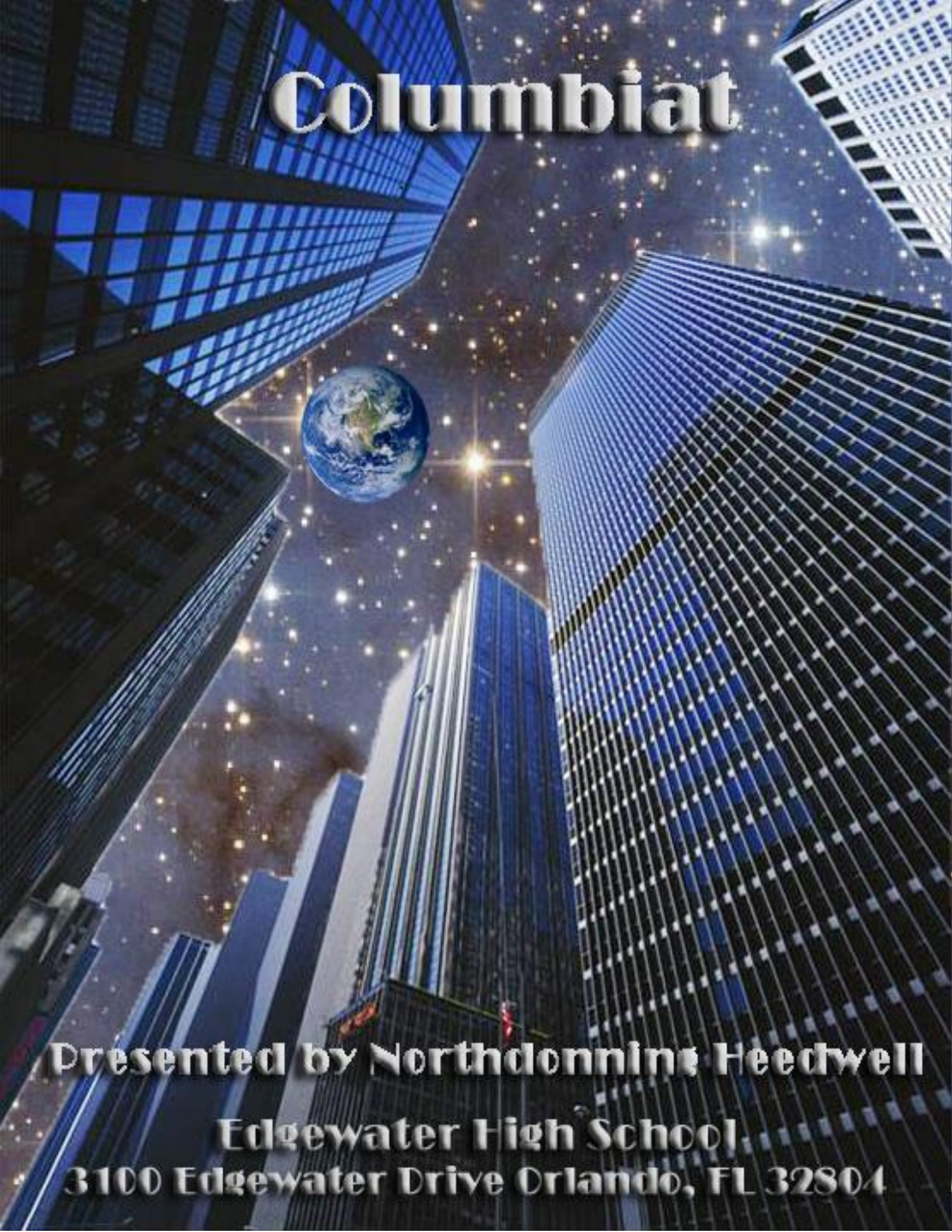
Columbiat
Presented by Northdonning Heedwell
Edgewater High School
3100 Edgewater Drive Orlando, FL 32804

21st Annual International Space Settlement Design Competition
Proposing Team Data 2014

Name of responsible teacher/advisor: Jason Seickel
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Names, [grade levels], and (ages) of 12 students currently expecting to attend the Finalist Comp:

Taylor Krublit [12](18)	Jonathan Henderson [11](17)	Gina Dignam [11](17)
Ian Vanness [12](18)	Nixza Gonzalez [9](15)	James Smalley [9](15)
Marcus Smith [12](18)	Dustin Canfield [9](15)	Billy Flowers [11](17)
Jasper Zaporteza [11](17)	Amy Solomon [9](15)	Adrian Wallace [12](18)

Names of two adult advisors currently expecting to attend the Finalist Competition:
Justin Sumpter, Chelsea Rohrer

I inderstand that if our Team qualifies for the International Space Settlement Design Finalist Competition, we will have to pay for our own travel to/from Cape Canaveral, Florida, USA

Jason Seickel — April 19, 2014

Responsible Teacher/ Advisor Signature — Date

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1.0 Executive Summary

Northdonning Heedwell has taken great strides to design a station to live up to the Foundation Society's grand vision of Columbiat. This station will be the pinnacle of human engineering and ambition, an impossible city hanging above the Earth and Moon on a string, a grand capital for space exploration and colonization, the embarkment point for a century of pioneers, the crossroads of trade and travel between the Moon and Earth, Mars and the Asteroid Belt, maybe even the hot inner planets, or the cold moons of the gas giants. Who knows how far we'll go?

The scale of this project is unprecedented; Columbiat will be the largest and most populous Foundation Society settlement to date by far. This undertaking would be nothing but a dream were it not for the recently completed Alaskol settlement 37,000 miles directly below the prime real estate. Columbiat will and can only be constructed from lunar materials, the task of bringing the vast amount of materials to construct the 25,000+ citizen city would be herculean. By using the largest mining and refining station off of Earth as a base camp, we bring this project from science fiction to a fully-reachable reality. Our team has a great deal of knowledge of Columbiat's sister-colony's capabilities, on our team are the System's Engineer and Director of Operations for the Alaskol settlement, recently recruited from Grumbo Aerospace. This added expertise gives Northdonning Heedwell a massive lead over the competition, any other company is going into this blind to what's already out there, we have a solid base guaranteed for us to be able to build off of.

Columbiat's design draws inspiration from the Foundation Society settlements that came before it. We will have some of the manufacturing capabilities of Bellevistat and Alaskol both to produce the buckystructures required to build the space elevator and settlement, and also to capitalize off of the enormously profitable industry. Taking inspiration from Alexandriat, we will have a smaller ring within the main torus with half the gravity and higher air pressure. This gives us both the practical benefit of having an ideal environment for growing 25,000 people's worth of crops, but also gives us a place to house retirees and hold station wide cultural events.

The innovative structural design of the station was created to be efficient to build on the buckystructure elevator cable. The inverted torus allows us to begin rotation with traditional rockets and bring it to full speed and sustain rotation using electromagnets powered by the station's twin nuclear reactors. The industrial sections and docking area are designed for easy expandability outwards and upwards.

To accommodate citizens from different nations, cultures, and time zones, Columbiat's community will be designed around six different world cities: New York, Paris, Dubai, Sydney, Singapore, and Hollywood. The residential torus will be divided into six sections, one based around each city and its culture. Each section will have its own time zone, each offset by four hours, because of this, Columbiat will truly be a world city that never sleeps. Behind the scenes, the colony will feature fully automated life support and maintenance for maximum efficiency and convenience for the busy residents managing humanity's commerce in space.

STRUCTURES

"ARCHITECTURE IS, AND ALWAYS WILL BE CONCERNED, ROUGHLY SPEAKING, WITH CAREFULLY BALANCING HORIZONTAL THINGS ON TOP OF VERTICAL THINGS." - REYNER BANHAM

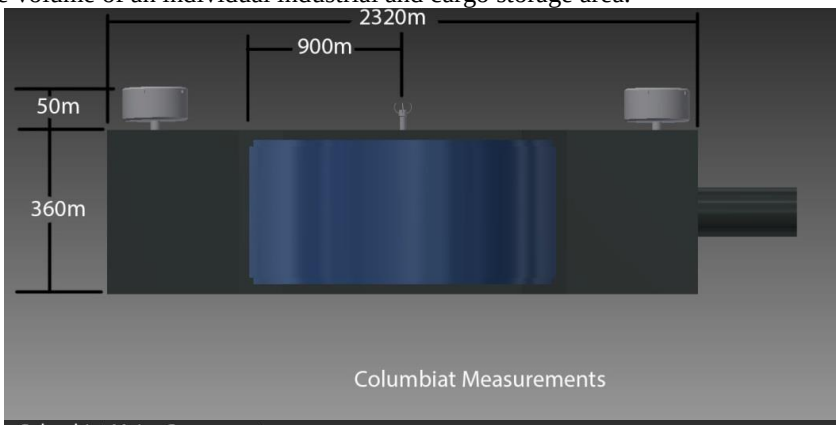
2.0 Structural Design

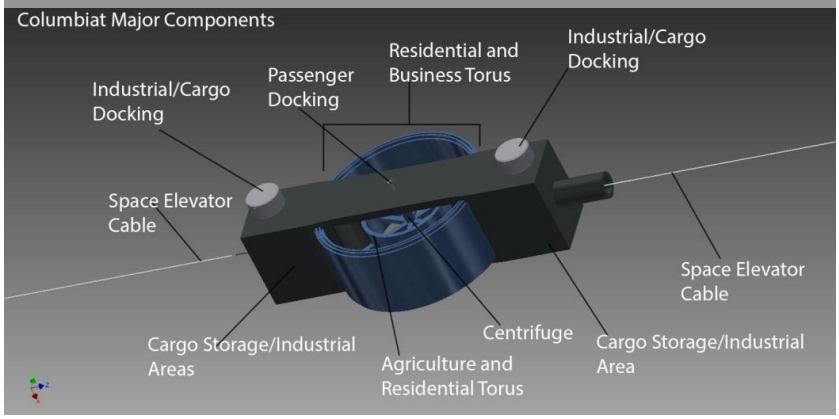
Columbiat's unique inverted torus design provides not just a pleasant and unique environment for the 23000 full-time residents and 2500 transients, but also provides a safe environment for residents with clear boundaries between industrial and residential regions and simulated natural views for our citizens while protecting them from any cosmic radiation.

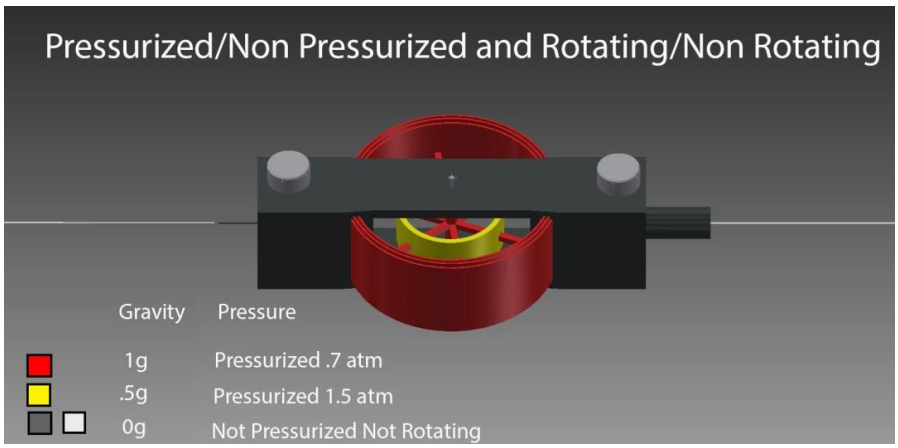
2.1 External Design

2.1.1 Large Enclosed Volumes and Major External Structures

The inner Torus is at half of Earth's gravity and used as a retirement center and an agricultural station. Its volume is 10,797,244$m^{3.}$ The outer Torus is used as a residential and commercial unit. Its volume is 54,895,913m^3. 10,800,000m^3 is the volume of an individual industrial and cargo storage area.







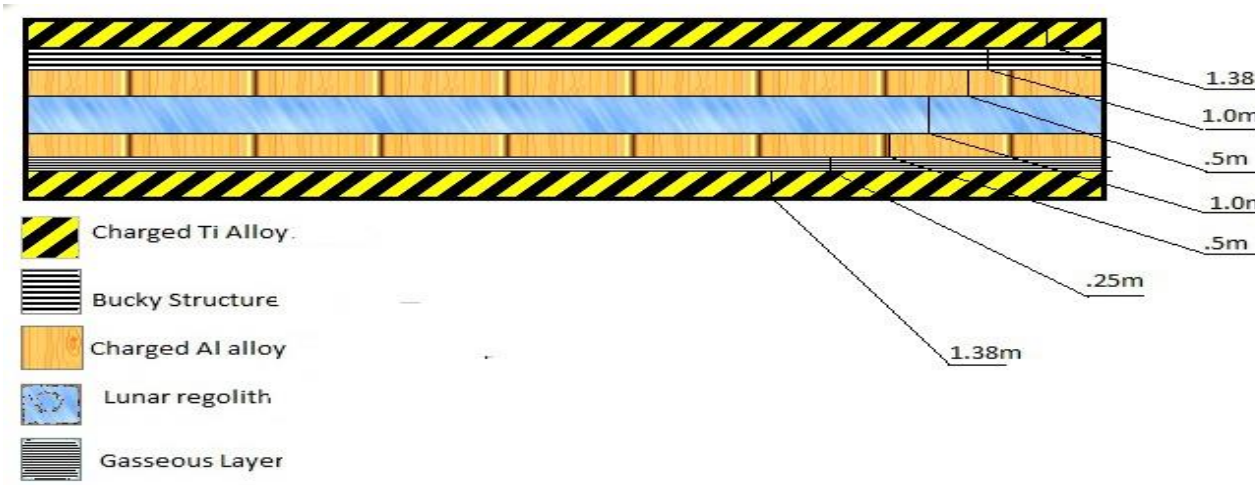
2.1.2 Pressurized, Unpressurized, Rotating and Non-Rotating Volumes with Artificial Gravity

2.1.3 Materials of the Hull - Residential Torus & Industrial Area

The industrial and residential hull will contain silicon buckystructures, titanium, lunar regolith and aluminum.

Material	Thickness of layering	Purpose
Silicon Buckystructures	1meter	Maintaining structural integrity and Shielding
Titanium	1.38 meters	Structural integrity and radiation protection
Lunar regolith	1 meter	Radiation protection
Gaseous Layer	25 cm	Reserved for infrastructure
Aluminum	0.5m	Radiation Protection

Residential/Industrial Hull Design



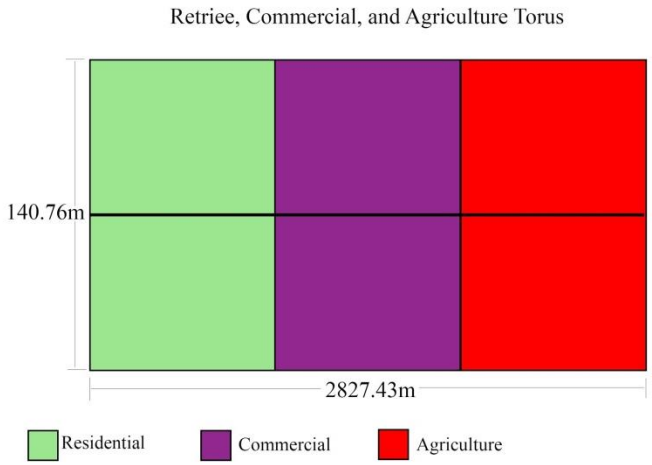
2.2 Down Surfaces

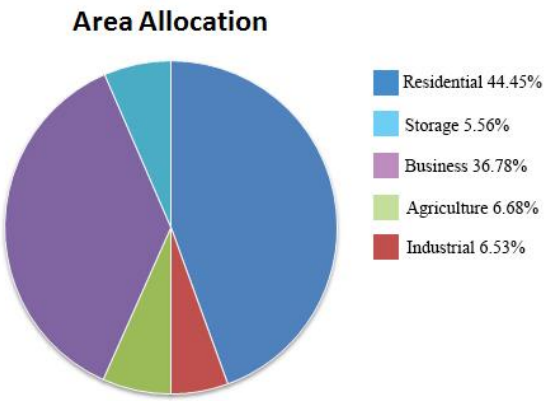
Columbiat's residential/commercial torus down surface is divided into 6 sections. These 6 sections are divided further into residential and commercial sections. The low-g retiree torus is divided into the 3 sections of residential, commercial and agriculture.

The vertical clearance will be 28 meters for both tori. For the outer torus this allows there to be enough space for buildings with 6+ floors along with additional space for storage and the ground between each floor. Buildings within this vertical clearance will not be impacted by any loss in gravity. The vertical clearance is the same for the low g torus to allow room for the multiple layers of crops and housing for the retirees.

