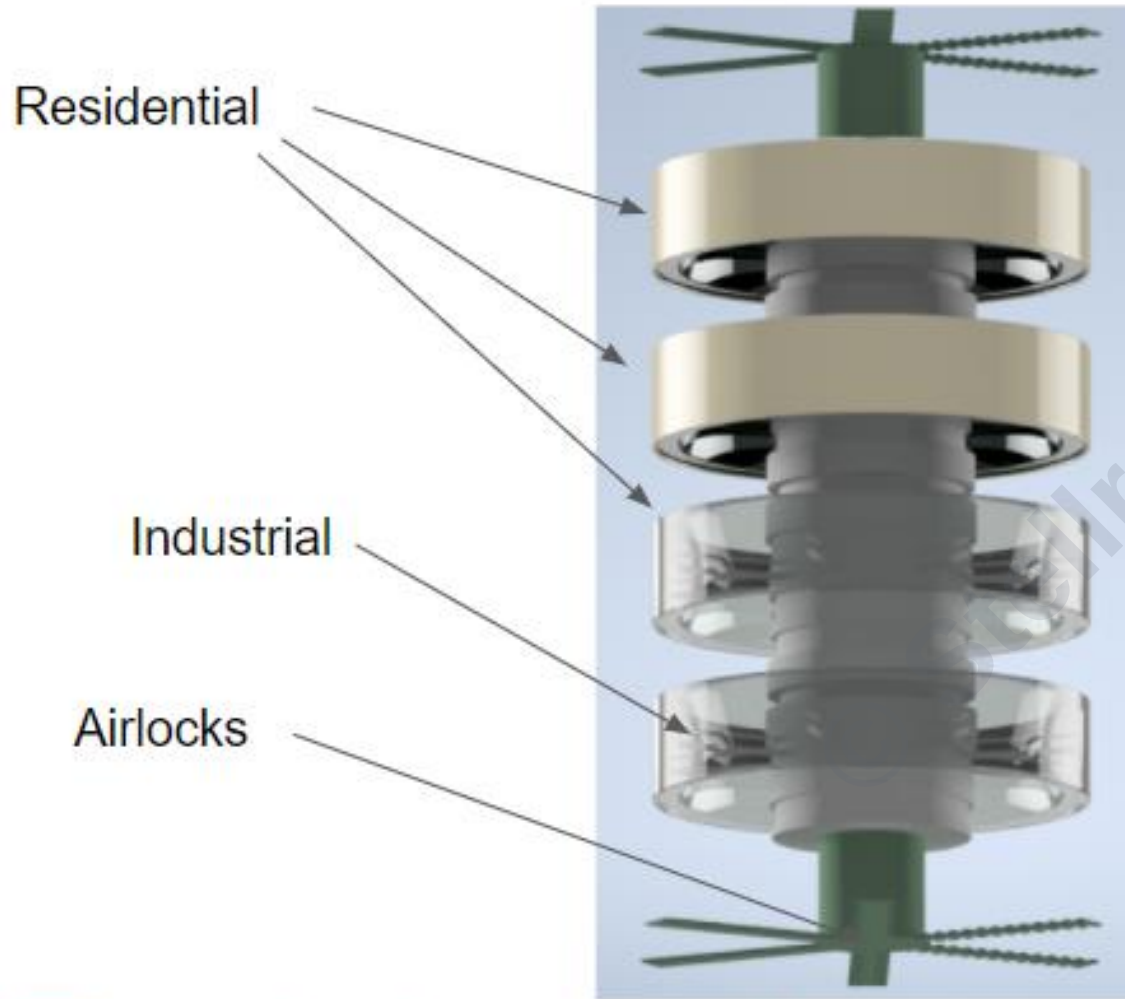


Down Surface Allocation

RFP 2.2



Credit: David G, Rockdonnell

Available materials from the Asteroid Belt

- C-type (Carbonaceous):
 - Carbon-rich asteroids
- S-type ("Stony" or silicate)
 - Stony, silicate-rich asteroids
- M-type (Metal):
 - Asteroids made up of mainly iron and nickel.
 - M-type asteroids will be the most useful for RPO.
 - However, M-type asteroids only make up a small amount of the asteroid belt.

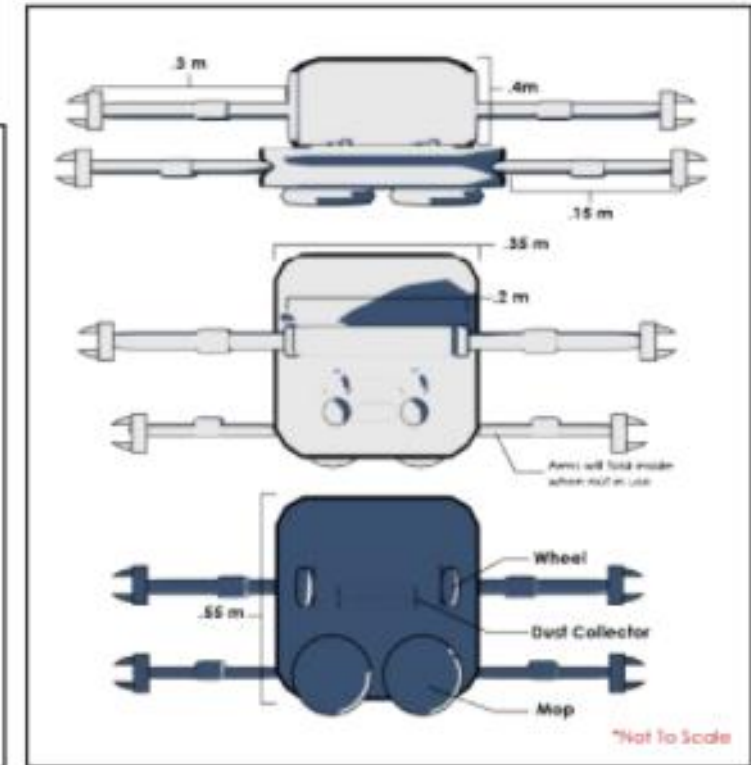
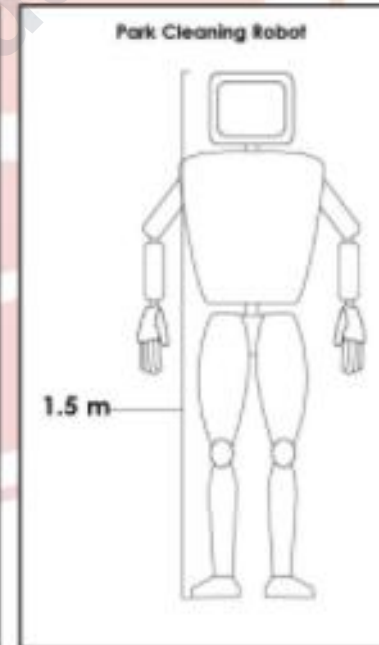
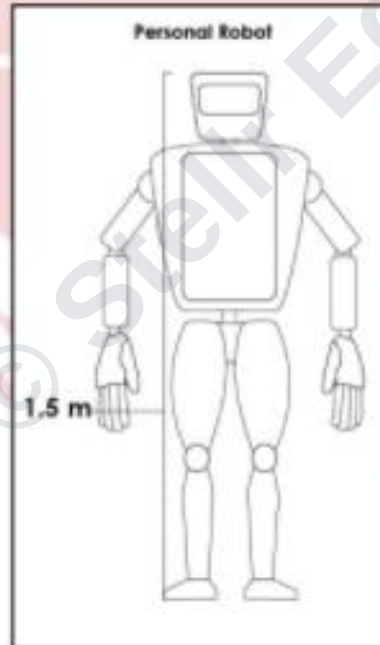
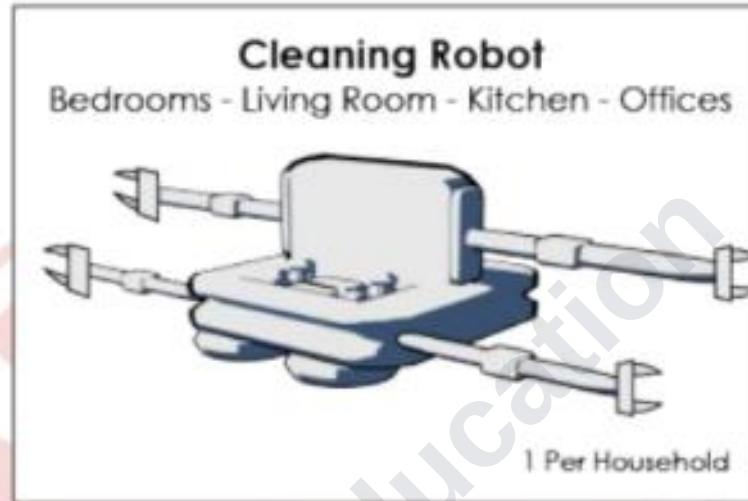
Source: nineplanets.org



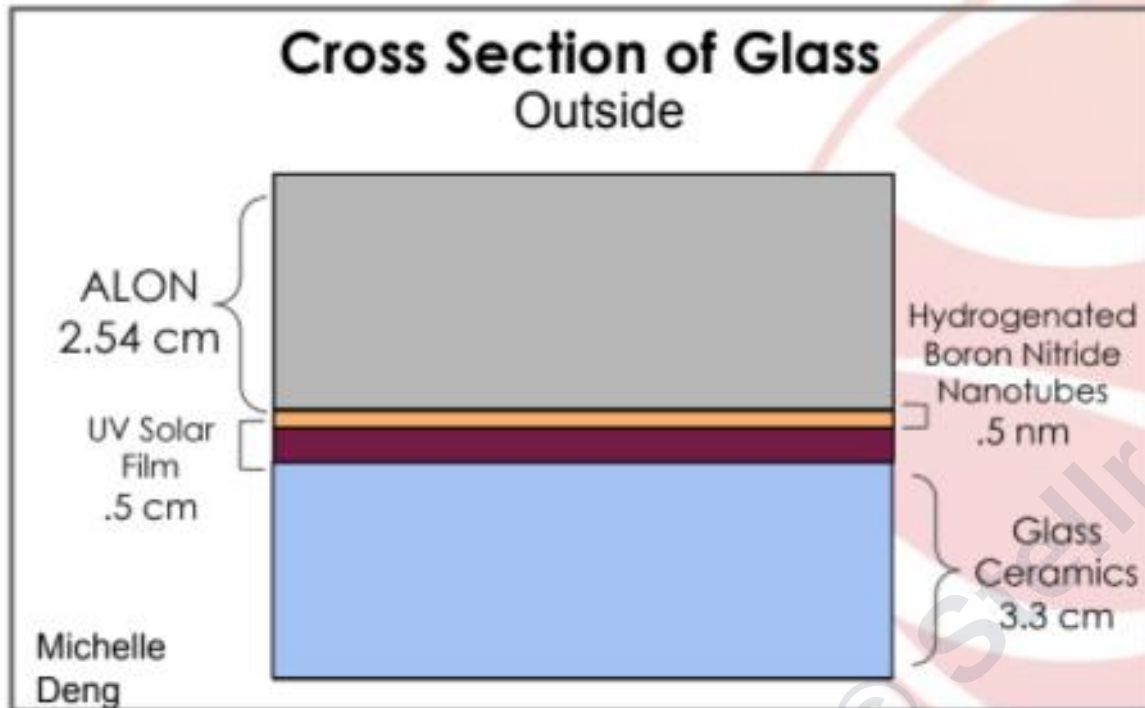
- **Move** objects to specific areas
- **Contact** and **Pressure** sensors
- **Interchangeable** arm parts
- Arm/robot **storage** after cleaning
- **Minimize** manual labor

Personal robot

- Security
- Entertainment
- Cooking

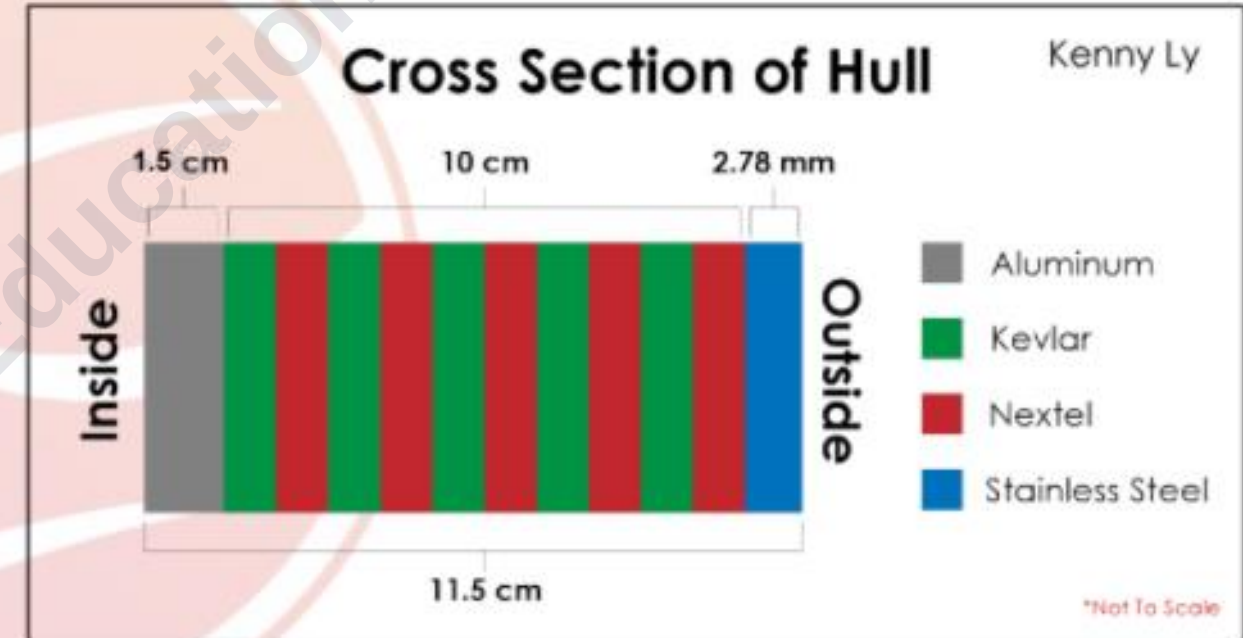


Glass Design



- Radiation- UV blocking film and hydrogenated boron nitride nanotubes (Prototype material from NASA)
- Debris- ALON/Aluminum Oxynitride (Damage resistant glass) and Glass Ceramics (Thermal insulator)