Zone	**Percent Allocated**	**Area (in m^2)**
Residential	44.45%	1,020,000 m^2
Agriculture	6.68%	153,000 m^2
Storage	5.56%	127500 m^2
Business	36.78%	844050 m^2

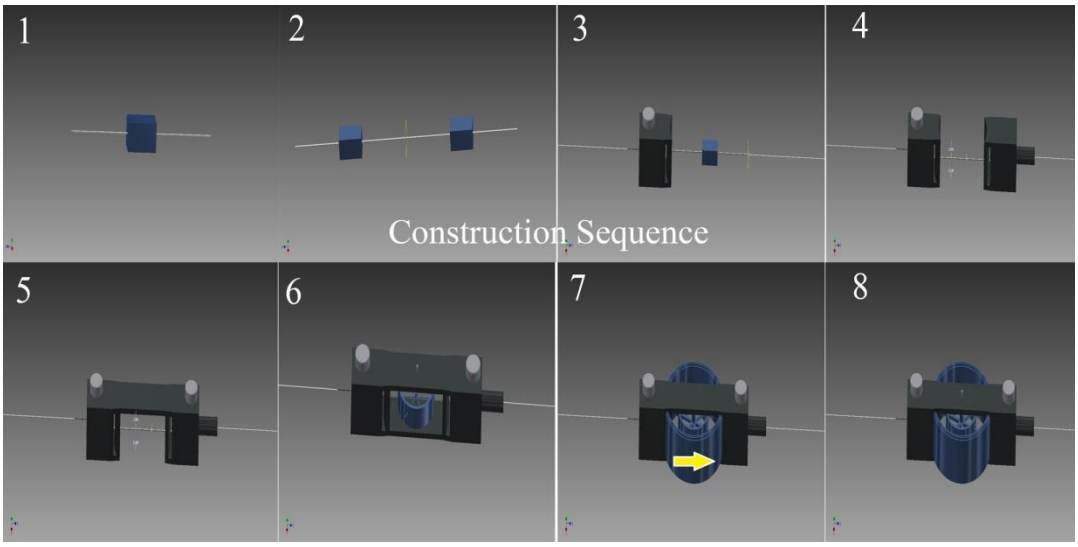
Industrial	6.53%	150000 m^2
Total	100%	2294550 m^2





2.3 Construction Process

Constructing a temporary industrial station first and sending both the space elevator cable and the counterweight allows the station to maintain a stable position within the unstable Earth-Moon L1 point. Without both tethers to balance the structure, the station will either fall toward the Earth or the moon. Constructing both tethers allows construction materials to be sent up from Alaskol via the space elevator cable. Constructing the station in this sequence allows maximum use of industrial areas during the construction sequence. Additionally, through construction of industrial docking, industrial materials can be received and sorted during the construction sequence. Overall, constructing the station using this method allows for best use of resources, and industrial space to lessen expenses and ease construction.

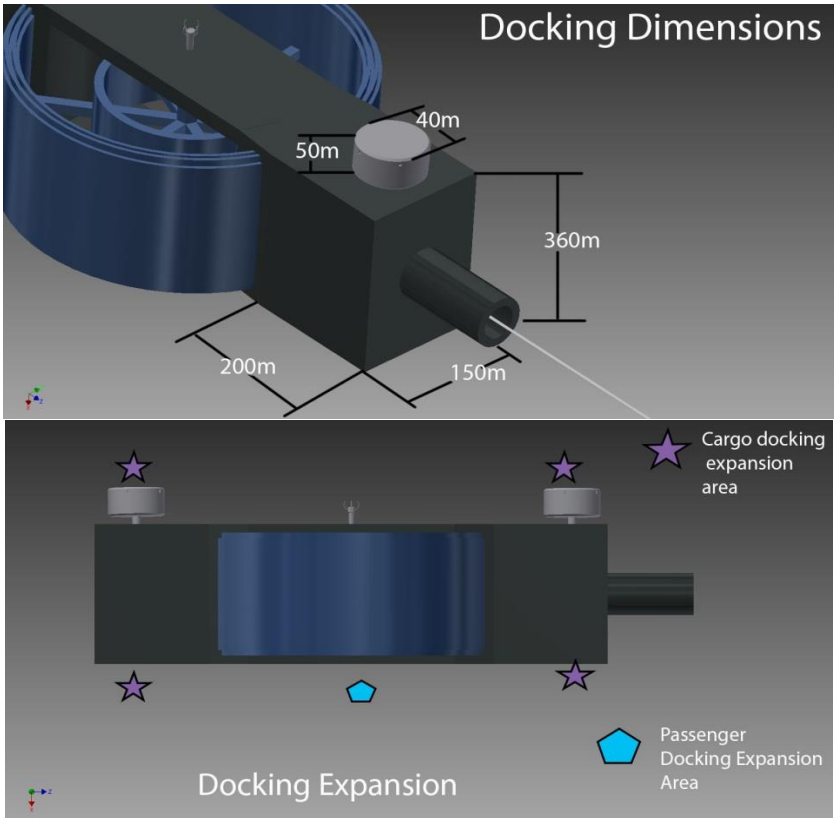


Step #/Title of Step	Description of Step	Materials
1. Argo	Small industrial area placed in L1 point. Elevator cable and counterweight are extruded.	Buckystructures, Charged Titanium alloy, charged aluminum alloy, lunar regolith
2. Santa Maria	Split industrial area in half, the outer end of the original area spread the full distance of 2320m apart.	Buckystructures, lunar regolith, charged titanium alloy, charged aluminum alloy.
3. Flying Cloud	The first industrial section is fully completed and industrial docking is built.	Charged aluminum alloy, buckystructures, lunar regolith, gaseous layer, charged Titanium alloy.
4. Savannah	Space elevator docking station is now built and the second industrial area expansion is started	Charged aluminum alloy, buckystructures, lunar regolith, charged Titanium alloy.
5. Wright	The second industrial section is completed along with the second industrial docking. The construction of the bracers begins.	Charged aluminum alloy, buckystructures, lunar regolith, charged Titanium alloy.
6. Enterprise	The cable running through the middle of the station is cut and construction on the centrifuge, spokes, and inner torus begins.	Titanium alloys, aluminum alloys, buckystructures

7. Eagle	Construction of the outer torus, rotation is initiated (seen by the yellow arrow; refer to ops 3.4.1). Community construction begins.	Charged Titanium Alloy, buckystructures, infrastructure, charged aluminum alloy, lunar regolith
8. Discovery	Passenger docking is completed. Infrastructure and community is completed.	Buckystructures and infrastructure space

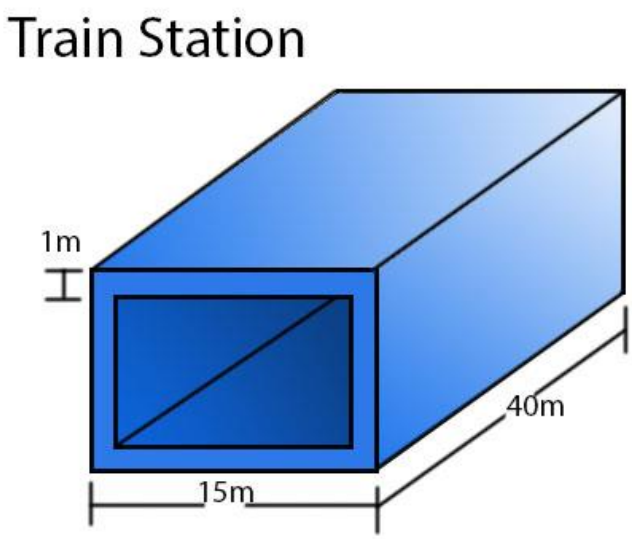
2.4 Cargo and Passenger Docking

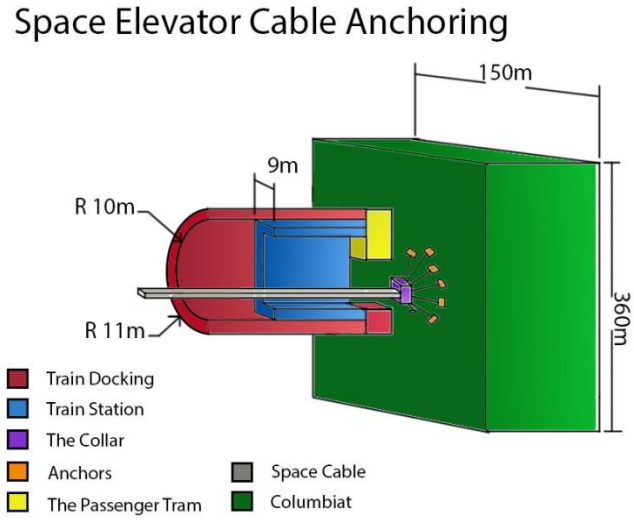
Passenger docking will hold one passenger ship at a time, and will be expanded by the addition of another human port on the opposite side of the centrifuge. Cargo docking ports will service four ships at once, and will be expanded through stacking the ports on top of each other and adding ports on the opposite side of the station. Passenger docking will be most effective by routing the direct transportation into the centrifuge and then into the torus. This will separate the passenger docking from the industrial docking. Industrial docking will provide almost limitless time of docking in any of the four docking directions due to its ability to stack ports vertically on top of each other. The automated processes will quickly repair, load, and unload ships that can be docked for any amount of time. These automated processes and multiple industrial docking ports allow more ships to drop off cargo and trade goods faster, allowing Columbiat to be an interstellar commercial hub of activity.



2.5 Space elevator

The space elevator cab stop where the space elevator cab meets Columbiat will be a rectangular prism. In this station, passengers will exit and board the space elevator cab. Cargo containers will be unloaded outside of the station, and a tram will be located inside of the station in order to provide transportation to passenger docking. The tram will travel to the passenger docking to provide visitors from the moon the same experience as those coming from other stations and will allow them to choose a time zone/city that they wish to be in. From the passenger docking, the residents will be transported back to the district of their choice. The docking station of the space cab will contain small stores and seating as the residents wait for the tram.





OPERATIONS

"THE SMALLEST PATCH OF GREEN TO ARREST THE MONOTONY OF ASPHALT AND CONCRETE IS AS IMPORTANT TO THE VALUE OF REAL ESTATE AS STREETS, SEWERS AND CONVENIENT SHOPPING." -JAMES FELT

3.0 Operations

Columbiat's design and infrastructure will be designed to maximize efficiency and convenience in construction of the port of call at 37,000 miles, supporting everyday life for residents and its countless visitors, and facilitating transportation and trade through our orbital crossroads.

3.1 Materials and Equipment

3.1.1 Sources of Materials and Equipment

Material	Source	Purpose	Quantity
Titanium - grade 5	Alaskol	Main structure	27,772,317 tonnes
Regolith	Alaskol	Radiation/impact shielding	6,490,352 tonnes
Buckystructures	Feedstock on Alaskol, manufactured on site	Elevator cable, wiring, insulation	3,898,743 tonnes
Aluminum-2195	Alaskol	Main structure	7,096,118 tonnes
Uranium	Earth	Power generation	5 tonnes
Oxygen	Alaskol	Atmosphere, propulsion	19955 tonnes
Hydrogen	Alaskol	Propulsion	2500 tonnes
Nitrogen	Alaskol	Atmosphere	50 tonnes
Srang construction robots	Belevistat	Assembling the main structure	150 robots
Bamboo	Columbiat	Housing	18,000 tonnes
Refined Regolith	Alaskol	Furniture	14,000 tonnes

3.1.2 Transportation of Materials

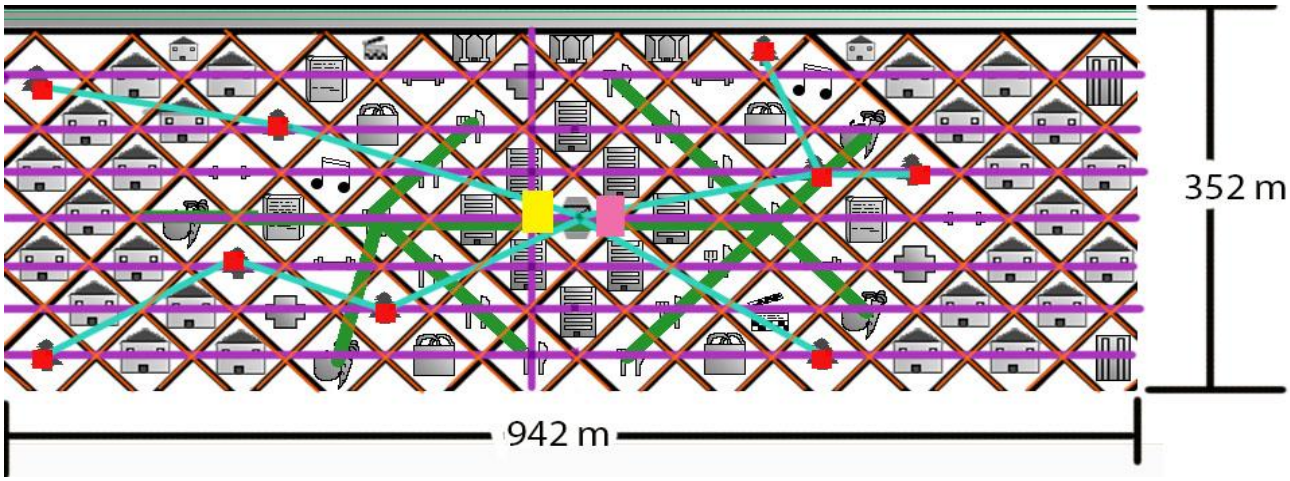
Buckystructure feedstock for the elevator cable will be launched to the initial structure from the Moon using Alaskol's mass driver. Once the cable has been attached to the moon, elevator cars will bring up the majority of the station's materials. Titanium, regolith, and aluminum for the hull will all come from Alaskol. Uranium will be brought from Earth independent of any other materials in standard shielded containers. Bamboo will be grown on site.

3.1.3 Storage of Materials

The primary module that will be placed in the L1 point will include temporary docking and storage facilities that will hold any construction materials and equipment until the full warehouses are completed (see 5.4.2) Uranium will be kept near the reactor in a lead-lined storage room to prevent contamination of other cargo and depleted fuel will be collected, resealed, and returned to Earth for disposal.

3.2 Basic Infrastructure

Columbiat's community infrastructure will provide a completely seamless life support system for the residents' convenience and peace of mind. The interior of the settlement will provide amenities befitting everything from a small town to an orbital megacity.



3.2.1 Atmosphere, Climate, and Weather Control

To filter out carbon dioxide, Columbiat will have air be filtered to aluminum tanks within fake trees in the community parks, containing an ethanolamine solution to bond with the CO2. The solvent will bond with the carbon dioxide which will then be separated from the air when the solution is heated and routed to the agricultural center for use of the plants. The plants in turn will then convert the carbon dioxide to oxygen to repeat the process. The buckystructures in the hull insulate the station to keep heat in because of its thermal insulating qualities. Cooling will be made possible by radiators and electric cooling to maintain optimal temperatures within each of the station's sections. To make for optimal air quantities and comfort while factoring in price, the pressures in the station will be 0.7 atm for public and residential areas, and 1.5 atm for the agricultural center to promote plant growth and for added comfort for retirees.

Gas	Atmospheric Percentage (%)-	Quantity (Mass)
Nitrogen	79%	50 tonnes
Oxygen	21%	15 tonnes

Area	Temperature (F)	Humidity (%)	Pressure
Public	72 degrees	35%	0.7 atm
Residential	72 degrees	35%	0.7 atm
Agricultural	~80 degrees	82%	1.5 atm

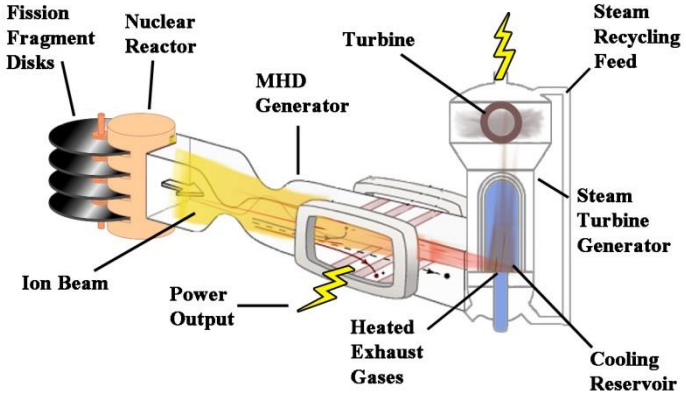
3.2.2 Food Production

Crops will be grown in an ideal low gravity, high pressure, high temperature environment. To promote optimal growth, dynaponics will be used to convey nutrients. Crops will be harvested by Ernte robots (see 5.2) Meat will be produced by bioprinting animal stem cells grown in vitro. Bioprinting can simulate different cuts of meat to meet a variety of tastes. Food will be transported through a pneumatic tube system which will bring food from the half-g torus to the stores in the residential torus. In case of blight, the station will have two weeks' worth of contingency food stored in silica aerogel containers at any time. Each section will hold an equal share of the backup food. Columbiat will also grow bamboo for a source of housing materials and paper.

Product	**Grams per person per day- 15.963 kg/year**
Grains	400
Fruits	350
Vegetables/Legumes	450
Meat Products	175
Total	**1375**

3.2.3 Electrical Power Generation

Electrical power will be provided via the use of 2 industrial nuclear reactors. The nuclear reactors will run on a fission fragment process to efficiently generate electricity through use of a magnetohydrodynamic (MHD) generator, with gaseous byproducts being used to power a steam turbine for additional efficiency. It will run on the fission of Uranium-235 arranged in spinning disks to produce a high amount of heat and fission byproducts which can be decelerated to produce power. The fuel is stored in rotating disks so that the outermost layers will be the most likely to undergo fission and ionized due to the high temperatures of the reaction and handled magnetically through the MHD generator, which will decelerate the charged ions to generate electricity, then the remaining high temperature gases will pass through a heat exchanger to generate more power from the exhaust, finally the radioactive waste gases will be compressed and stored until they can be returned to Earth. If one reactor fails, the other will be able to double its output for up to two weeks while repairs are made, however, it will not be possible for the reactors to experience a meltdown, the heat generated by the Uranium fuel will be spread over such a large surface area to prevent any components from reaching critical temperatures. Power will be carried through the settlement by buckystructure wires.