Basic Hull Design



*Kevlar-Nextel layers will be alternating in much thinner sections

ATMOSPHERE

TOTAL PRESSURE

- .65 atm

COMPOSITION



66.15%
Nitrogen



32.31%
Oxygen



0.06%
Carbon
Dioxide



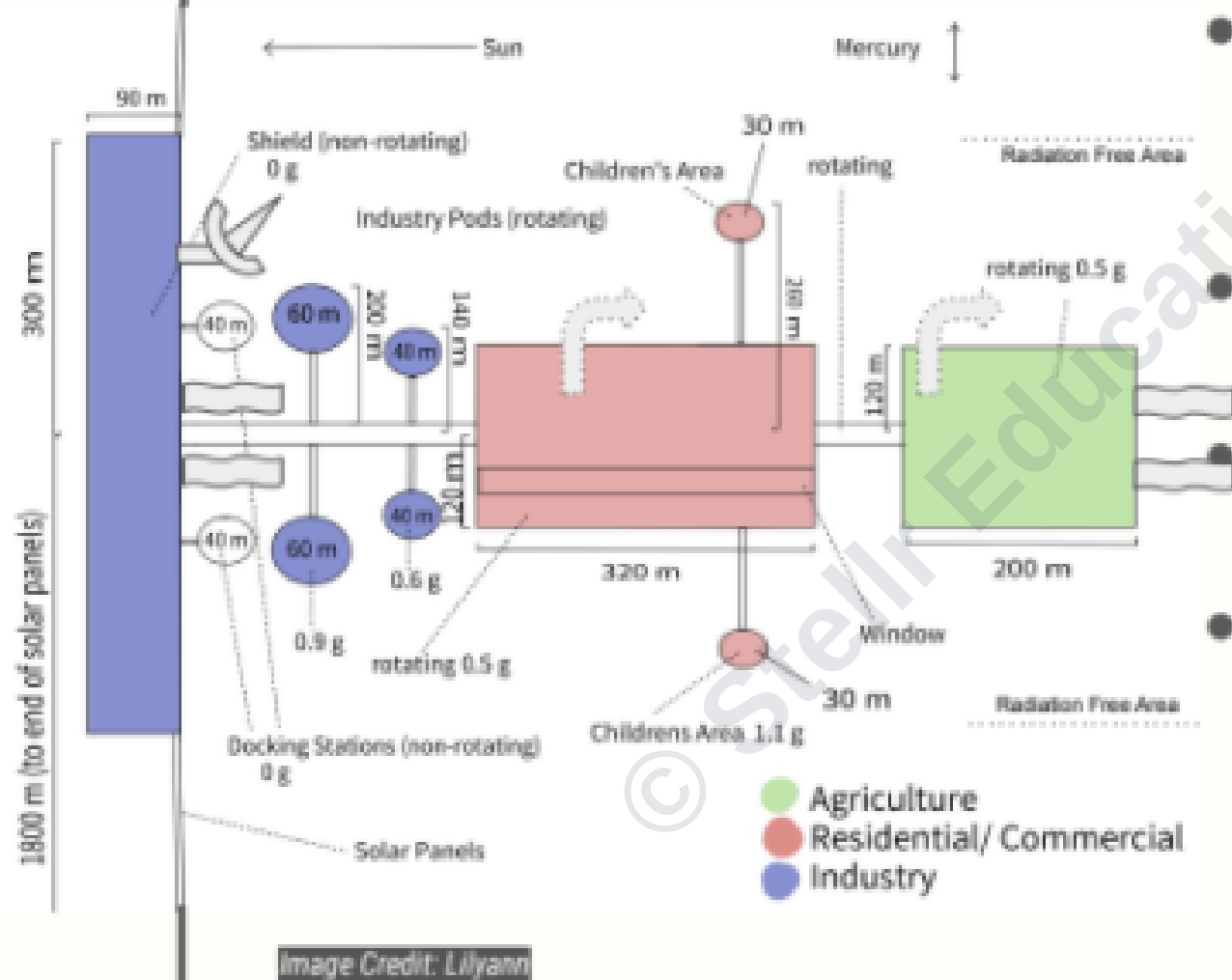
1.54%
Argon &
Others

KEY MESSAGE

This was calculated using the partial pressures of each component under normal atmospheric conditions as a fraction of .65 atm. The partial pressure of Nitrogen is decreased to accommodate for the rest.

All of the components allow for a non flammable and non reactive atmosphere that is good for any fixing that is necessary to the titanium.

Settlement Side View



- Fixed Rotation speed: **2 rpm**
- Different Radii for different gravity
 - 260m radius = 1.1g for kids
 - 120m = 0.5 g
- Zero-G Heavy Industry blocks radiation for residential areas
- Solar panels flare out from the shield
- Agriculture is a separate volume with similar gravity to Residential

Security Systems

Alarm System

- automated Voice System with added vibrations
- Slow Flashing Lights
- 1-5 Levels of Threat
- Accommodations for those in need
- Is a LED light with sensor and speaker
- Installed in street lights or in housing hallways.

Camera System

- Monitor Hallways and Rec Areas
- Monitor Space Exports and imports to the settlement
- Cameras on exterior to determine necessary repairs and then send Glomper and OSAM by finesse required.

Level 1 Threat:

Hull: <5% hull damage > 10% VC: "Minor Hull Damage, Notify Assistance."

Air Pressure: <1% pressure loss > 3% VC: "Air Pressure declining, Notify Assistance."

Fire Alarm/Smoke Detector: Smoke Detected Alarm goes off with flashing white lights.

Level 2 Threat:

Hull: <10% hull damage > 22% VC: "Increased Hull Damage, Notify Assistance"

Air Pressure: <3.3% Pressure Loss >5% VC: "Lower Air Pressure, Notify Assistance."

Fire Alarm/ Smoke Detector: Smoke Detection activates Alarm with flashing white lights

Level 3 Threat:

Hull: <22% hull damage > 33% VC: "Significant Hull Damage, Notified Assistance"

Air Pressure: <5.1% Pressure Loss >5% VC: "Lower Air Pressure, Notified Assistance."

Fire Alarm/ Smoke Detector: This Level shuts off all electronics in range of fire.

Level 4 Threat:

Hull: <34% hull damage > 40% VC: "Major Hull Damage, Notified Assistance"

Air Pressure: <9.1% Pressure Loss >15% VC: "Significantly low Air Pressure, Notified Assistance, evacuate area"

Fire Alarm/ Smoke Detector: This Level ejects retardant into fire to stop (Evacuate Area)

Level 5 Threat:

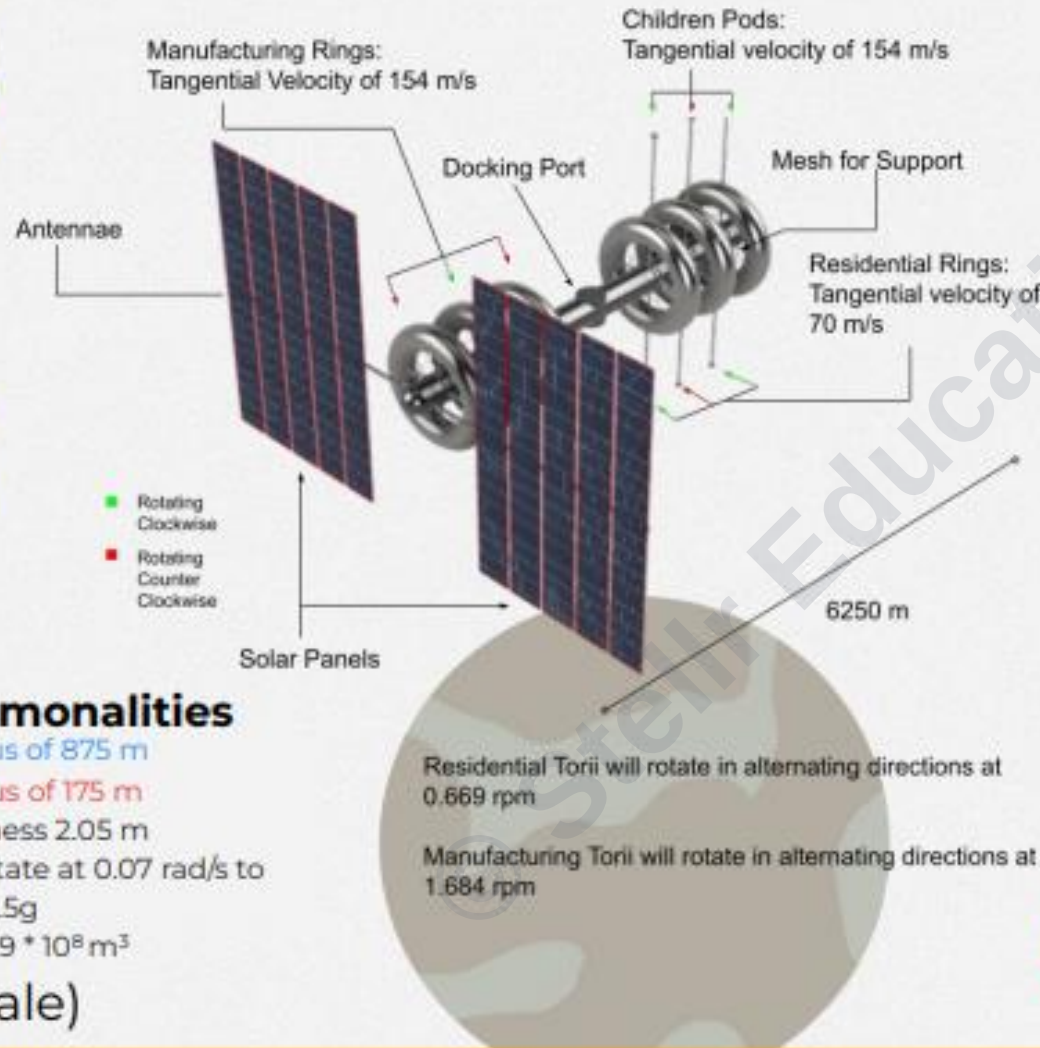
Hull: <40% hull damage > 100% VC: "Substantial Hull Damage, Notified Assistance, evacuate area immediately."

Air Pressure: <13.1% Pressure Loss >100% VC: "Substantially low Air Pressure, Notified Assistance, EVACUATE AREA NOW."

Fire Alarm/ Smoke Detector: This Level shuts down portion of settlement, Evacuate ASAP

Credit: David Estrada

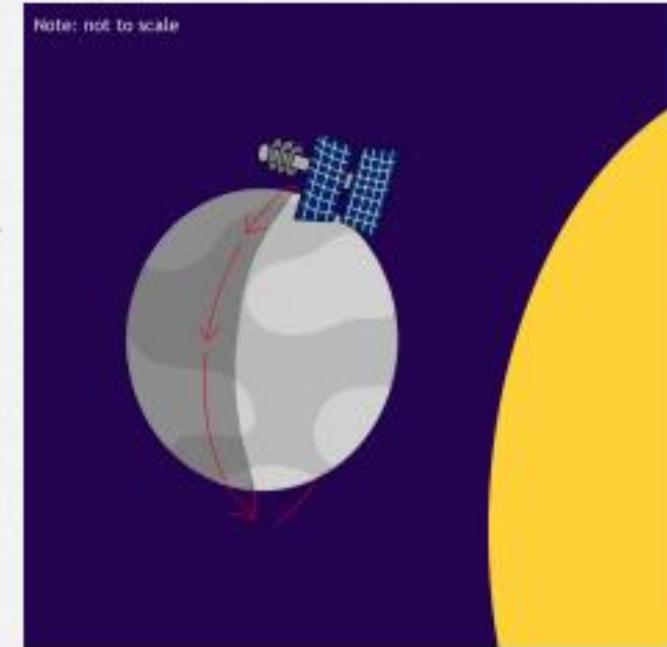
Labeled Design



Torii commonalities

- Major radius of 875 m
- Minor radius of 175 m
- Wall thickness 2.05 m
- Torii will rotate at 0.07 rad/s to generate 0.5g
- Volume $5.29 \times 10^8 \text{ m}^3$

(not to scale)



Orientation: tangent to planets surface
90 degrees to Mercury facing the sun

Render: Tyler Li

Annotation: Aarav Agarwal & Kevin Shen



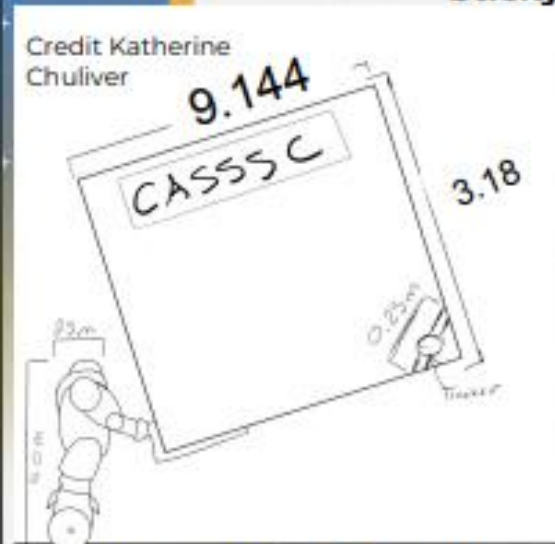
Construction Bots

Exterior: Centipede:

- Construction of large external structures
- Modular design with many toolhead options
- (is it autonomous)
- Ex: attaching an exterior antenna

Sticky Rollerbot [Rockdonnell]

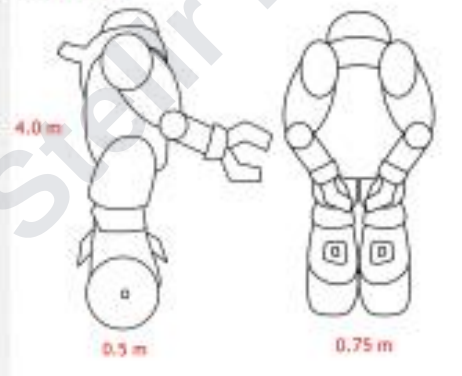
Transport of large components (cargo after construction)
Self propelled and adapted for 0g environments
Ex: transports a wall plate to be attached by centipede