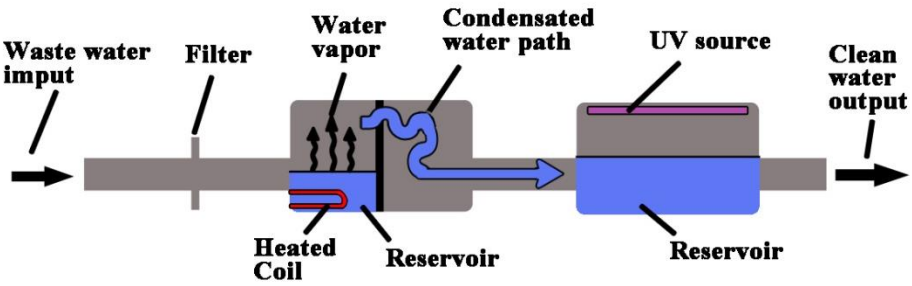
Uses	Amount (kW)
Residential	80,000 kW
Industrial	500,000 kW
Agriculture	2,000 kW
Life Support	10,000 kW
Total	**592,000 kW**

3.2.4 Water Management

Sewage will be pumped to a waste treatment plant beneath the business center of each section. Water will be separated from solid waste through vapor distillation, the waste will be heated until most of the water has evaporated out. The vapor will then be condensed back to a liquid and subjected to a series of microfilters and UV radiation to further purify it and kill any pathogens. The remaining sewage will continue on to the solid waste treatment center.

Each section of the residential torus will store and recycle its own water supply, if any section detects contamination in its water supply, it can pump water in from the two adjacent sections until water quality can be restored.

Purpose	Amount (L)
Residential	8,500,000 L
Agricultural	2,000,000 L
Contingency	3,000,000 L
Total	**13,500,000 L**

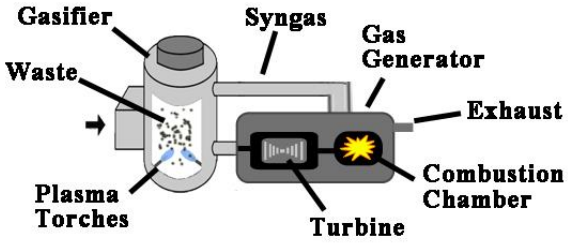


3.2.5 Solid Waste Management

After most of the water is removed, the waste will be delivered into a plasma gasifier unit to incinerate the waste and turn it into syngas (mainly hydrogen, carbon monoxide and carbon dioxide) which can be combusted to produce electricity to sustain the system. As long as trash keeps going into the system, the gasifier can replenish

itself with only occasional required maintenance. The anaerobic nature of the gasifier chamber will eliminate any production of toxic byproducts. The inorganic recyclables will be reprocessed and repurposed back into commission, as all inorganic matter on the station will be recyclable.

Waste Source	**Approximate amount (tonnes per year)**
Residential - Organic	3,200,000 tonnes
Residential - Inorganic	550,000 tonnes
Agricultural	25,000 tonnes
Total	**3,775,000 tonnes**



3.2.6 Communication

Internal Communication

Within Columbiat internal communications will be provided with the use of fashion and communications accessories called Savast. These devices are highly customizable and come in necklaces, rings, watches, and wristbands all connected to each other wirelessly and utilize molecular storage technology to deliver information at fast speeds. These devices can also project holograms through ionized particles and laser gridding to communicate in a 3 dimensional aspect. Radio frequency communication will allow the devices the ability to provide inhabitants with communication possibilities along with installed other features (see automations). Internet access will be provided through local servers containing a mirror of the most frequently visited sites to delay latency. For queries of uncached information, WAN (Wide Area Network) optimization software shall be used to improve performance through eliminating redundant data, compressing information, prioritizing information, and controlling data flow for consistency.

External Communications.

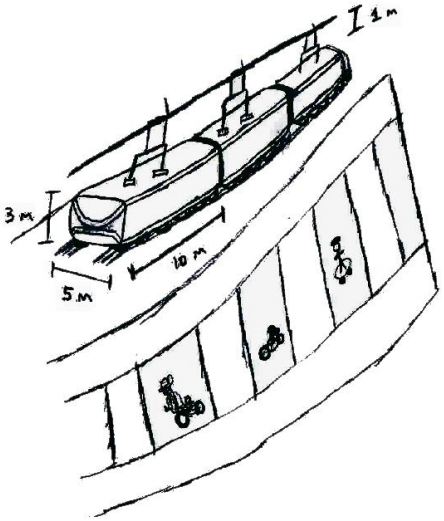
Columbiat will utilize an array of laser transmitters to communicate with the Earth and other stations. Through the use of wavelength multiplexing, Columbiat will be capable of meeting the demand for bandwidth in the foreseeable future. In addition to the laser communication arrays, we will be able to communicate with Alaskol by running a fiber optic cable along the space elevator ribbon to directly connect the two stations and speed information transfer between them.

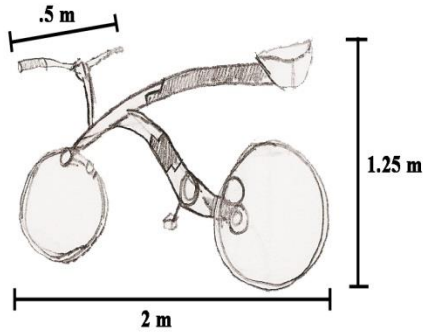
Device	**Function**	**Location**	**Quantity**
Laser Communication Transmitter and receiver	External Communication	Outside attached to station	12 each
Sovast accessories (ring, wristband, necklace)	Personal Device	On resident	29000 units each

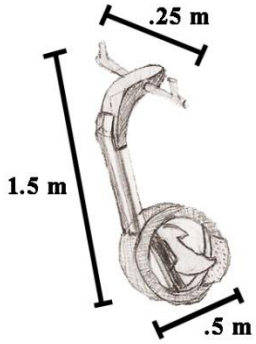
Radio dishes and transmitters	Internal Communication	In every area	24

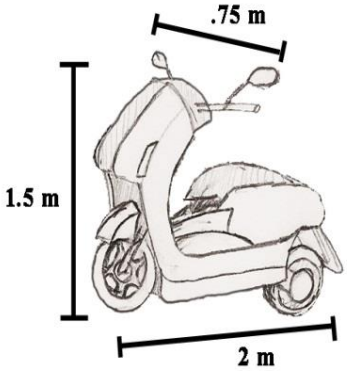
3.2.7 Internal Transportation

To provide exercise and leisure for inhabitants of Columbiat, we will have a 2 level transportation system around the mid perimeter of the torus. The lower level will be an open road for bikes and personal vehicle use while the upper level will have an electric trolley system for mass transportation around the tori to give a small town feel amongst the largeness of the city. To power the trolleys, electrically conductive buckystructures will be used as the overhead cable to give the vehicle enough electricity to move at a fast speed. Bikes, motorized scooters, and STATS will also be available for residents and transients to rent. The wheels of the STATS and scooter will be made out of an airless tire that is filled with a crisscrossing thermoplastic material both more durable than conventional tires and easier to recycle. There will also be a small electric tram to move residents to and from the space elevator dock, and an elevator within each spoke of the tori to move them between the centrifuge, half-g torus, and residential torus.









Vehicle	Quantity
Trolley	2

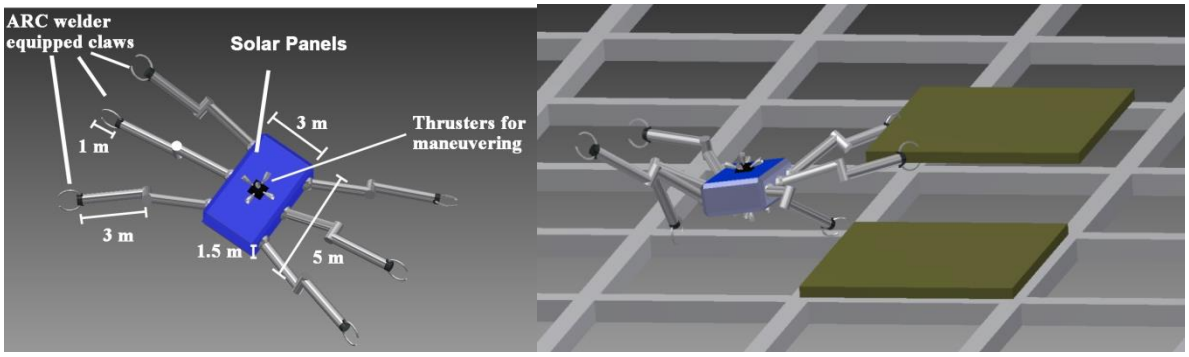
STATS (Single Tire And Transportation System)	2000
Scooter	5000
Bicycle	15000

3.2.8 Day and Night Cycle

Day and night cycles within the station will include the sectioning of the station into six themed cities each having their own time zones in increments of four hours. This will ensure that transients entering the station can enter to the area similar to their own time zones to prevent excessive disorientation. To simulate the daytime for inhabitants, we will project images of the Earth sky onto the ceiling and transition that according to the time. At night the ceiling will show video of the outside to see the Earth, moon, and stars and all the lights will be dimmed. The station literally becomes a city that never sleeps. The days will consist of 12 hours of daylight, 10 hours of night, and an hour of dawn or dusk in between. Each time zone follows the same schedule offset by four hours in each consecutive time zone. The station temperature will remain at a constant 72 degrees Fahrenheit to avoid creating convection currents between the time zones.

3.3 Construction Equipment and Machinery

The Srangs will have 6 arms for moving hull segments and gripping the structure, and two omni-directional thrusters for maneuvering. Each arm is equipped with an ARC welder for joining metal plates after the initial cold welding upon contact (see 5.1.1)



3.4 Propulsion Systems

3.4.1 Rotation of Artificial Gravity Volumes

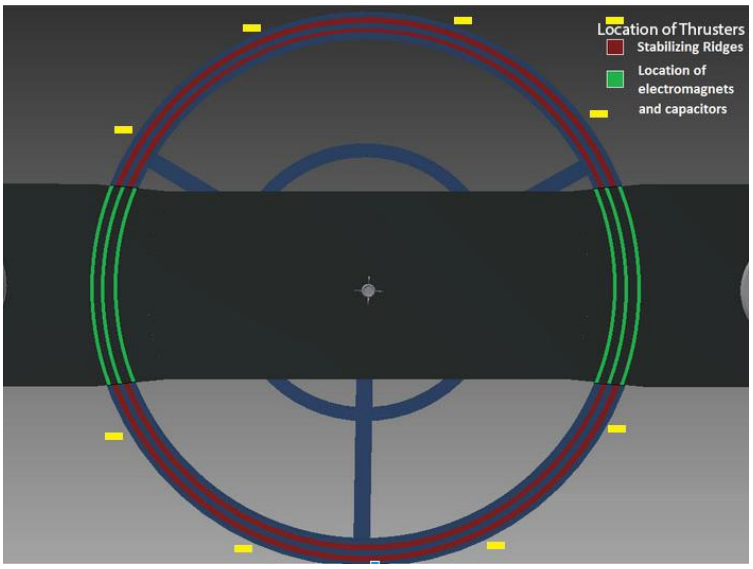
The torii will be brought to full rotational speed during construction step 7 (see 2.3) by an array of electromagnets that grip metal ridges built onto each side of the residential torus. Chemical rockets will be used to begin the rotation until it reaches the required 8.33 meters per second required for efficient electromagnetic suspension. These hydrogen-oxygen rockets will be attached to the outside edge of the residential torus and fire until the torus reaches the minimum speed, at which point the electromagnets will take over and accelerate it up to the target 94 m/s. Chemical fuel will be stored in the industrial area and brought to the thrusters by Srangs, the nuclear reactors will provide the electromagnet arrays with energy.

Propulsion Type	**Energy produced**	**Propellant required**
Chemical rockets	9,983 GJ	22320 tonnes

Electromagnetic induction	102,625 GJ	114 Gwh

3.4.2 Station-Keeping

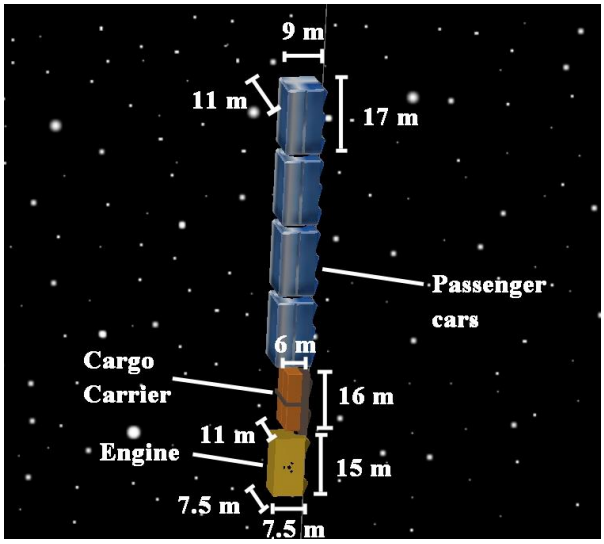
The Earthwards counterweight opposite to the space elevator cable is to provide the tension needed to keep Columbiat suspended in the Earth-Moon L1 point. However the Moon is known to "wobble" unpredictably, which could pull on the elevator cable and bring the whole station closer to the moon. To account for this, a winch system can be used to extend the counterweight cable to increase the tension and keep the whole system taut. Columbiat will monitor its position relative to the Earth and Moon constantly with an array of accelerometers and adjust the counterweight accordingly.



3.5 Space Elevator

3.5.1 Elevator Cab Design

The elevator car will be a train of passenger and cargo cars that can be chained together to accommodate different numbers of cargo containers and passengers. There will be a car designed to hold two standard cargo containers and a larger car to house 25 passengers for the 6 day. An "engine" car will provide power to the other cars from a liquid-thorium reactor. The different cars can be used in any combination to meet the amount of passengers and cargo needed. One train can consist of up to 6 passenger cars or 12 cargo containers; the standard configuration will be 4-25 person cars and 2 boxcars

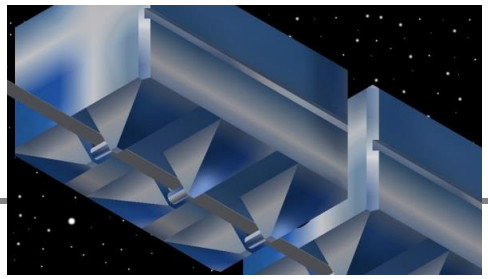


3.5.2 Attachment Method

The train cars will grip the buckystructure ribbon between pairs of steel rollers coated in high-friction Kevlar. The many attachment points made possible by the train design ensures a secure connection to the ribbon and spreads out the weight of the vehicle.

3.5.3 Method of Travel

The wheels will press on each other with high enough pressure to provide traction to climb the vertical cable. The engine will provide enough electricity to the individual cars of at least two to move the train at up to 250 miles per hour, with acceleration of no more than .25 g.



HUMAN FACTORS

"WHAT IS A CITY BUT THE PEOPLE?"
- WILLIAM SHAKESPEARE

4.0 Human Factors

Residents will be kept healthy and entertained with the variety of cultural activities and healthy options on Columbiat.

4.1 Community Attributes

Columbiat will be a bustling commerce city with areas diverse in time and culture, featuring attributes which residents from smaller cities will appreciate, as well as amenities busy inner city professional will enjoy.

4.1.1 Natural Sunlight and views

Columbiat will utilize simulated natural views projected during station nights to remind them of the beauty of their surroundings and to have an eye on outer cosmic events (refer to 3.2.8 for more information). They will also be provided in docking areas and inside the space cabs for additional aesthetic appeal.

4.1.2 Community Amenities

Columbiat will be an enlivened settlement split into 6 "cities" each heavily inspired by large, influential trade cities across Earth including New York, Paris, Singapore, Sydney, Los Angeles and Dubai themed sections. Each of these sections will be operating at differing "time-zones", providing citizens with desirable amenities at all times of day. Beyond their time differences, each city will specialize in different kinds of entertainment. New York will have a Broadway theatre, with many popular plays and musicals; Paris will have an elaborate shopping district, complete with the latest in buckystructure fashion; Singapore will have a modern art museum; Sydney will have an archetypal opera house; Los Angeles will have a movie theatre showcasing classic films throughout the ages; Finally, Dubai will have the Cornucopia, a restaurant district featuring cuisines from all over the world.

The inner torus will host a multicultural Plaza to celebrate major holidays. It will also be the area that retired space dwellers call home- because of its lower gravity, the elderly will have less stress on their bodies when they move. For education, students from kindergarten to twelfth grade will participate in virtual schooling. There will also be automated processes to emphasize livability and convenience (see point 5.3 for more information).

Columbiat will have all the amenities that can be found on Earth. Residents will have access to entertainment centers such as movie theatres, theatres of the performing arts, comedy clubs, nightclubs, malls, libraries, playgrounds, museums, casinos and much more. Residents will also have access to the health center, which includes a gymnasium and spa, featuring the best equipment, most advanced technology for treatments, and a recreation center where one can practice hobbies and join resident-founded clubs.