Heavy Wheeler Bot carrying CASSSC (not to scale)



Credit Katherine Chuliver



Heavy Wheeler Bot

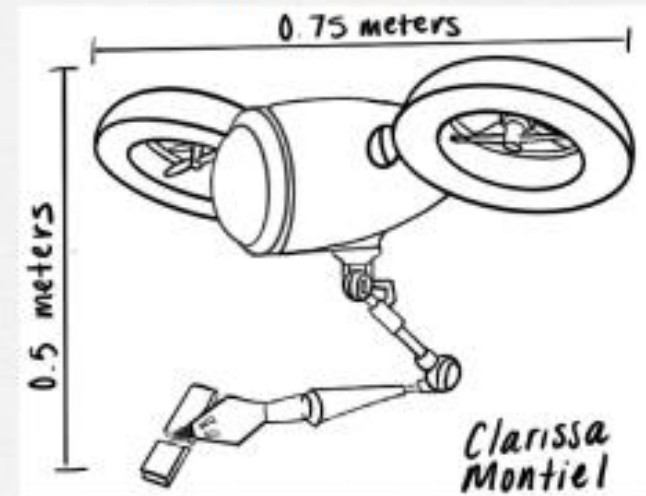
Interior:

Creator Drone Bot

- Precision
- Arm with exchable attachments: claw and plasma cutter(welding), and 3D printing.
- For lighter interior construction

Heavy Wheeler Bot

- Heavy duty
- Different types of customizable hand parts: claws and plasma cutter
- Used to cut windows



Creator Drone Bot

Structural

Operations

Human

Automation

Cost &
Schedule

Business
Development

5.1

28

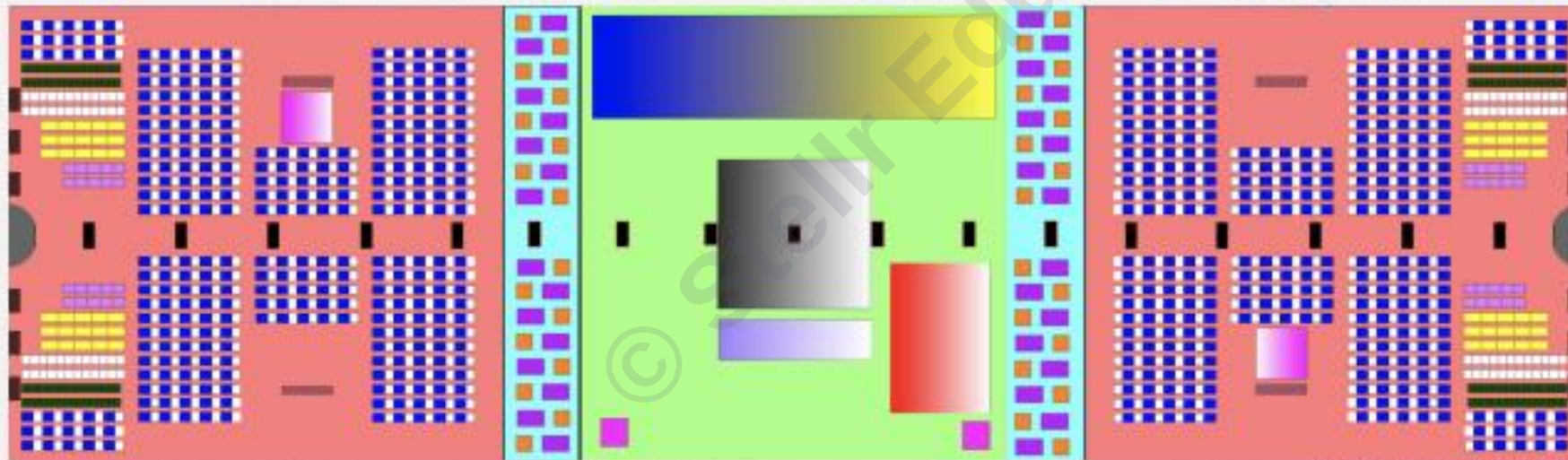


Residential Facilities

Each torus has four sectors:

Below model is only 1/4th of a torus

- | | | | |
|-----------------------|----------------|----------------------|------------------|
| Hospital | Control Room | Transient Population | Panic Rooms |
| Office/research space | Research labs | Recreational space | Air locks |
| Bot storage | Mall | Couples House | Couple w/ 1 kid |
| Restaurant | Ecosystem-Park | Singles House | Couple w/ 2 kids |

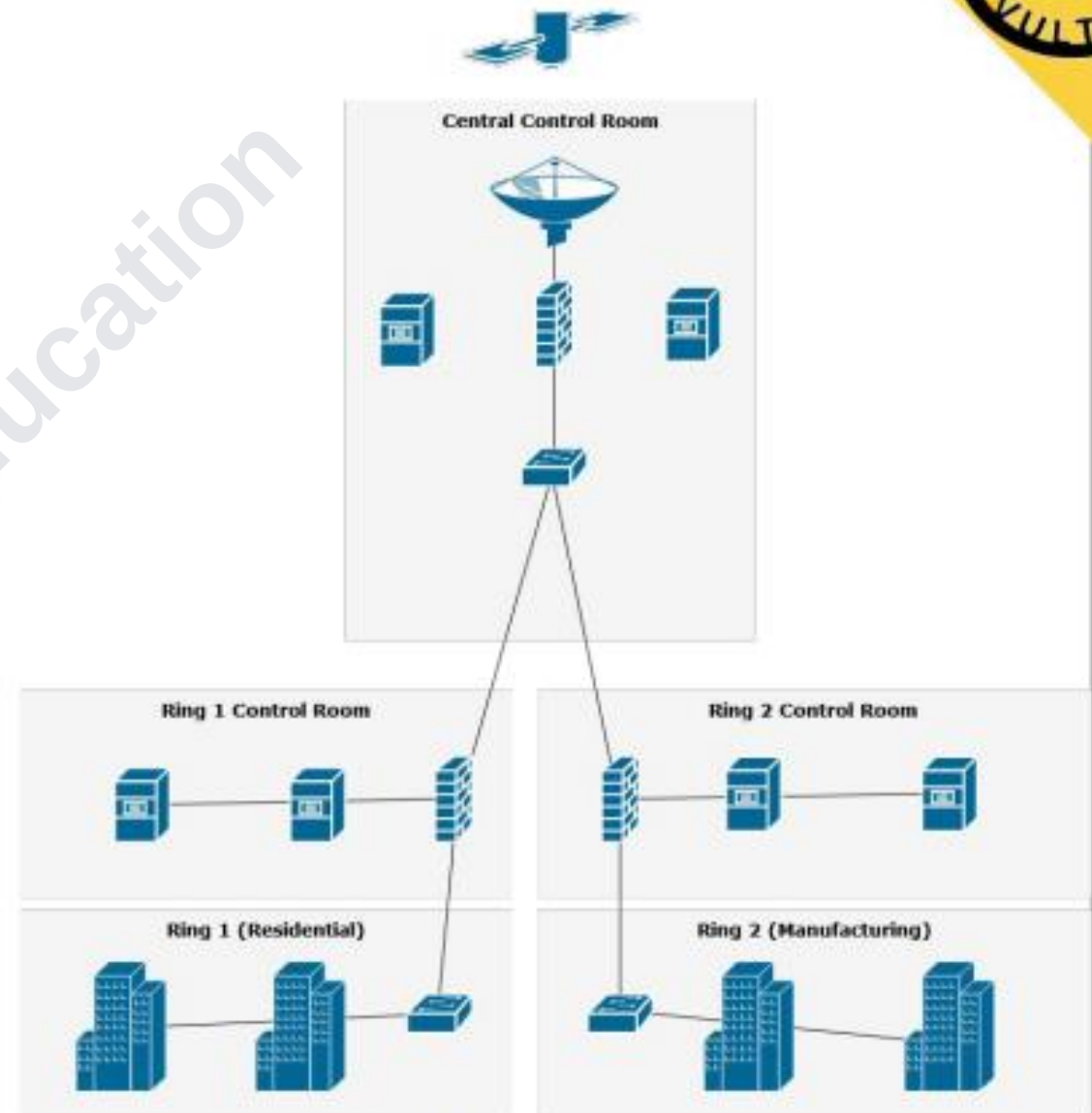


Community Layout: Apoorva, Aaron

5.2 - Automated Systems - Networking

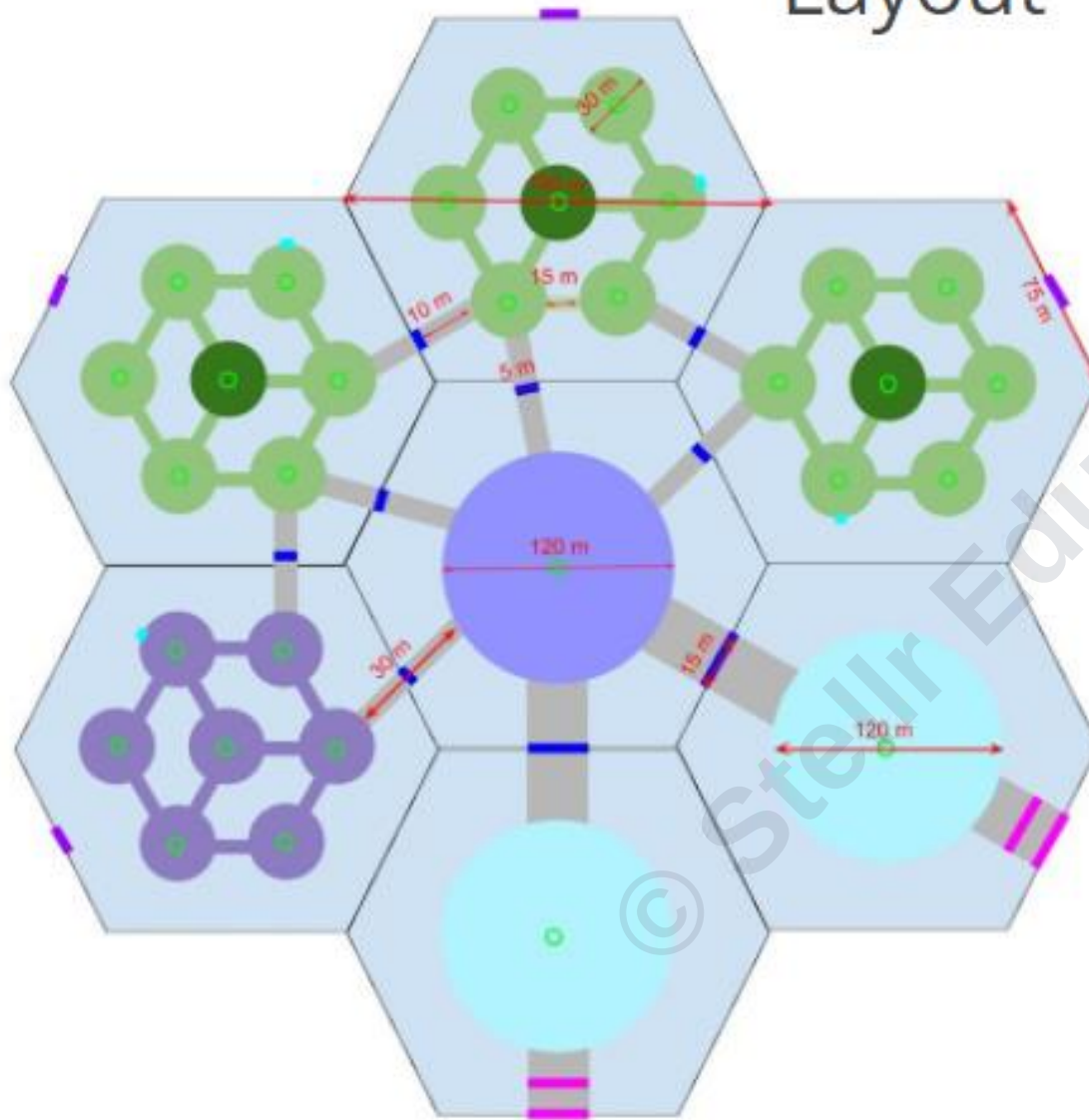


- Multiple wired redundancies
- Access points are available for wireless connection
- Terminals will be placed throughout the station
- Strict firewalls to prevent unneeded access to other parts of the network
- All traffic will be routed through the central control room
- Server located in the central tube for. Secondary storage in residential and manufacturing ring
 - Average person uses ~500GB of data.
 - $500\text{gb} * 14000 \text{ people} = 7000000\text{gb} = 7 \text{ petabytes of storage}$
 - Estimation 2 more petabytes from industry, other administration, and leeway.
 - 9 petabytes of storage in total.
- New domain ".merc" to host websites on Mercury
- OrbitLink Communications to network locally Mercury



By: Logan Senning

Layout

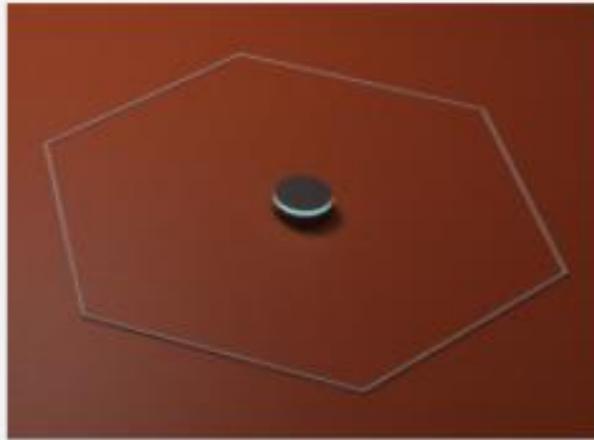


Legend	Down Surfaces
Residential Spaces (Modular Cells)	28,274 m ²
Community Spaces (Modular Cells)	2,121 m ²
Recreational Center	11,310 m ²
Research Lab/Office Spaces (Modular Cells)	20,264 m ²
Industrial/Manufacturing Spaces	22,620 m ²
Transport	2100 m ²
Interior bulkhead	
Interior/TARP airlock	
TARP/TARP airlock	
Emergency exterior airlock	
Standard exterior airlock	