Columbiat will feature a lively restaurant district, known as the cornucopia, with meals to suit any taste, culture, or nationality, including but not limited to: English, Spanish, Italian, Chinese, Korean, and Mexican.

Supermarkets will sell mostly pre-prepared dinners, pure organic ingredients, and snacks, and will be generally smaller than Earth supermarkets. Food may also be pre-ordered and delivered through a pneumatic tube system directly to residents' homes. (Refer to 3.2.2 and 5.2 for more information).

Medical centers in *Columbiat* will be highly advanced. Staffing will be an interdisciplinary team of human doctors, nurses, surgeons, other experts and robotic assistants.

Buckystructure fabric will be available for the community to be used in Columbiat fashion. The style will be white formal wear with clear accents such as belts and ruffles. The buckystructure clothing will be paired with jewelry and other accessories made from polished moonrocks. As the material is a common resource, the outfits will be inexpensive and easily purchased by transients as souvenirs.

Columbiat will be a modernized society that features a variety of automated systems to increase the quality of life in the station. STAT's, scooters and bikes will be available in rental stations across the community for ease of transportation; an electric trolley system will be available for convenient mass transportation (refer to 3.2.7 for more information). A personal device called the Sovast will be provided for communication between residents as well as for entertainment and general utility purposes. Being able to carry important documents on these devices and host holographic conference calls are a few of the ways this device will improve the lives of citizens.

The Birlik will be a street roaming tour guide available to assist tourists with general information and directions. In the household, Podairshkah, Hoondose, Kumbenay, and Asha will be the maintaining and sanitizing

systems to increase efficiency and productivity in business men and women's daily lives. To keep our communities clean, the Folley bots will be a multi-purposed, automated trash collector. For residents with disabilities, the Unity will assist on a need basis with daily care. Together these, and maybe more automated systems, will ensure a modernized feel in our city splendor. (For more information on livability bots, refer to 5.3 for more information.)

4.1.3 Consumables

Food will be distributed through pneumatic tubes to stores, restaurants and residential homes.

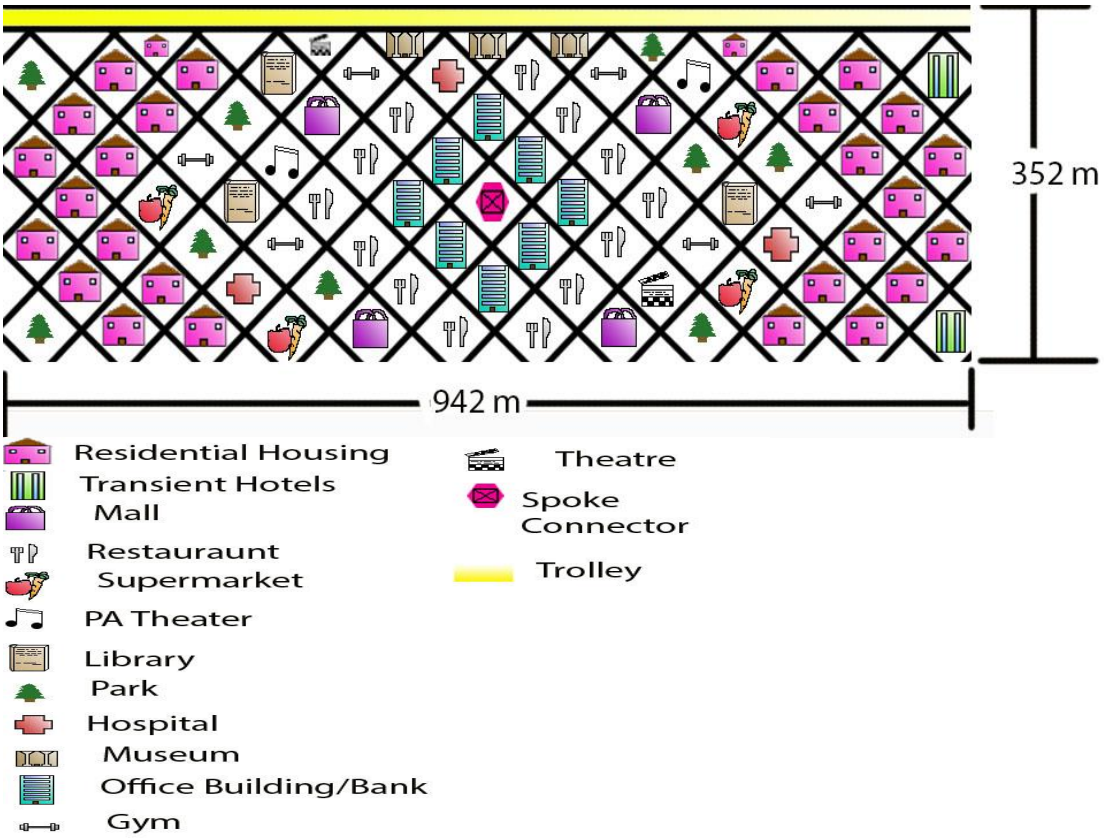
Categories	Products Needed per Year	Description	Source
Toiletries	4,491,777.6 items	Soap, toothbrushes, hair brushes, makeup, toothpaste and personal hygiene products.	Earth
Clothing	7,484,721.75 products	Shirts, pants, jackets, socks, undergarments, spacesuits, etc.	Columbiat (Buckystructures)
Food	407057.61 kg	Meats, vegetables, fruits, grains, dairy, etc.	Columbiat
Medicinal	1,454,451.26 products	Prescription and over the counter medications, herbal remedies, hospital supplies, etc.	Earth and Columbiat
Paper	19,099,500 sheets	Printing paper, Lined Paper	Columbiat

Residents in the torus will be encouraged to lead a healthy lifestyle by working out and keeping a nutritious and balanced diet. When the appropriate goals of either is reached, rewards will be given that range from newer games in the simulation rooms, discounts, free concerts and even gift cards. Shutza Armbands will track bike riding distance of each citizen and a high score list will be generated every week, month and year to create a competitive atmosphere to exercise.

In order to prevent the loss of muscle within the human body, walking, jogging and riding a bike will be encouraged as means of transportation. Eva (refer to 5.3) will encourage simulated activities for exercise, in order to keep muscles in shape and prevent atrophy. When muscle loss is already active, exercise is encouraged to rebuild muscles and joints are used to support weakened muscles. In the case of extreme muscle degradation ultrasounds are used to target specific weak areas and growth is solely built in those areas.

4.2 Community Design

The community was designed to provide full time residents with easy access to places of work, restaurants, shops, and entertainment by placing most apartments in the middle of each section. Transients visiting each section are given the full experience of the culture but will be separated from the permanent population as to not interrupt business. Natural and man-made landmarks of the section's city are scattered throughout the section to provide a real-life feeling of living in one of the six major cities; open areas are also placed strategically to provide space between buildings, while giving long open diagonal views to prevent disorientation from coriolis effect while still feeling expansive.



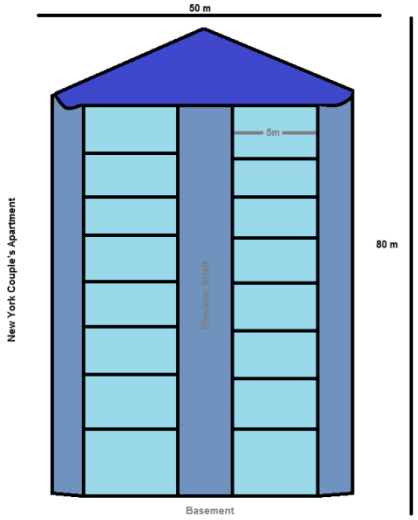
4.2.1 Furniture/Sources

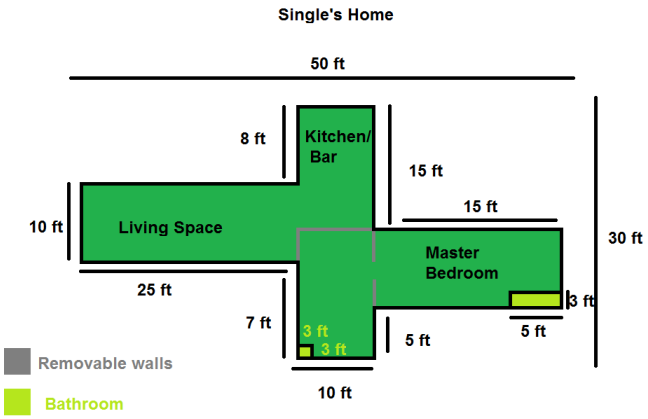
Most furniture will be created from the copious amounts of lunar dust recycled from Alaskol. This dust can be melted into refined metal and silicon. Any other materials needed will be shipped from Earth.

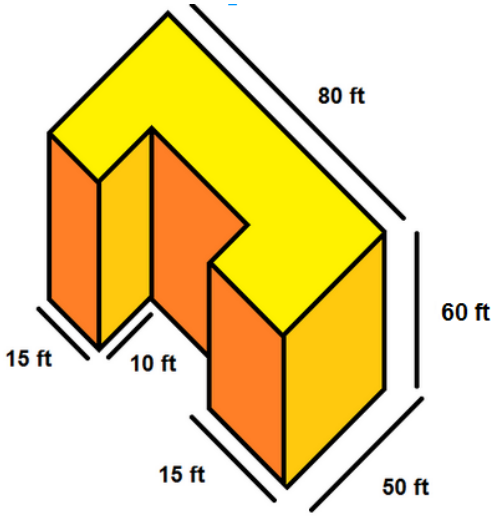
Furniture	Amount	Furniture	Amount
Beds	17,450	**Toilet**	27,800
Couches	40,750	**Sink**	79,750
Shower/Bath	27,800	**Chairs**	85,100

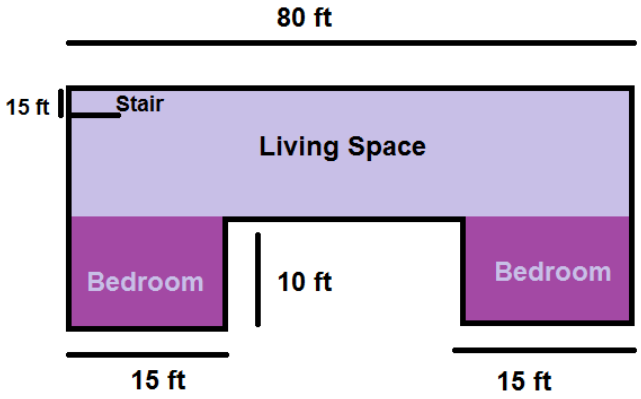
4.2.2 Residential Floor Plans

Residents will have the opportunity to obtain a domicile that suits their style of living. There will be varied architectural inspiration from city to city; all having in common their tessellating properties to aid in future expansion. We expect to accommodate for an approximate 25% increase in population over the next 10 years, or a predicted 3,060 home unit increase.

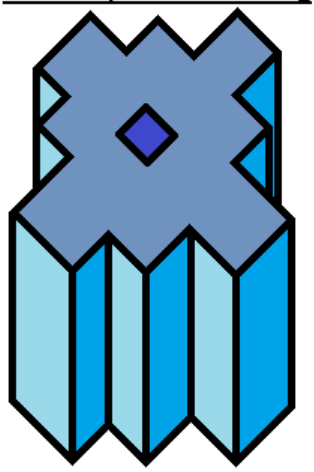

50 m
80 m
New York Couple's Apartment
Elevator Shaft
Basement


Single's Home
50 ft
8 ft
Kitchen/
Bar
15 ft
15 ft
10 ft
Living Space
Master
Bedroom
30 ft
25 ft
3 ft
7 ft
3 ft
3 ft
5 ft
5 ft
10 ft
Removable walls
Bathroom

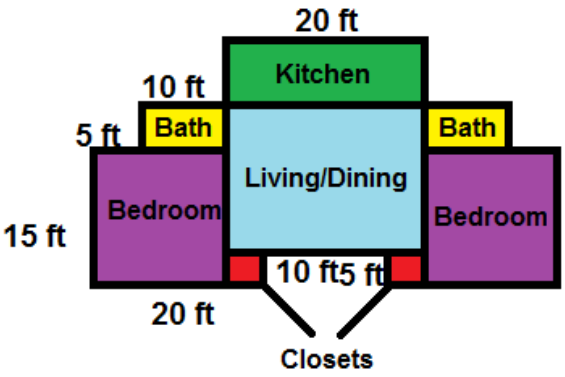

80 ft
60 ft
15 ft
10 ft
15 ft
50 ft


Married Couple House
80 ft
15 ft
Stair
Living Space
Bedroom
10 ft
Bedroom
15 ft
15 ft

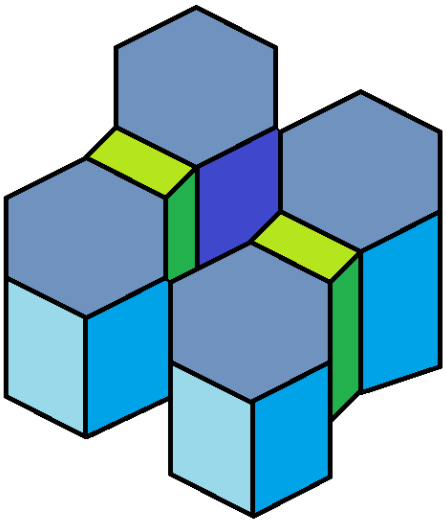
Double Apartment Building



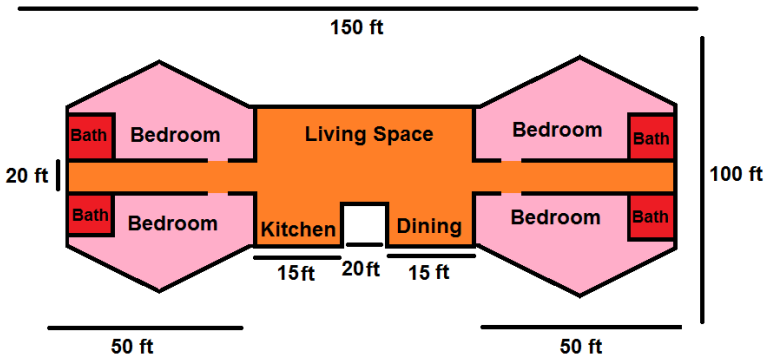
Double Apartment



Family House



Family House

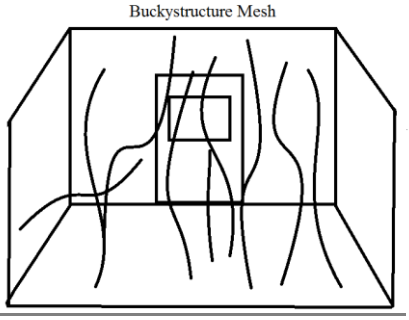


4.3 Artificial Gravity Safety

4.3.1 Systems

The primary system used for safety in low-to-zero gravity areas will be a task analysis system that will be available through screens in airlock rooms as well as personal devices. This system will determine what equipment will be needed for a task to safely be completed as well as the best course of action to complete it. Different tools and spacesuit components may be needed depending on what area and task the person is performing.

Buckystructure Mesh



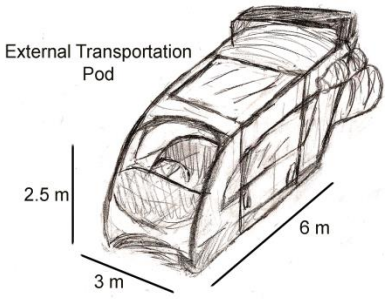
Mesh webs of buckystructures will wind through low-gravity areas, such as the space cab and docking areas. These webs will enable easier motion by having the worker be able to climb, follow, and push off in their

desired direction. Basic handrails will also be on edges of rooms and pathways in these areas.

When out of range of safe return or a fatal injury is received (or any injury that restricts movement), an "alarm" is signaled by Shutza. (See point 5.2.5 for more information) This will call for help while giving coordinates of the specific location. Once the signal is received, a Dinkin is deployed for rescue. (See point 5.2.3 for more information).

4.3.2 Vehicles/Transportation

The foot soles of the space suit will have magnetic shoes. The magnetic system can be enabled or disabled at the user's discretion, to give workers a full 360 degree range of freedom when working and to be unrestricted to a particular up-down orientation. Furthermore, the user can launch themselves over larger distances through a combination of three assets. A magnetic grappling hook device a worker may use to guide the operator's trajectory when crossing a distance; mechanized joints in the suit will provide extra strength when pushing away from a surface. Finally, the soles of the magnetic shoes will switch polarity to repel the wearer from where they are currently standing. The sole's polarity will reflip when approaching the destination so they may land securely. Two of the magnetic cord launchers will be provided to each worker to allow for a quick way to change course in case of a miscalculation, Exter



For travelling long distances in these areas, a 2-passenger pod will be provided to traverse the distance.

4.3.3 Spacesuit

Space suits provided will be designed with safety and mobility in mind. The suit will consist of layers of buckystructure sheets for heat resistance, insulation and radiation resistance. The under suit will be comprised of both Sportwool and Micromesh, with a vest system crystal/gel reaction acting as a coolant with a thermostat regulation system. Specialized armor is worn over the suit at all times. A rebreather system will be utilized for oxygen supply. The space suit will have a communications device in the form of a panel display slightly below eye level on the helmet, operated by a voice command system for a hands-free experience.