Construction Process

5

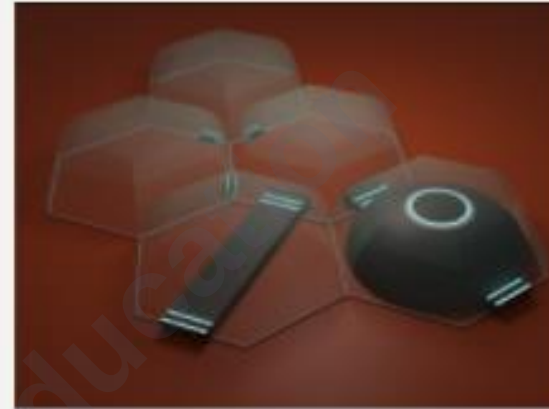
Stage 1: Ground Zero (2-4 months)



- Deploy robots and initial supplies, then control robots from humans in orbiting delivery ship.
- Complete initial 25% of 1st Rectenna. (Dougeldyne-Flechtel)
- Deploy safety enclosure shack on-site (Blown Away)
- First 5-10 workers arrive.
- Organize excavation/construction bot fleets
- Prep dirt (compact/pave paths, Planetary Pavers), lay screw-pile foundation (Holey Moley) and inflate 1st MAGIC-TARP
- Deploy inflatable frame (Blown Away) and inject regolith/sulfur cement
- Establish control rooms, server rooms, materials processing facilities, and automation facilities (repurposed CASSSCs)
- Construct first set of power lines, expand first rectenna to 50% , and construct 2 antennas (Flechtel Constructors) outside of MAGIC-TARPS

RFP Points: 2.3

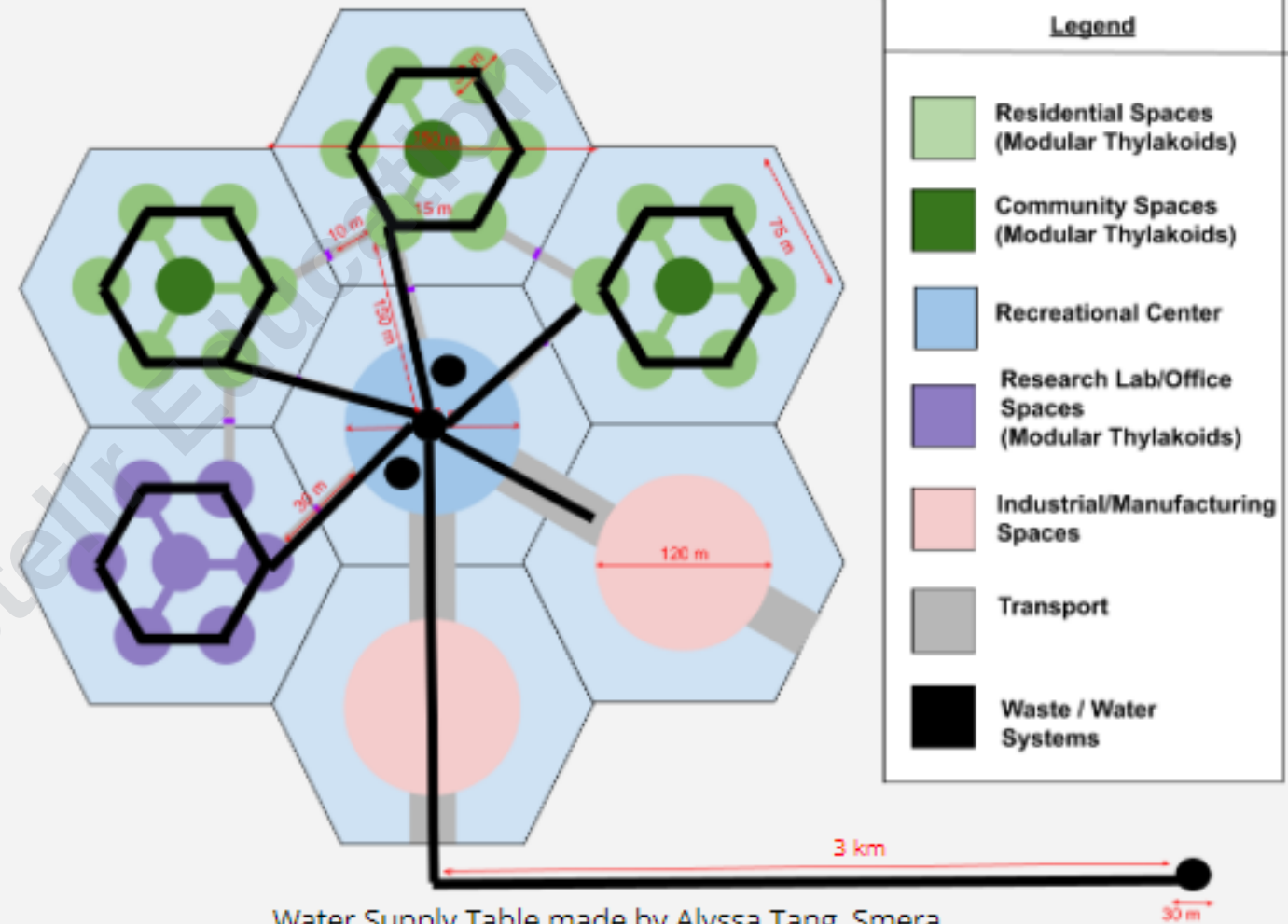
Stage 2: First Residential (3-5 months)



- Prep dirt & lay foundations for lab spaces, recreational center, second industrial facility, and first residential center
- Inflate 3 MAGIC-TARPS for these spaces
- Construction protocol: Deploy inflatable forms (Blown Away) and inject regolith/sulfur cement. Repurpose used CASSSC's for non-load-bearing elements.
- Build first residential section; start building recreational center, lab/office spaces, and second industrial section
- Construct first 6-7 tubes
- First rectenna 75-100% constructed, 2nd rectenna 0-25% constructed; 2 more antennas constructed

Waste Management

- **Toss it to Me:** recycles trash, sending 10% to landfill
- **Waste Products:** recycled human waste into water, fertilizer, and a source of carbon
- Recreational waste bins separating general waste, recyclables, and other to keep communities clean
- Repurposing waste
 - **Carbon Creations:** turns carbon from Waste Products/Toss it it Me into fuels and plastics
 - Biological solid waste will be burnt for fuel



Water Supply Table made by Alyssa Tang, Smera Venkateswar in Google Sheets

Furniture



Interior Render Made by Carly Zhou in Live Home 3D

- Subcontractor **Remotely Local Products** manufactures all furniture and appliances.
- Carbon and silicon supplied by subcontractors **Carbon Creations** , **Toss it to Me**, and **Waste Products**. Waste can be recycled into furniture.

Furniture Type	Family Unit	Couple Unit
Sectional	1	1
Armchair (assorted)	5	3
Dining table	1	1
Stools	4	4
Dining chairs	6	6
Poufs/ottomans	3	1
Bed	2	1
Desk	1	1
Shower	1	1
Bidet	1	1
Bathroom counter	1	1
Fireplace	1	1
Bookshelves	8	8
Ficuses	5	4
Stove	1	1
Kitchen sink	1	1
Dishwasher	1	1
Kitchen base units	6	7
Kitchen cabinets	6	7
Kitchen island	1	1

Furniture Table Made by Carly Zhou in Google Sheets

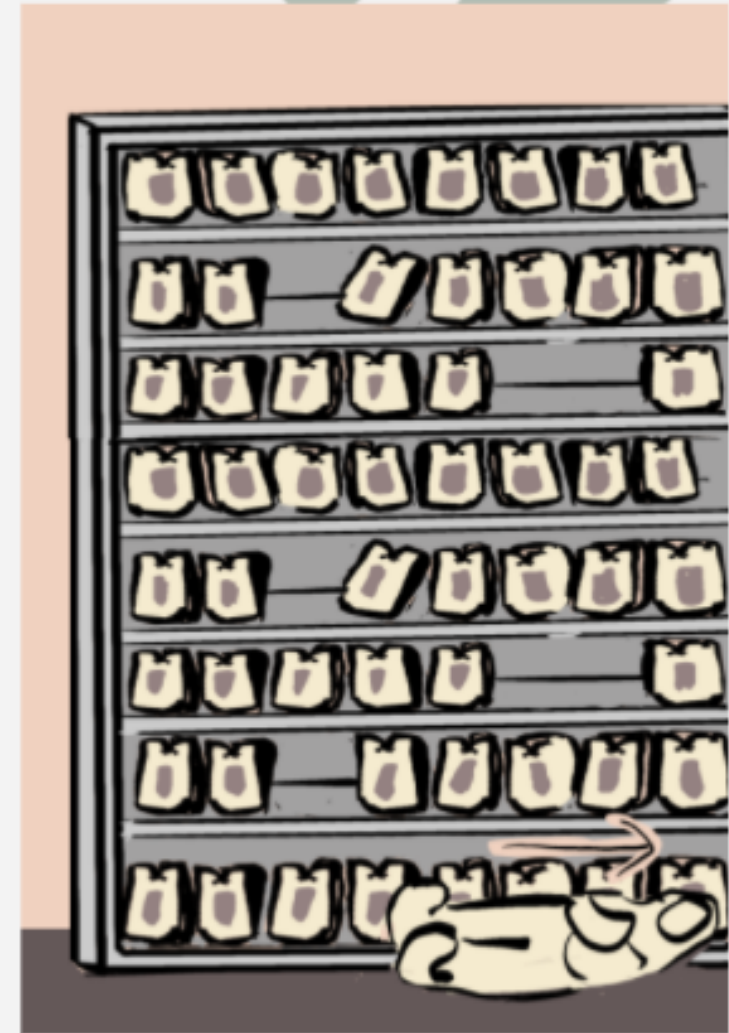
Spacesuits: Types, Quantities, and Features

Type	Count	Purpose & Features
Extravehicular Activity (EVA) Suit	Initial: 400 + 40 spares (various sizes) Replacements: 40/year	Hard-shelled, fiberglass; for maintenance & emergencies; mitigates radiation
Outer Protective Layer	Initial: 400 + 80 spares (various sizes) Replacements: 100/year	Thin outer layer worn over EVA suits for dust mitigation; can be taken off, cleaned, washed, and reused
TARP Suit	Initial: 75 (various sizes) Replacements: 20/year	Thin, athletic, and flexible suit; for recreation; used and stored in the central TARP

Subcontractor: **Extreme Survival Technologies (EST)**

Spacesuit Table made by Grace Jin in Google Sheets

RFP Points: 4.4



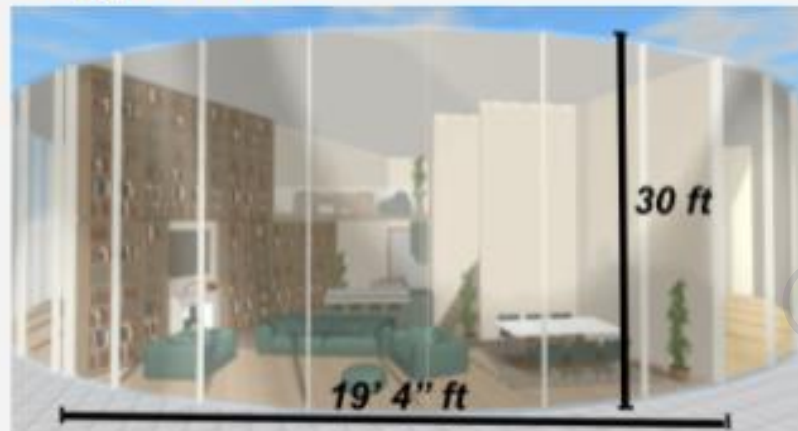
Spacesuit Storage Facility made by Matilda Hilton in Procreate

Family exterior



Family Housing Render made by Carly Zhou in Live Home 3D

Single exterior

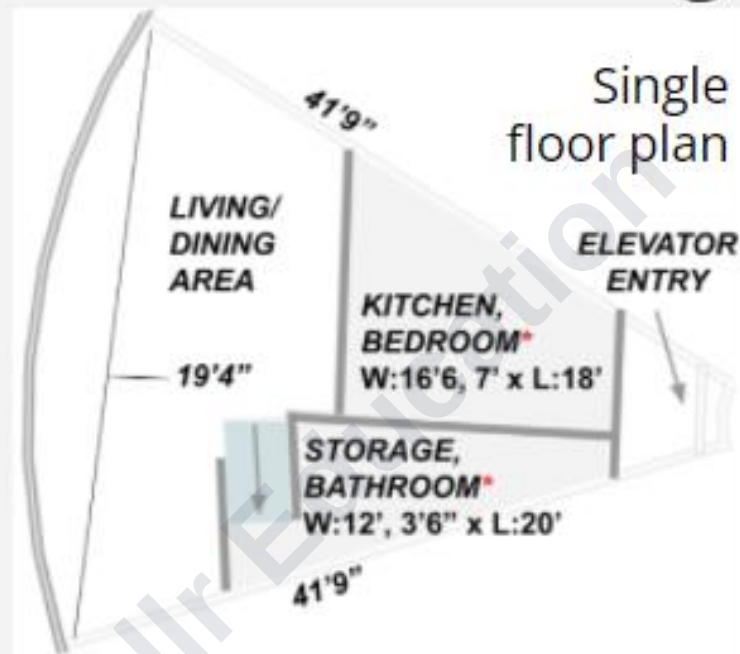


Single Housing Render Made by Carly Zhou in Live Home 3D

*High ceilings due to higher jump height

RFP Points: 4.2

Residential Housing



Single Floor plan made by Carly Zhou in Google Drawing



Family Floor plan made by Carly Zhou in Google Drawing

	Area (Sq. ft)	Area Division	Total
Family Unit	1177.9173	Sextant ($\frac{1}{6}$ of thylakoid)	80 units, 240 ppl (3 people per unit)
Single Unit	883.4379	Octant ($\frac{1}{8}$ of thylakoid)	80 units, 160 ppl (1-2 people per unit)

Housing Table made by Carly Zhou in Google Sheets