When in a null gravity zone, the self-repair space suit will be in effect. Shutza's system is applied to an entire suit with a self-heal system. The suit will have a separate container that will be highly pressurized and contain a healing agent. It will contain universal stress-induced healers; allowing areas that are constantly torn or worn down to naturally grow stronger over time. Furthermore, this technology can be used to pre-reinforce material vulnerable or otherwise important areas.

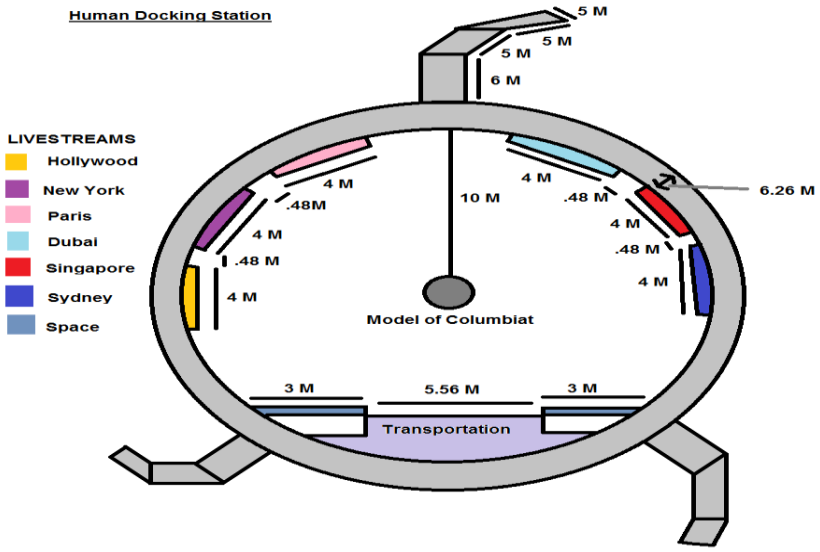
All the joints of the suit will be mechanized joints. This will be helpful for movement in the case of injury, such as a broken limb, by helping support the limb without inhibiting motion.

4.3.4 Donning/Doffing Procedures

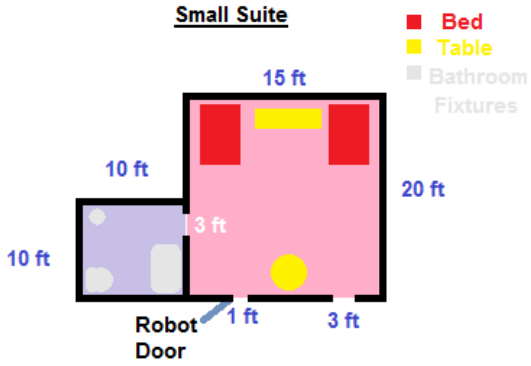
Before donning, the user uses the task analysis system to obtain the designated tools from an automated list, which is provided during the donning procedure. During the procedure, a robot dresses the worker in his or her space suit, providing the previously selected tools. Finally, the airlock is depressurized and the worker exits.

After the worker re-enters the airlock, doffing begins. The first steps of the procedure are the pressurization of the airlock and for the robot to remove any loaned tools. Afterwards, the suit is removed and analyzed. If the space suit has been reported as ripped or torn, the robot takes in the suit to be repaired. If the buckystructure layers are damaged, they will be repaired using cold fusion.

4.4 Initial Experience/Docking Amenities



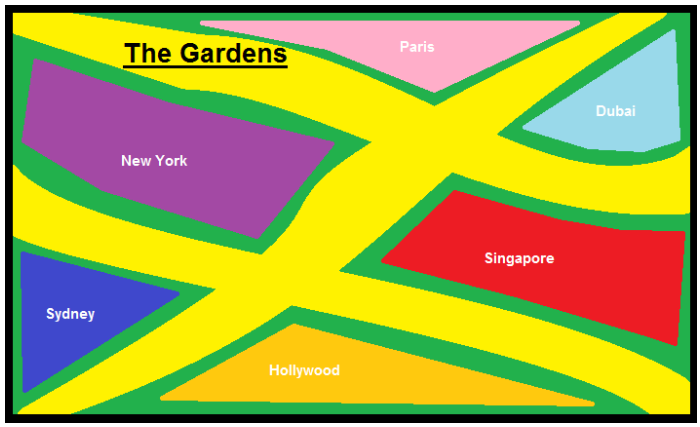
Walking into Columbiat's central arrival area, passengers exiting their ships will view the central hub of each city via OLED screens spread across ⅔ of the wall perimeter with the final ⅓ containing a stretching view of the settlement's surroundings. This will allow residents to see exactly what our unique and bustling city has to offer, while showing evidence of the time-zone configuration. There will be a sound system implemented to audibly welcome arriving passengers, give safety instruction and guidelines and instruct the residents and transients to the transportation system bringing them to the spokes (refer to 2.1.1 for a visual) that will then transport them to the appropriate torus. In the center of the arrival area, there will be an impressively sized model of the settlement design itself.



4.4.1 Hotel floor plans and other visitor accommodations.

Columbiat will offer 12 hotels for transients to choose from located in the designated tourist section of each area. The hotels will have 8 floors each and will offer a small or large suite. Small rooms can house up to two people while the large suite can house up to four.

For the convenience of transients a Trans-Continental breakfast will be served every morning. This breakfast will be inspired by cultures from all continents. To promote permanent and visiting residents' interaction, a visiting center will be included in Columbiat's design. An impressive view of the station will also be available from the roof tops of all hotels. The hotels may also be used for special events such as conventions, dances, or scientific expositions. In the center of the lobby, there will be an holographic star sphere display, showing various views that can be seen outside of the station.



One major attraction will be a large "art garden" filled with replicas of notable buildings, statues of notable figures, and distinct plants and general city-inspired art from each city represented on the station.

4.4.2 Visitor Security Measures

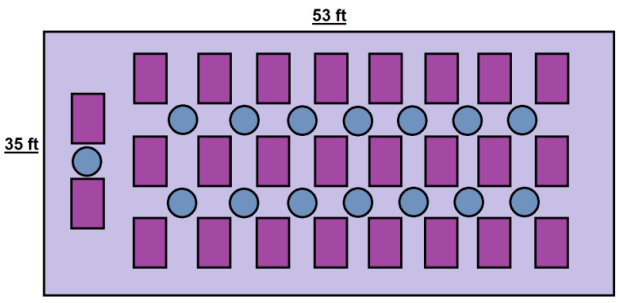
For security precautions, a 3D print of a transient resident's thumb will be taken upon initial arrival to the hotel. Access to public areas will be provided freely, but access to private rooms, lounges, and restricted areas will require one to place one's entire thumb into a sensor. This then prevents unauthorized access that could possibly take place with a 2D scanner by pressing a picture of a print to it. The scans will be deleted after checkout. In addition, there will be limited interaction between permanent and transient populations via spatial division in order to minimize the impact of the constantly changing transient population on the residents.

4.5 Space Cab Seating Arrangements

4.5.1 Space Cab Accommodations and Privacy

Columbiat will provide a variety of accommodations for the length trip inside of the space elevator cabs. Each passenger will have their own seat, ergonomically designed so passengers can sit for long periods of time if they choose to; noise cancelling headphones will be provided in each seat. Chairs will be arranged accordingly to give passengers a space efficient yet comfortable space. Curtains will be provided to surround a seat for privacy. Personal devices will be encouraged to be brought upon the space cab for personal entertainment; loan-out devices will be provided for those who do not have their own. There will be rentable personal rooms for those who wish for an experience with complete privacy. For business travellers, there is general business space cab with a variety of technology to assist the working process on the trip, such as strap-in seats and computer integrated touch screen tables. These tables will also be provided in the seating cab, to double as entertainment devices. These tables begin small and round between seats, and will be able to expand with additional screen panels to stretch across seats.

After leaving the reach of gravity's force, every wall becomes a viable living space. Each chair has an attachable portion that aids the seat to extend upward and turn into a "sleeping cocoon", a vertical sleeping bag, therefore being space-efficient and acting in spirit of comfortable traditional no-G sleeping accommodations. Because of the lack of gravity, there will be resistance style exercise machines, a simulated bike adventure machine as a prime example, as well as a padded trampoline room for younger passengers. Food carts will be available in every passenger cab, supplied with a variety of zero-G optimized cuisine designed by celebrity chefs to provide the best meal experience, while creating meals that will be safe to consume without risking crumbs or other food particles to hang in the atmosphere. A communal lounge will be provided for a relaxing place for passengers to socialize. The lounge walls with have projections of the outer view so loungers may enjoy their environment while staying in this cab. In the corners of the lounge, the "Sunny Space Sauna [SSS]" chambers to assist relaxation, complete with a personalizable radio system to create the most calming atmosphere and an attached shower for post-sauna refreshing.



AUTOMATIONS

"INVENTOR: A PERSON WHO MAKES AN INGENIOUS ARRANGEMENT OF WHEELS, LEVERS AND SPRINGS, AND BELIEVES IT CIVILIZATION."

-AMBROSE BIERCE

5.0 Automation Design and Services

5.1 Automated Functions

Automation is the robots of the community. Simple and even some complex tasks are carried out by robots. Safety is not a problem on Columbiat; everything was pre-designed in case of failure.

Construction Robots	**Function**	**Amount**	**Size**	**Location**
Srang	Exterior Construction Bot, Exterior Repair Bot, & Elevator Cable Maintenance Bot	250	12m*20m*4m	Warehouse Storage; Surrounding Space Elevator Cable
Jie	Pipe Construction Bot & Interior Maintenance Bot	500	.3m*.15m*.15m	Residential Settlements
Kahay	Infrastructure Assembly Bot; Restructures into Birlik	1500	.4m*.4m*1.7m	Residential Settlements

Maintenance & Settlement Robots/Systems	Function	Amount	Size	Location
Xamuul	Multi-purpose Settlement Bot	100	2.5m*2.5m*4m	Docking Facilities; Robot Repair Facilities
Mele	Cleaning Maintenance Bot	1000	.5m*.5m*.5m	Residential Settlements
Ernte Bot	Farming Bot	1000	.3m*.6m*.6m	Agricultural Area
Pneumatic Tube System	Food Moving Systems	1	--	Underground within Residential Torus
Papo	Water & Waste Management System	6	--	Underground within Residential Torus
Accelerometer	Orientation Establishment System	12	--	Warehouse Storage
LunR	Lunar Dust Collector	20	.6m*.4m*.4m	Robot Repair Facilities

Human Resource Robots	Function	Amount	Size	Location
Dinkin	Life Saving Retrieval Robot	30	1m diameter*1m	Warehouse Storage
Birlik	Human Resource Robot	1500	.4m*.4m*1.7m	Residential Settlements

CPU Systems	Function	Location
Molecular Storage	Data Storage	--
Data Servers	Wireless Intranet & Internet	Within Business Sectors

Personal Systems/Robots	Function	Amount	Size
Sovast	Holographic Communications System	29,000	--
Shutza	Vital Information Sensing System	29,000	--

Business Box/Systems	Function	Amount	Size	Location
Currency Kiosk	Currency Exchanger	--	--	Foundation Society Headquarters
Suggestion and Complain Kiosk	Suggestion and Complaint Kiosk	--	--	Foundation Society Headquarters

Household Utilities	Function	Amount	Size
Podairshka	Laundry Washer	18,000	1m*.6m diameter*.8m diameter
Asha	Self-cleaning Dishes	--	--
Kumbenay	Refrigerator Table	18,000	1.m*1.7m*1m

5.1.1 Automation of Construction Processes

Robot	Description
Srang	Using welding ranging from solid-state to electrical arc, Srang will assemble the frame of Columbiat using the pre-assembled buckystructures. It will be propelled by h2o2 rockets.
Jie	Jie that will assemble all of the pipes for the infrastructure of the settlement.
Blomstre	Blomstre will create the frame and foundation for the houses and businesses. It will also transport appliances to a house and assemble it there. This robot will also assemble all furniture and decorations for the housing units.

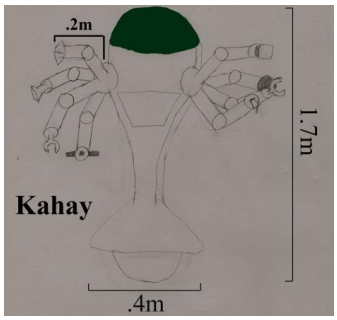
5.1.2 Transportation & Delivery of Materials:

Through utilizing the mass driver on Alaskol, buckystructures will be shot up into the L1 area; the buckystructure containers will use retrorockets to ease entry into the L1 area and eventually stop. Once the buckystructures are tethered to the Moon's surface, transportation of materials from the moon will then begin. As soon as the space elevator is completed, materials from the Moon will be easily accessible in the L1 point; thus, begins exterior construction.

5.1.3 Exterior Constructions:

Solid state welding will be applied to all outer frame structures, allowing the buckystructures to fuse together using non-oxidized atom-to-atom contact. The Srang will then be able to scrape off all unnecessary scrap metal and clear the sides of the newly placed piece. To ensure the stability of the frame, electron beam welding will be quickly applied to the connected edges of the metal and the frame. The Srang's claws will be coated with oxygen to ensure that the claws will not stick to the buckystructures. In order to work constantly, Srang will be outfitted with solar panels (see 3.1.1 for more information).

5.1.4 Interior Construction:



Once exterior construction is complete, 3D printers and robots will begin construction of the interior, starting with appliance parts and walls. The basic pieces for interior construction will then be moved out of the industrial sector and into the torus. Interior construction, however, will not begin until gravity is established within the torus.

The process of interior construction will go as follows:

1. Settlements and structures, including painting
2. Appliances, furniture, and other amenities
3. Community fixtures
4. Decoration

Kahay, the interior construction bot, will have interchangeable arms. This multitude of extendable and retractable arms will be able to accomplish a variety of tasks simultaneously, including attaching two walls together and joining them. The bot will travel on a sphere, allowing for 360 degree circular movement.

5.2 Automated Facility

In automating facilities, safety is a top priority. Our goal is to make sure people are not hurt or injured while maintaining the optimal privacy for everyone.

Name of Robot/System	**Description**
Papo	The waste will be put into the gasifier and turned into burnable gases for energy; Water in the Papo will be boiled and condensed into clean water. (See 3.2.4 and 3.2.5)
Jie Bot	This robot will have interchangeable parts that allow for multiple uses. The Jie bot will be able to repair pipes and other interior necessities using magnetorheological (MR) fluid; An epoxy requiring oxygen to harden will be mixed in with the fluid. The bot will patch the hole by spraying the thick fluid and will magnetize it, allowing the MR fluid to turn into solid. While the epoxy hardens, the MR fluid within the patch will demagnetize.
Ernte Bot	The Ernte Bot will pick & gather crops up from the dynaponic section & replants seeds. This bot will consist of four metal arms; two will collect the crops; the other two will replant seeds. It will move on a fixed system throughout the agricultural area. It will then take the crops to the Pneumatic Tube System.
Pneumatic Tube System	The Pneumatic Tube System will move agricultural food to stores and residential houses based on pre-order. See 3.2.2 for more information.
Accelerometer	Accelerometers will monitor the station's position relative to the earth and the moon. See 3.4.2 for more information.

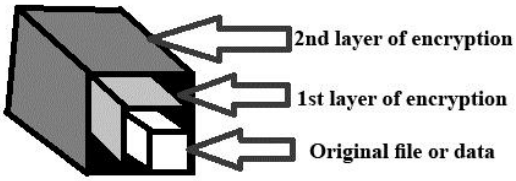
Xamuul	Xamuul will be a multi-purpose bot located within the lunar dust prevention and cargo transportation facilities. Its rectangular frame will include a magnetic plate on the top of the robot that can be increased or decreased in polarity depending on the circumstance. This plate will allow the Xamuuls to be constantly "attached" to the settlement without it actually touching the walls and creating friction. It will move via rocket propulsion and carry various objects, as it will have two robotic arms on the sides of the robot.

5.2.1 Maintenance & Repair

Issue	Solution
Structural Repairs	Through utilizing the Srang bot, the space settlement will be maintained, as it will be capable of electron beam welding. The Srang bot will be equipped with a 3D printing attachment within its claw. It will be able to retract the fingers of the claw to allow room for the 3D printer. With titanium-alloy powder, the 3D printer will be able to apply titanium-alloy onto the hull to reform and mend the surface of the station.
Internal Structural & Appliance Repairs	Magnetorheological fluid with epoxy will be used to patch holes and attach parts together. For more information refer to 5.2, Jie.
Pipe or Small Gap Repairs	This issue will be repaired using a Kahay bot using the magnetorheological fluid with epoxy.
Cleaning Maintenance	It will be completed by the Fally. Refer to 5.3 for more information on the Fally.
Space Elevator Maintenance	Srangs will constantly monitor the space elevator cable, making sure that it is stable and secure. See 7.3.2 for more information. If an issue occurs, Srangs will repair it the same way it does with structural repairs.
Space Elevator Repairs	If the space elevator is in need of repair, external repair robots, Srangs, will travel towards the space elevator and fix it using the appropriate methods.

5.2.2 Backup Systems & Safety Functions

All information will be backed up by an extra storage unit. RAID, through tiered parity, will prevent most of the hardware issues that occur when data storage is lost while still being able to function normally even though problems. If hardware breaks, RAID10 technology will allow the user to continue working without any loss of information or power. All information will be encrypted using onion routing, a routing system that encrypts a file multiple times and sends through network nodes known as onion routers. The nodes will hold one encryption key and take off one layer of encryption at a time. No data will be able to be traced back to the sender or will be recovered by hackers because the system will detect a corrupt node and reroute through a different one if connection is not secure. The last node will be protected using SSL (secure sockets layer), which encrypts data using session specific information and encryption to which only the last node has.



Encryption Key Layering

5.2.3 Contingency Plans

Hazard	Contingency Plan
Fire	The carbon dioxide fire extinguishing system will be able to suppress the fire completely. The fire extinguishers will be able stop the oxygen from fueling the fire and smother the fire. Carbon dioxide will be collected from trash cans. In emergencies, Birliks will be able to take out the fire extinguisher and use it accordingly.
Hull Breach	If a hull breach is detected, any surrounding Birliks will escort people towards the nearest interior hatch while the Shutza will alert the surrounding people. During this time, buckystructures be used as a temporary means to seal the hole until actual repairs can be made. When everyone is out of danger, the hatch will close and external repair robots will come to the aid.
Solar Flare	Although solar flares will be safely shielded from by buckystructures, an extra coating of an impurity will be introduced to create z-shielding to robots performing external functions.
Water Contamination	Six separate water supply systems will constantly monitor water quality. If contamination is detected the water will be sent to the water recycling plant to be purified. During this time the two adjacent water suppliers will each give one third of their water supply to the section which water has been contaminated. See 3.2.4 for more information.
Depressurization	In times of depressurization, Birlik will escort people away from danger in a similar manner as the Hull Breach. Jie bots will then contend with the issue.
Epidemic	During an epidemic, Birliks will be deployed to quarantine disease as fast as possible. Using sectional wall-offs, a determined area will be provided based upon the time to employ the wall-offs and the rapid spread of the disease; from there, the patients within the infected area will be treated and taken care of until further analyzation of a cure can begin.
Power Failure	If a reactor fails, a second reactor will be able to sustain the entire settlement due to increased output until repairs can be made. See Ops 3.2.3 for more information.
Cooling Failure	Backup cooling radiators will temporarily replace the original cooling radiator until a solution is available and repairs can be made.
Air Contamination	When Shutza recognizes an imbalance in several people's air levels within a certain time frame, the system will alert all the surrounding people via alarms that there is air contamination. The main systems will then guide the people by voice to the nearest safe place by the armband.
Docking Failure	If an issue is detected within one of the industrial docking ports, it will shutdown and maintenance and repairs will begin. Srang bots will then repair the docking ports. If the issue is within the human docking port, repairs will have to be made first before another ship can dock. The ship will be rerouted to the industrial docking port, where trams will take the humans into the human docking port, down the centrifuge, and into one of the six districts.
Docking Elevator Malfunction	If a docking elevator becomes faulty, the elevator will be temporarily removed to continue the allowance of the second elevator. After repairs are complete, the second elevator will then be reattached to the mainframe.

Lunar Dust Intrusion	If lunar dust is detected within the space station, humans will be rerouted to avoid the area. Birlik robots will then clean the area using nylon dust brushes; a charged plate will attract the particles, and the lunar dust will be transferred to a LunR bot. If the dust is in zero gravity, Srang bots will clean the dust.
Adrift Human	Dinkin, a donut shaped robot, will launch itself towards anyone that is unable to get back to the space station. The Shutza will have the coordinates that the robot will be able to travel towards. Once Dinkin has reached a person, the person will climb into the opening of the middle of the robot, and the robot will then contract or inflate according to the person's size. After the person is firmly secured within the Dinkin, it will accelerate slowly and eventually make it back to Columbiat.

5.2.4 Facility Security

Security Level	Authorized Personnel	Security Measures	Accessed Data
Terra	Transients and Residents	Shutza	Public records
Gladio	Employees and employers	Shutza and password	Authorized company services
Rerum	Business Owners and Temporary Crew Members	3D retinal scanner and passcode	Industry control and accounting information
Newlum	Site Managers	Gel finger scanner/ 3D hand image and Passcode	Automated systems control and network access
Imperium	Settlement Officials	Gel finger scanner/ 3D hand image & 3D retinal scanner	Settlement control

Employees, employers, business owners and site managers will be all independently based on user; a specific individual will be able to only access what he or she has been authorized to access through a higher level. The Gel finger scanner will randomly ask for a finger on the preferred hand to help enhance security.

If authoritarian access is needed to access critical computing functions and automated services through the Sovast, a 3D image of the hand will be needed to access the data and information.

5.2.5 Automated Devices

Automated Device	Number	Purpose
Shutza	29,000	This robot will give Terra access and track O2 levels, heart rate, blood pressure, and temperature.
Molecular Storage	1	Using organic molecules, molecular storage will embed enormous amounts of data into small chips.
Sovast	29,000	This robot will be a communications system using watches rings, necklaces, glasses, and any other accessories.

There will be 5 servers: Business, Residential, Docking, Main and Backup.

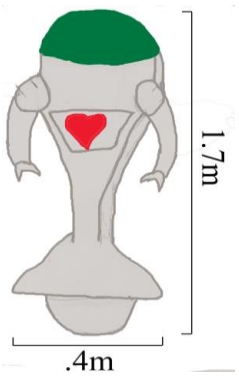
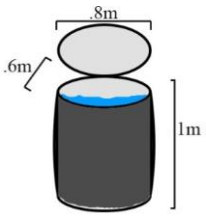
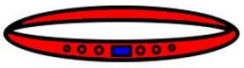
Thin provisioning will further enhance the performance of the computer by storing only the necessary systems and files for the user's convenience. Due to thin provisioning, the data capacity will be decreased drastically to improve the RAID tiered parity. Reed and Solomon encoding will check that 100% of the data is sent through checkpoints, and if any data was not passed through, the program will alert the owner of the data and will attempt to recover the missing data bits. See 5.2.3 or 5.3.4 for more information.

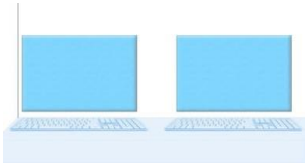
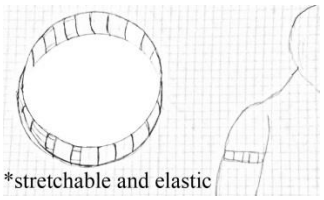
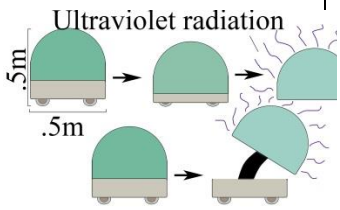
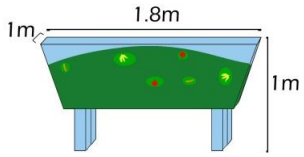
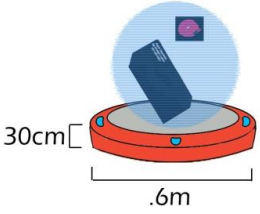
Networking will be done on a local network for hosting; data access will be from the LAN network connected to the central data storage. Separate software will monitor usage, robot control, and other various systems. Any hardwired connections needed, including all business functions such as kiosks, will be connected with Columbiat's servers via fiber optic cables. Within cities, optical wireless will be established to further enhance speed.

5.3 Automated Habitability and Community

The life of a business professional can be demanding and nobody has time for simple tasks like cleaning. In Columbiat this will all be automated for ease of life and more time for relaxation. Business professionals will enjoy the simplicity of managing a corporation within Columbiat's automated business community.

5.3.1 Automated Robot Systems in the Community

Robot Name	Purpose	Picture
Birlik	Birlik robots will interact with tourists and residents. These robots will be located throughout the settlement, communicating in a variety of languages. Birlik also will assist senior citizens with cooking according to their dietary needs and other necessary functions. A Birlik that is assigned to a room will contain a scanner that will scan the room and store the images it took. The robot will use the images to organize the room once everything has become unorganized. If the user of the room decides to rearrange items in the room he/or she can reset the bot so it can scan the room again.	
Podairshkah	Podairshkah will be a compact laundry basket and washing machine in one. All the clothes added to the washing machine will be washed every three days unless otherwise specified. This process will be completed by using nylon polymer beads absorbing all dirt, stains, and other impurities; these beads will be able to absorb the dirt and stains more effectively than water. Once the beads have been released, the basket will begin to spin.	
Eva	If a user chooses to partake in any type of activity, they will be able to use one of the offered headbands that a Birlik will provide. The headbands will be custom fit and will project a full 3D simulation of a particular exercise or activity, depending on if it can also interact with any of the Sovast communication devices.	 *stretchable and elastic
Asha	Asha will be the self-cleaning dishes. The eating utensils will be made out of cellulose-based material that will prevent the food from sticking while hydrophobic coating will allow liquids to fall right off without leaving residue. The cellulose-based material and the hydrophobic coating will cover the frame of the utensil.	

Currency Kiosk	Only able to be activated once the Rerum security level has been granted, the currency kiosk will be able to exchange any form of currency for the desired currency. If the user wants, a Columbiat specific debit card will be issued, and he or she will be able to put in or take out any money on the card. The user adds in money by dumping all currency into a box, where it will be scanned and valued accordingly. All of this will be done on the wall itself, so no robot or protruding space is created.	
Suggestion/ Complaint Kiosk	Within the lobby of the Foundation Society Headquarters, there will be countertops will projected keyboards. These keyboards will be able to be used for Columbiat input; suggestions and complaints will be offered to the site managers of Columbiat through this system.	
Shutza	A band that will be placed upon the user's bicep, Shutza will record the user's vital information periodically; this information will be recorded and can be easily accessed through Sovast. The band will record the user's temperature, oxygen levels and heart rate. If a dramatic change in oxygen levels, temperature, or blood pressure is measured, it will send the information directly to the emergency center. Testing will continue to repeat more frequently to make sure there won't be a late reaction to an emergency. The band will be covered with a blending of hydrophobic micro-porous membrane, knitted fabric, polyester fibre, and polyurethane coat so it will not irritate the user.	
Mele	While Kahay will preliminarily spray titanium dioxide onto easily dirtied surfaces, ultraviolet light emitted by Mele will be absorbed and used by the titanium dioxide to maintain the space station. The ultraviolet light would be emitted by the Mele and go transparent-like aluminum, allowing the light to emit in full potential. This will kill all bacteria affected by the titanium dioxide, producing trace amounts of water and carbon dioxide. Mele will have extendable arms and an extendable head made for getting high-up places in the community; it will also be able to retract and turn into a half a sphere.	
Kumbenay	The refrigerator will be made made up of biopolymer gel and a transparent casing. The biopolymer gel will transfer incoming radiation to visible light which provides cooling to individual pods of food that was placed within it. The refrigerator will be located within the dining room table, allowing the user to grab food more quickly to and to sit down and eat. With a click of a button its smart glass will cover the top layer of the polymer, which allows the user to place items above it.	
Sovast	This robot will be a communications system using watches rings, necklaces, glasses, and any other accessories. These systems will use a gesture based interface on 3D holograms. the holograms are created by ionizing the particles in the air with an array of lasers to make colored images float in air. Sensors will be used to determine the movements and gestures based on starting, mid, and end position of your hands.	

Dinkin	Dinkin will be a life preserver type bot that will rescue any adrift humans. Sensors surrounding the outside of the robot will allow Dinkin to sense object around it. It will adjust its inner body based upon the user's size due to sensors within the bot by inflating or deflating. Although it will be 100% auto-piloted, it will be able to become manually piloted with the controls within the tube.	

5.3.2 Privacy of Personal Data and Control of Systems in Private Spaces

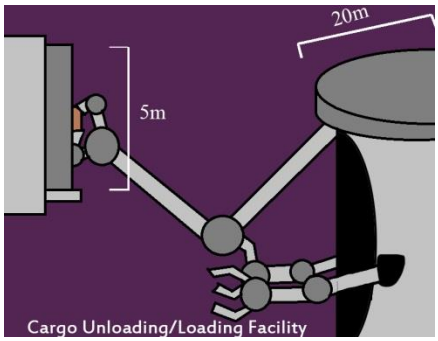
Using near-field communication, users will be able to access specific data that has been archived around the area of influence (AOI). AOI will only initiate if two or more processors touch each other and the users both consent. All of the archived information will be encrypted using onion routing and backed up online. For more information regarding onion routing refer to 5.2.2. Systems in private spaces would utilize voice commands for completing desired tasks. Shutza and Sovast will be linked according to each user, and if they get too far from the other system, Sovast will render itself incapable to use.

5.3.3 Types and capacities of data storage media, data collection, data distribution, and user access to computer networks

All users will be connected to both the main and backup systems simultaneously. All data will be secured by molecular storage. Sovast users will connect using wireless internet provided on Columbiat. Security and Encryption will be done using a 3 layer version of onion routing; refer to 5.2.2 for more information regarding onion routing. There will be an array of lasers connecting the networking system to the internet and a fiber optic cable connecting Columbiat's intranet to Alaskol. See 3.2.6 for more information.
Although the entire station will include some form of wireless LAN network, fiber optic cables will be the main source of internal data communication. See 5.2.5 for more information.

5.4 Handling of Cargo Ships

5.4.1 Loading and Unloading of Materials

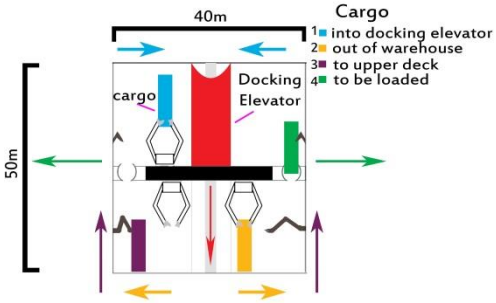


A robotic arm from within the docking station will take hold of the cargo and pull it towards the docking elevator. Once inside the docking elevator, the cargo will proceed towards the warehouse storage.

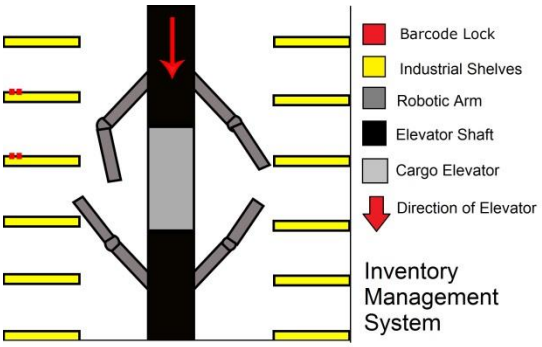
If materials within the warehouse storage need to be loaded onto a ship, they will be transported back to the elevator and taken to just below deck. Once the elevator arrives at its destination, the materials will be moved underneath the deck where the materials go down for storage. Xamuuls will transport the materials below the appropriate docked ship and pass it above dock. From there, it will be loaded onto the ship.

The cargo process within the docking station will be separated into four different steps. The first step will be unloading the cargo and placing the cargo into the docking elevator. The second step will be the beginning process of loading the cargo onto a different ship. The cargo will come out of the docking elevator in the lower deck and gets picked up by a Xamuul. The bot then will bring the cargo underneath its respective ship that it needs to be loaded on. From there, the cargo will be transferred into the upper deck loaded into the ship.

Cargo Transfer Facilities



5.4.2 Warehouse Storage



Once the cargo is inside the warehouse, it will be taken by robotic claws to the nearest open lock. On each side of the elevator will be wide open spaces with locks on the bottom of the warehouse to secure the cargo. Cargo will be placed onto the locks according to specific sections; Temporary storage will be closer to the elevator all the while broad categories will be established for the industrial shelves (i.e. food will not be surrounding dangerous materials).

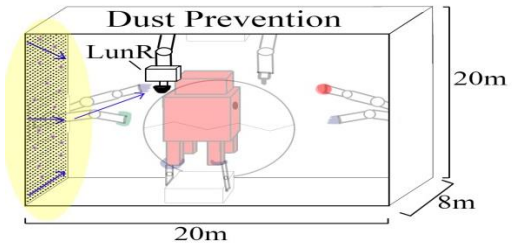
5.4.3 Inventory Management

Any cargo that enters the upper docking area will be inputted into the industrial radio frequency identification system; the automated system awaiting the arrival of the cargo ship will preliminarily prepare the unloading or loading of the ship. If there is no specific marking on the cargo or the cargo does not have a compatible lock with Columbiat's lock, the system will provide one, allowing easier tracking of the cargo and a way to store it. Once the cargo is taken hold by the system, the system will then inventory the cargo, tracking which ship it came from and matching the information (which it retrieved earlier) with the correct cargo. Each cargo will be marked with the owner and what is inside of it (if applicable).

5.5 Robot Repair Facilities

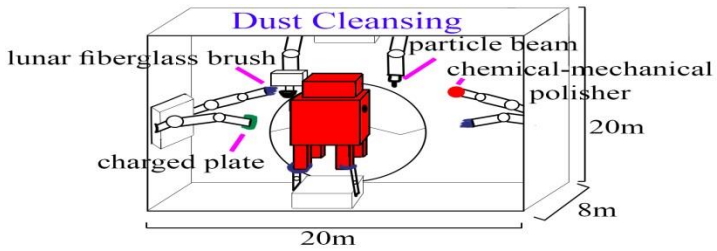
5.5.1 Dust Prevention

Chemical-mechanical planarization will be used to polish anything that comes into contact with the visiting lunar dust infested robots and ships. To further prevent lunar dust from being attracted to Columbiat's bots and surfaces, a dust shield will be activated. This shield is made of electrophoretic and dielectrophoretic forces (electromagnetic waves) that move away large lunar dust particles away from the source of the dust shield. LunR will collect the dust by vacuum and keep it within a container for future purposes, including lunar dust furniture.



5.5.2 Dust Cleansing

To clean robots of lunar dust, the automated dust cleaning facility will have the ability to produce charged particle beams to dislodge and direct any charged particles away from the robots onto a charged plate. Following the particle beam, if lunar dust still exists, a cleansed lunar fiberglass brush will be used. LunR will then collect the dust via vacuum.

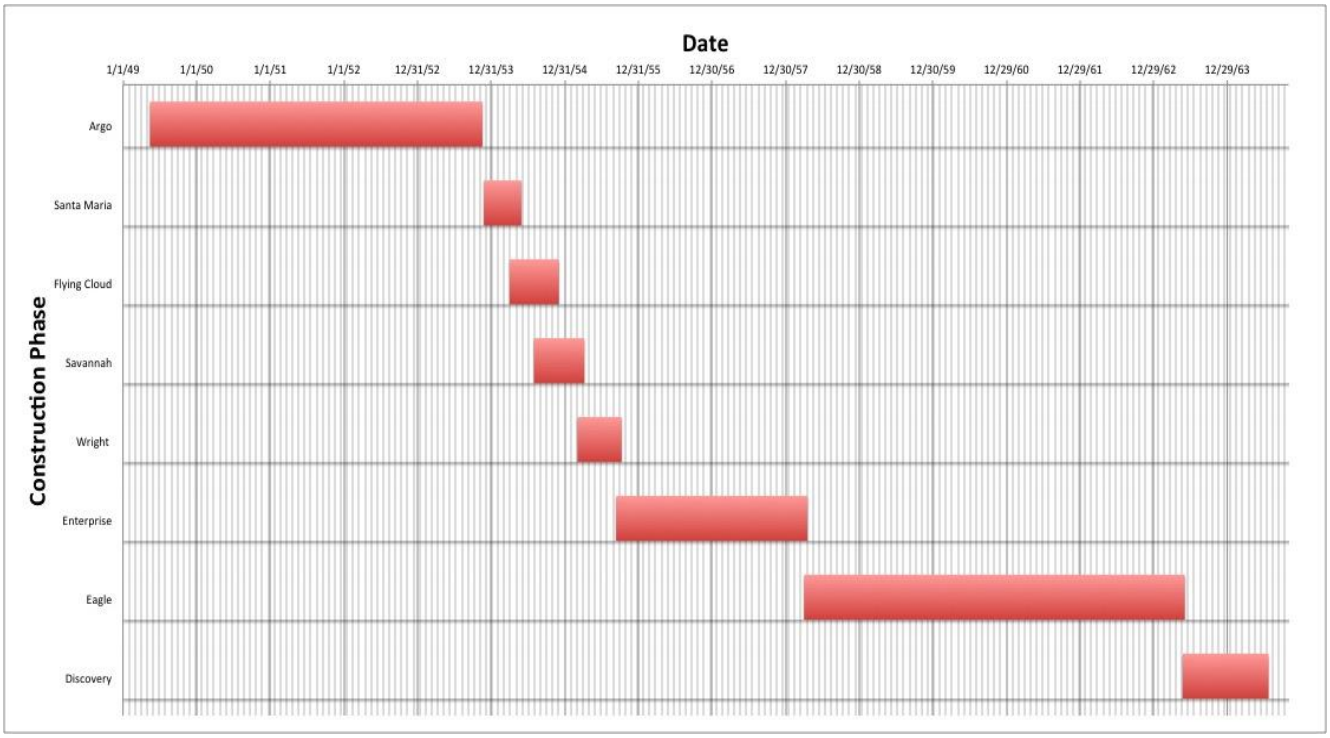


SCHEDULING AND COST

"THIS IS THE GOAL: TO MAKE AVAILABLE FOR LIFE EVERY PLACE WHERE LIFE IS POSSIBLE. TO MAKE INHABITABLE ALL WORLDS AS YET UNINHABITABLE, AND ALL LIFE PURPOSEFUL." -HERMANN OBERTH

6.0 Schedule and Cost

6.1 Schedule



Phase	Start Date	End Date
Argo	5/15/49	11/15/62
Santa Maria	12/1/62	5/15/63
Flying Cloud	4/1/53	11/15/53
Savannah	8/1/53	4/1/54
Wright	3/1/54	10/15/54
Enterprise	10/1/54	4/1/57
Eagle	3/15/57	3/1/62
Discovery	2/15/62	7/20/63
Residents Move In	3/1/62	7/20/63

6.2 Costs

6.2.1 Structural Costs

Material	Source	Amount	Cost
Titanium - grade 5	Alaskol	27,772,317 tonnes	$97,203,109,500
Regolith	Alaskol	6,490,352 tonnes	$3,245,176,000
Buckystructures	Feedstock from Alaskol, manufactured on site	3,898,743 tonnes	$44,835,544,500
Aluminum-2195	Alaskol	7,096,118 tonnes	$26,965,248,500
Total	--	--	**$172,249,078,500**

6.2.2 Infrastructure Costs

Material	Source	Amount	Cost
Uranium	Earth	5 tonnes	$5,830,000
Oxygen	Alaskol	19955 tonnes	$14,950,000
Hydrogen	Alaskol	2500 tonnes	$5,625,000
Nitrogen	Alaskol	50 tonnes	$400,000
Srang construction robots	Bellevistat	150 robots	$63,750,000
Ethanolamine	Earth	15,000 L	$28,000
Seeds	Earth	50 kg	$50,000
Personal Vehicles	Bellevistat	22,000	$25,500,000
Electromagnets	Bellevistat	15,000 units	$800,000,000
Trolley systems	Alaskol	2	$26,000,000
Nuclear reactor	Earth	2	$22,500,000,000
Recycling Systems	Earth	21	$8,500,000,000

Elevator Cab	Alaskol	2 engines, 12 passenger cars, 12 cargo carriers	$500,000,000
Total	--	--	**$32,442,133,000**

6.2.3 Community Costs

Material	Source	Amount	Cost
Toiletries	Earth	4491778	$1,785,000,000
Medicines	Earth	1454452	$3,500,000,000
Spacesuits	Belevistat	1500	$37,500,000
Bamboo	Columbiat	18,000 tonnes	$1,900,000,000
Refined Regolith	Alaskol	14,000 tonnes	$355,000,000
LEDs	Earth	250 tonnes	$2,725,050,000
Total	--	--	**$10,302,550,000**

6.2.4 Automations costs

Material	Source	Amount	Price
Networking system	Earth	1	$2,350,000,000
Communications systems	Earth	1	$1,850,000,000
Maintenance systems	Earth	1	$5,255,000,000
Titanium Grade 5	Bellevistat/Columbiat	36,000 tonnes	$126,000,000
Titanium Alloy Powder	Alaskol	200 tonnes	$3,500,000
Biopolymer Gel	Earth	40.5 tonnes	$1,600,000
Titanium Dioxide	Alaskol	25 tonnes	$2,036,000
Magnetorheological Fluid	Earth	30 tonnes	$27,000,000

Aluminium Oxynitride	Alaskol	74 tonnes	$1,500,000
Epoxy	Earth	10 tonnes	$13,624,500
Neodymium Magnets	Earth	45 tonnes	$25,148,000
Electromagnetic Padding	Bellevistat	20 tonnes	$35,000,000
Polyester Fibre	Earth	.5 tonnes	$517,500
Polyurethane	Earth	.5 tonnes	$502,500
Fiber optic cable	Alaskol	60,000 km	$55,000,000
Total	--	--	**$9,746,428,000**

Phase	Cost	Associated expenses	Estimated employees
Argo	$3,500,000,000	Industrial module, space elevator cable	150
Santa Maria	$828,750,000	Second industrial model, construction robots	300
Flying Cloud	$7,502,500,000	Structural materials for spacecraft dock and expanding industrial areas	300
Savannah	$5,506,500,000	Structural materials for space elevator dock and expanding industrial areas	350
Wright	$27,375,000,000	Structural materials for connecting industrial areas and adding second spacecraft dock and nuclear reactors	500
Enterprise	$43,650,000,000	Structural materials to construct half-gravity torus, centrifuge, and residential docking	1000
Eagle	$87,502,350,000	Structural material to construct residential torus, liquid-hydrogen and oxygen to begin rotation, primary infrastructure and automations	1500
Discovery	$48875089500	Remainder of infrastructure and automations, community constructed and remainder of supplies delivered.	2500
Total	**$224,740,189,500**	--	--

7.0 Business Development

7.1 Transportation Node and Port

The docking and warehouse capabilities provided by Columbiat will make our station the most advanced, efficient, and economical option for businesspeople to vacationing families.

7.1.1 Industrial Capabilities

Columbiat's industrial docking port will emphasize the ability to accommodate for multiple ships at once as well as many varying sizes of ships. This will make Columbiat the best option for those trading between stations as Columbiat's docking has the most commodious design. The docking is also an exceptionally simple and cost-effective design as it can readily expand as Columbiat becomes more popular. Another capability of the docking design is that ships can dock for extended periods of time to get the most up-to-date repairs from automated processes and robots as well as be cleaned and refueled. As ships travel to Columbiat from both sides of space we will have two available industrial docking ports at the start of Columbiat. These two industrial ports make it so that ships from many other stations, such as Alaskol, will find that coming to Columbiat will be incredibly accessible and beneficial to them.

The warehouse featured on Columbiat will be fully automated. This automated system will unload and load cargo from ships. When unloading cargo each item is "radio identified" by a robot. Radio frequency identification is most efficient and safe for the businesses of Columbiat since it reduces lost cargo and keeps track of products. Since this is fully automated the retrieval of products will be quick so time and money will be saved. For all cargo there will be sections to ensure safety of cargo such as keeping industrial material away from food products. The 0g feature also provides ease of moving cargo and makes the warehouse a productive and efficient place for all businesses to store their products.

7.1.2 Passenger Traffic

When passengers arrive at Columbiat they will travel through the docking elevator and arrive at the welcome center. The welcome center will have six different live streams from the six cities featured at Columbiat. The times of each city will also be shown to the arriving passengers. Featuring six different time zones will offer more of a variety to all of those traveling to Columbiat. The six different time zones creates a city that never sleeps so businesspeople can go straight to working in New York or a family on vacation can get settled to sleep in Dubai. Having six different time zones also increases productivity by decreasing the jet lag. Whether a passenger is here to work or enjoy an exciting vacation Columbiat offers options to suit all personal tastes.

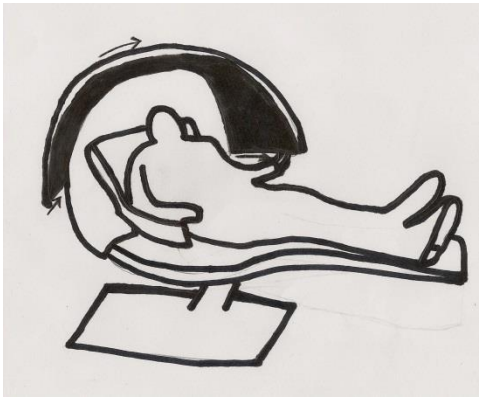
7.1.3 Passenger Activities

Passengers will be able to experience and tour six different kinds of populous cities within the main residential torus, with their own vacationer portion of each city to increase travel efficiency and transient experience. A festival grounds with regular annual station-wide events will be located in the inner torus, with experiences that can bring together the tens of thousands of people, permanent and temporary. From fashion shows to restaurant districts, there will a location that provides entertainment for every preference. Columbiat, being the crossroads of space settlements will star a transient-driven activity, The Bazar. The Bazar will be a unique cosmic culture showcasing grounds, featuring products brought from across the solar system; a marketplace experience unlike any other. In addition to these arriving cultures, vacationers will be able to immerse themselves in a growing Columbiat culture with classes provided in making basic buckystructure art and fashion.

7.2 Commerce and Financial Center

7.2.1 Office Facilities

Within Columbiat office buildings will be supplied to ensure the convenience of the businesspeople attracted to the capital. To provide optimum productivity capabilities businesses will be able to select which city their business office is located in. Selecting a city will enhance the work done by employees and provide a new type of personalization to office buildings. Along with the location of office buildings we offer innovative floor plans to promote group work, efficiency, and innovation from employees. These floor plans will feature large open areas providing for clear and simple communication between employees and increased workflow. As employers see fit, movable walls can be used to divide open floor plans into cubicles or sections. To enhance security employers and employees will have passwords to access important company documents and information. Our most up-to-date encryption services will be utilized to ensure safety of all companies and their employees making Columbiat the most secure and protected station for businesses. For breaks, Sleeping Pods will be located in every break rooms of Columbiat's office. These Sleeping Pods will be a chair with a dome that comes over it so that employees may be able to take power naps. Sleeping Pods also include a device under the seat to track movements and wake up employees within a 45-minute period according to their REM cycle. The naps that employees take ultimately increase productivity substantially and provide more work to be done for companies. These pods will be cleaned by the Hoondose (see 5.0.3) to ensure safety and sanitation. The offices on Columbiat will be made to promote team building, innovation, and optimum workflow from employees and employers.



7.2.2 Provide Facilities for Banks

For space-based companies, Columbiat's banks will offer immense loan opportunities. Since Columbiat is the crossroad of space settlements both investors and business owners have a greater access to one another. Columbiat's bank serves to connect these two resources and provide optimum communication and connection. Banks on Columbiat will also track the progress of businesses so that investors and business owners will be able to have a record of their progress. For residents, Columbiat's bank will offer a secure and more personal management of their money. Residents' communication devices, such as Sovast, will be able to be linked to their bank account so that residents will be able to simply use their communication necklace, ring, or bracelet and a pin number to pay for items. Also available through residents' communication devices is an application able to track residents' bank accounts and how much money they spend weekly, monthly, or annually. When tracking their bank account residents will be able to see what percentage of money is spent on food, clothing, entertainment, savings, and other living expenses. This application will be easily accessible at any point in time. Along with the application on communications devices consultations will be available with Columbiat's banking staff. These options are made so that while living on Columbiat residents are still able to stay on budget and work on personal financial goals such as saving money. For ships' crews, banks of columbiat will offer quick and efficient exchange of currency. This exchange of currency will be via Currency Kiosks that are located within banks (see 5.3). If temporary residents prefer not to carry cash the bank will be available to exchange their money for a debit card for exclusive use on Columbiat, as they do not carry Sovast devices. If temporary residents such as ship crews often find themselves at Columbiat a permanent bank account can be opened along with keeping a Columbiat debit card.

7.2.3 New Foundation Society Headquarters

The New Foundation Society Headquarters will be centrally located on Columbiat. The Headquarters will be set up with the banks so that businesses along with investments can be monitored and displayed on a board if a company on the station is "up" or "down" a certain percentage. The Headquarters will be modeled to look like a planetarium with a large office building with a lobby connected to it. The large office building it will be a open area to promote work flow but moveable walls can be utilized for whatever purposes the Foundation Society may need. The planetarium will have a stadium set up so that a podium is in the middle with a control pad that a presenter may use to explore the solar system projected onto the arched ceiling. This projection system will provide the most engaging and hands-on way to research possible new settlements and convey information to a staff of 300. To

provide member services a lobby will be showcased where residents may meet and speak with available Foundation Society officials. To allow residents to offer suggestions or improvements for the station, kiosks will be available in the lobby of the headquarters (see 5.3).

7.2.4 The Golden Age

For residents looking to retire the inner torus with the 0.5g is the best option. Those residing in the inner torus will literally be "living easy" with less stress on joints due to less gravity. The atmosphere will also be under slightly higher pressure to supply more oxygen to inner torus residents. More leisurely activities will also be available on the inner torus such as painting and virtual golfing. The inner torus offers a smaller, more intimate community that residents can be involved in. There will also be resident-driven clubs that other residents may join to promote the sense of community Columbiat strives to foster.

7.3 Space Elevator Operations Center

7.3.1 Construction Control center

During the construction process views of the extrusion mechanism and ribbon will be live streamed to Columbiat using an array of high resolution cameras to view extrusion mechanism and ribbon integrity. These cameras will offer the most reliable method to view the space elevator operations.

7.3.2 Monitoring Ribbon Integrity

With cameras located on the industrial zone and along a fiber optic wire running down with the ribbon views of the ribbon via live stream will be available at all times. To ensure that the ribbon is maintaining integrity, cameras will also have a thermal viewing option where if the ribbon is ripping a temperature change would take place being shown on the live stream. The external construction bot, Srang (see 5.2.1), will work to inspect the ribbon. The inspection of the ribbon will take place constantly since 75 bots will be utilized running at 50 miles per hour on average. 25 Srang robots will be kept for contingency purposes in case a bot breaks. Srang will also detach and reattach when the elevator cab comes by as to not cause any interference. For the inspection, Srang will check the ribbon for abnormalities such as rips and if any are found the control center will be alerted. Both cameras and automated "inspection crawlers" will provide optimum security for the monitoring of the elevator cab ribbon.

7.3.3 Maintenance and Repair Systems

Once severe abnormalities of the ribbon are detected via Srang, the control center will be alerted. With the control center's permission the elevator cab will be stopped and multiple Srangs will perform repairs (see 5.2.1). If small scale issues are detected, repairs will be made by the Srang between trips. If the space elevator itself is malfunctioning, the control center will once again be altered. For severe issues, once the control panel gives permission, the elevator cab will be stopped. To repair the space elevator, the Srang will carry extra supplies; depending on the repair needed, the Jie robot will also be available, as the Srangs will be able to carry these bots to the space elevator (see 5.2.1). For less severe issues, the space elevator will complete its docking before the Srang and/or Jie bots will quickly repair the issue.

7.3.4 Passenger Monitoring

Facilities for monitoring temperature and oxygen level will be monitored to secure the safety of passengers. To ensure passenger experience is an enjoyable there will be an attendant on each elevator cab.

OPERATIONAL SCENARIO

"EQUIPPED WITH HIS FIVE SENSES, MAN EXPLORES THE UNIVERSE AROUND HIM AND CALLS THE ADVENTURE SCIENCE."

- EDWIN HUBBLE

8.0 Appendices

A. Operational Scenario

INTRODUCTION OF COLUMBIAT
A slow sweeping panoramic view of Columbiat, periodically flashing to a FIRST PERSON PERSPECTIVE of the initial walk into the passenger welcoming area. The perspective takes in each detail; the bustling city views on the SCREENS, the live view of the cosmos.

NARRATOR [YOUNG MAN'S VOICE]
I remember looking up to the skies and seeing potential. Opportunity. Now I stand at the doorstep of this frontier, an immigrant to a new world.

The panoramic view then fades to the perspective camera [PC]. The PC approached the BUCKYSTRUCTURE MODEL of Columbiat, gazes at it and swoops backwards, revealing a WOMAN following behind and a SMALL CHILD holding her hand, feverishly gazing around.

Now, that's some innovation. Honey, do you see this? Miracle cables, to me.

WOMAN
(Smiling)
Only in space.

The PC looks up to the city SCREENS. An ARM from off the side of the view points to the streams.

NARRATOR (YOUNG MAN'S VOICE)
Look, 6 cities to go to!
(Laughs)
We can start the day whenever we want to.

WOMAN
Looks like it's day time in New York and

night in Paris. We can leave Julia at the hotel during the day and immediately go for a midnight stroll in Paris!

SMALL CHILD
Hey! I want to go!

WOMAN
(chuckles)
I'm sorry, sweetie. It would be past your bedtime in Paris.

The PC looks to the welcome area EXIT.

NARRATOR (YOUNG MAN)
This docking area is going to be filled with ships coming across the solar system. Investing and growing this place. Almost reminds you of Wall Street, huh? Hope the can handle the traffic.

WOMAN
I think they can. Did you see that port back there?

NARRATOR (YOUNG MAN'S VOICE)
Yeah. Man.
(sighs contently)
I heard this is going to be the biggest port in the solar system. It's like humanity finally made it to the stars.

WOMAN
And if it's large, there's gotta be money in it. Being here, you know. I think it's the best choice we've made.

NARRATOR (YOUNG MAN'S VOICE)
Me too.

The PC looks back at the WOMAN and SMALL CHILD. The WOMAN

smiles encouragingly; the small child still looking around, eyes filled with wonder. The PC looks toward the exit again. The camera grows black as it approaches, the words

"Columbiat – City Splend" appearing across the screen.

FADE OUT:

THE END

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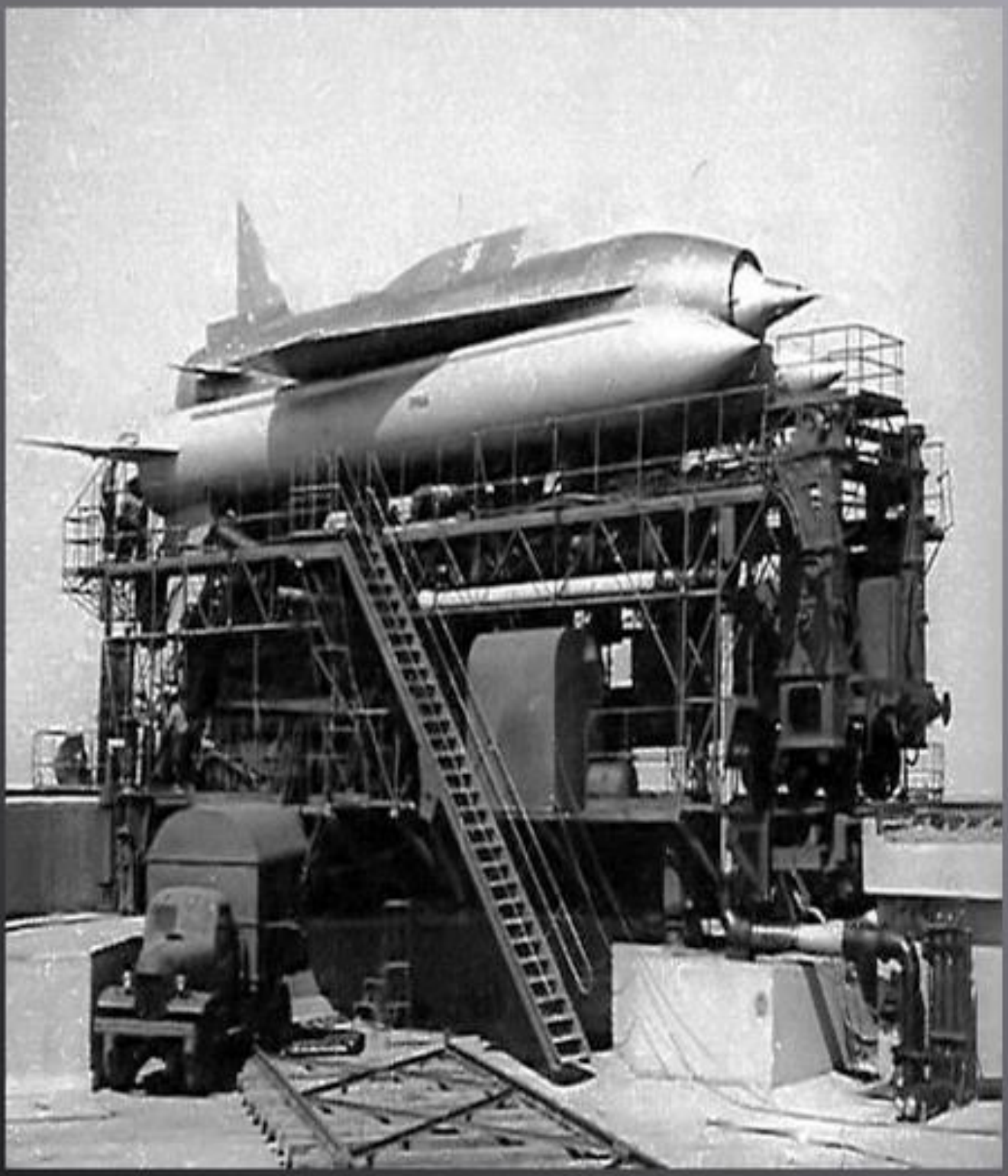
COMPLIANCE MATRIX



"THE DESIRE TO REACH FOR THE SKY RUNS DEEP IN OUR HUMAN PSYCHE." - CESAR PELLI

C. Compliance Matrix

	Title	Brief summary of the section
1.0	**Executive Summary**	Columbiat will be the largest and most cultural settlement made for the Foundation Society.
2.0	**Structures**	Safe and efficient use of space offered by two torii and two industrial zones.
2.1	External Design	Nonrotating, rotating, non-pressurized, and pressurized are clearly defined for residents and transients.
2.1.1	Enclosed Volumes	Columbiat will offer two torii, two industrial zones, and expandable docking.
2.1.2	Artificial Gravity	Zones of 1, 0.5, 0 gravity will be offered depending on the situation and preference.
2.1.3	Hull Design and Materials	The composition of the hull will offer prime protection for all inhabitants of Columbiat.
2.2	Down Surfaces	Columbiat is divided into six “cities” which are further divided into residential and commercial areas.
2.3	Construction Process	The construction process takes place in eight steps using completely automated procedures.
2.4	Cargo and Passenger Docking	Initially two industrial and one residential docking ports are offered but are able to be expanded in the future.
2.5	Space Elevator	A convenient waiting area is made and transportation to and from that area is provided and easily accessible.
3.0	**Operations**	Efficient and innovative infrastructure is made a priority on Columbiat.
3.1	Materials and Equipment	Columbiat is composed mostly of lunar materials transported via the space elevator and stored in the industrial zones.
3.1.1	Sources	Materials will come mainly from other space settlements and Earth.
3.1.2	Transportation of Materials	Materials will be transported mainly via the space elevator.
3.1.3	Storage of Materials	Materials will be stored mainly in the industrial zones.
3.2	Infrastructure	Operations will provide safe and efficient infrastructure processes keeping citizens healthy and safe.
3.2.1	Atmosphere	Air pressure will vary by the torus and the temperature will remain 72 degrees in residential areas.
3.2.2	Food Production	Columbiat will utilize dynaponics and bioprinting.
3.2.3	Electrical Power Generation	Nuclear reactors running on a fission fragment process will be utilized.
3.2.4	Water Management	Solid waste will be removed and liquid waste will go through a filtration process eliminating bacteria and pathogens.
3.2.5	Solid Waste Management	A plasma gasifier unit is utilized which will run on the solid waste that it is fed.
3.2.6	Communication	For internal communication fashionable accessories will made and for external a laser communication system will take place.
3.2.7	Internal Transportation	Many options including tram, bikes, scooter, and STATS will be available to residents.
3.2.8	Day and Night Cycle	There will be six time zones and videos of Earth, moon, and

		stars will be shown depending upon the time.
3.3	Construction Equipment and Machinery	The construction process is fully automated using a multifunctional robot.
3.4	Propulsion Systems	Both electromagnets and hydrogen-oxygen rockets will be utilized to initialize and sustain rotation.
3.4.1	Rotation of Artificial Gravity Volumes	In step 7, rotation is initialized via electromagnets and rockets.
3.4.2	Station-Keeping	A winch system using the counterweight of the elevator cable is utilized to stabilize station.
3.5	Space Elevator	Passenger and cargo train cabs using steel rollers allow the space elevator to be an efficient form of transportation
3.5.1	Elevator Cab Design	Passenger and cargo train cabs will run on the elevator cab ribbon providing ease of transport.
3.5.2	Attachment Method	Kevlar-coated steel rollers grip the space elevator ribbon.
3.5.3	Method of Travel	The pressure in which the rollers grip the elevator cab provide the traction for the elevator to "climb" the ribbon.
4.0	**Human Factors**	
4.0.1	Community Attributes	Both "big" city and "small" city cultures collide within Columbiat.
4.0.2	Natural Sunlight and Views	Simulated natural views will be projected onto ceiling of public place and private homes.
4.1.1	Community Amenities	Columbiat will be split into six "cities", different amenities for each "city".
4.1.2	Consumables	Consumables will come mainly from Earth and onsite manufacturing and be transported via underground pneumatic tubes.
4.1.3	Community Design	Columbiat will be split into "six" cities with centrally located office buildings and banks.
4.2.1	Furniture/Sources	Furniture will be constructed from recycled lunar dust from Alaskol and materials shipped from Earth.
4.2.2	Residential Floor Plans	Four residential floor plans are offered for residents to choose whichever meets their needs.
4.3	Artificial Gravity Safety	Different systems, vehicles, and spacesuits will be utilized to provide optimum safety on Columbiat.
4.3.1	Systems	Personal devices and meshes of buckystructures are the primary safety precautions.
4.3.2	Vehicles/Transportation	The external transportation pod and spacesuit provide safety precautions and usability.
4.3.3	Spacesuit	The spacesuit will provide comfort and usability as well as maximum safety features.
4.3.4	Donning/Doffing Procedures	Donning and doffing will take place in airlocks via robotic procedures.
4.4.1	Initial Experience/Docking Amenities	Arriving passengers will be able to see all six "cities" via OLED screens and choose their desired "city".
4.4.2	Hotel Floor Plans and Visitor Accommodations	12 hotels and a garden are featured to provide comfort and luxury to transients.
4.4.3	Visitor Security Measures	3D scans of thumbs will be used and deleted upon leaving the station.
4.5	Elevator Cab	Travelers are taken on an six day journey and enjoy themselves via lounges, private seating accommodations, and other space cab features.

4.5.1	Space Cab Seating Arrangements	Space cab seating can be personalized to be as public or private as the passenger enjoys.
4.5.2	Space Cab Accommodations and Privacy	Rentable rooms and curtains are provided for privacy and many other accommodations are made to entertain passengers.
5.0	**Automation**	Robots and automated processes will be utilized for all aspects of Columbiat.
5.0.1	Automated Functions	Automated functions are utilized in everyday life as well as for the construction of Columbiat.
5.1	Automation of the Construction Processes	Automated facilities and robots will be utilized to handle materials as well as handle construction tasks.
5.1.1	Transportation and Delivery of Materials	Transportation of materials will take place via Alaskol's mass driver.
5.1.2	Exterior Constructions	A welding and construction bot will fully automate the exterior construction process.
5.1.3	Interior Constructions	Interior construction will be handled via 3D printing and automated robots.
5.2	Automated Facility	Optimal safety and efficiency is utilized, providing contingency plan and security for all inhabitants of Columbiat.
5.2.1	Maintenance and Repair	Being able to detect any issues multiples robots have the capabilities to repair any issue.
5.2.2	Backup Systems and Safety Functions	Encryption and back up plans are put into use to offer safe use of personal devices on Columbiat.
5.2.3	Contingency Plans	In any emergency a contingency plan is ready fully automated and safe.
5.2.4	Facility Security	Five different security levels will be provided for residents up to settlement officials.
5.2.5	Personal Communication Devices	Armbands and personal communications are provided to each inhabitant of Columbiat.
5.3	Automated Habitability and Community	Simple tasks will be fully automated to provide more time for relaxation and business.
5.3.1	Automated Robot Systems in the Community	Robot systems within the community will be safe and beneficial to the Columbiat community.
5.3.2	Privacy of Data	Encryption as well as GPS tracking will keep data protected.
5.3.3	Data Storage, Collection, Distribution, and Access	Inhabitants will be linked to a main and backup server simultaneously.
5.4	Handling of Cargo Ships	The fully automated system of handling cargo makes Columbiat cost effective and safe.
5.4.1	Loading and Unloading of Materials	Robotic arms will handle loading and unloading of cargo ships.
5.4.2	Warehouse Storage	Warehouse storage will be 0g to provide ease of transport via robots.
5.4.3	Inventory Management	Each item entering the Columbiat is inventoried via a barcode system and tracked.
5.5	Robot Repair Facilities	Dust will be eliminated on all robots entering Columbiat.
5.5.1	Dust Prevention	To prevent dust contamination a coating will be applied as well as a dust shield.
5.5.2	Dust Cleansing	Charged particle beams and a fiberglass brush will ensure that no dangerous amount of dust will enter Columbiat.
6.0	**Schedule and Cost**	Construction schedule and all costs associated with building

		the settlement.
6.1	Schedule	Construction of Columbiat will take place from May 15, 2049, to July 20, 2064.
6.2	Cost	Building Columbiat will cost the Foundation Society a total of $224,740,189,500.
6.2.1	Structural Cost	Costs associated with constructing the main structure of the settlement.
6.2.2	Infrastructure Cost	Costs associated with the operations and infrastructure of the settlement.
6.2.3	Community Cost	Costs associated with building the community areas of Columbiat
6.2.4	Automation Cost	Costs associated with all automated tasks and systems for the station
6.2.5	Cost by Construction Stage	Costs associated with each phase of construction
7.0	**Business Development**	Columbiat will provide the facilities and systems to be expected of such a high-scale
7.1	Transportation Node and Port	The transportation node and port offer the most efficient and economic for businesses and corporations.
7.1.1	Industrial Capabilities	Multiple ships will be able to dock, unload/load, and have repairs made with a fully automated system.
7.1.2	Passenger Traffic	The welcome center, when passengers arrive, offers a choice of six different “cities” to prevent jet lag.
7.1.3	Passenger Activities	To promote participation in “big city” activities a festival ground and entertainment options will be featured.
7.2	Commerce and Financial Center	Columbiat will provide facilities for buisnesses, banks, and the Foundation Society headquarters.
7.2.1	Office Facilities	Office facilities that promote morale and efficiency are offered to businesses and corporations.
7.2.2	Bank Facilities	Centrally located banks allow for businesses, residents, and transients to utilize Columbiat’s banks.
7.2.3	New Foundation Society Headquarters	The headquarters will provide optimum services to research, manage, and provide member services.
7.2.4	The Golden Age	This community will offer the reality many have dreamed of, taking a step back and “living easy” in the inner 0.5g torus.
7.3	Space Elevator Operations Center	This control center will allow for the most efficient maintenance, repair, and monitoring of the space elevator ribbon and cabs.
7.3.1	Construction Control Center	Cameras will be utilized to view extrusion mechanisms and ribbon integrity during construction.
7.3.2	Monitoring Elevator Cab Ribbon	75 bots will crawl the wire constantly checking for ribbon integrity, notifying control center of any abnormalities detected.
7.3.3	Maintenance and Repair Systems of the Elevator Cab	If small-scale issues are detected they will fixed between trips. If large-scale issues are known the elevator cab will be stopped immediately for safety purposes.
7.3.4	Human Monitoring Within the Elevator Cab	Automated systems and an attendant in each car will ensure comfort and safety for passengers.