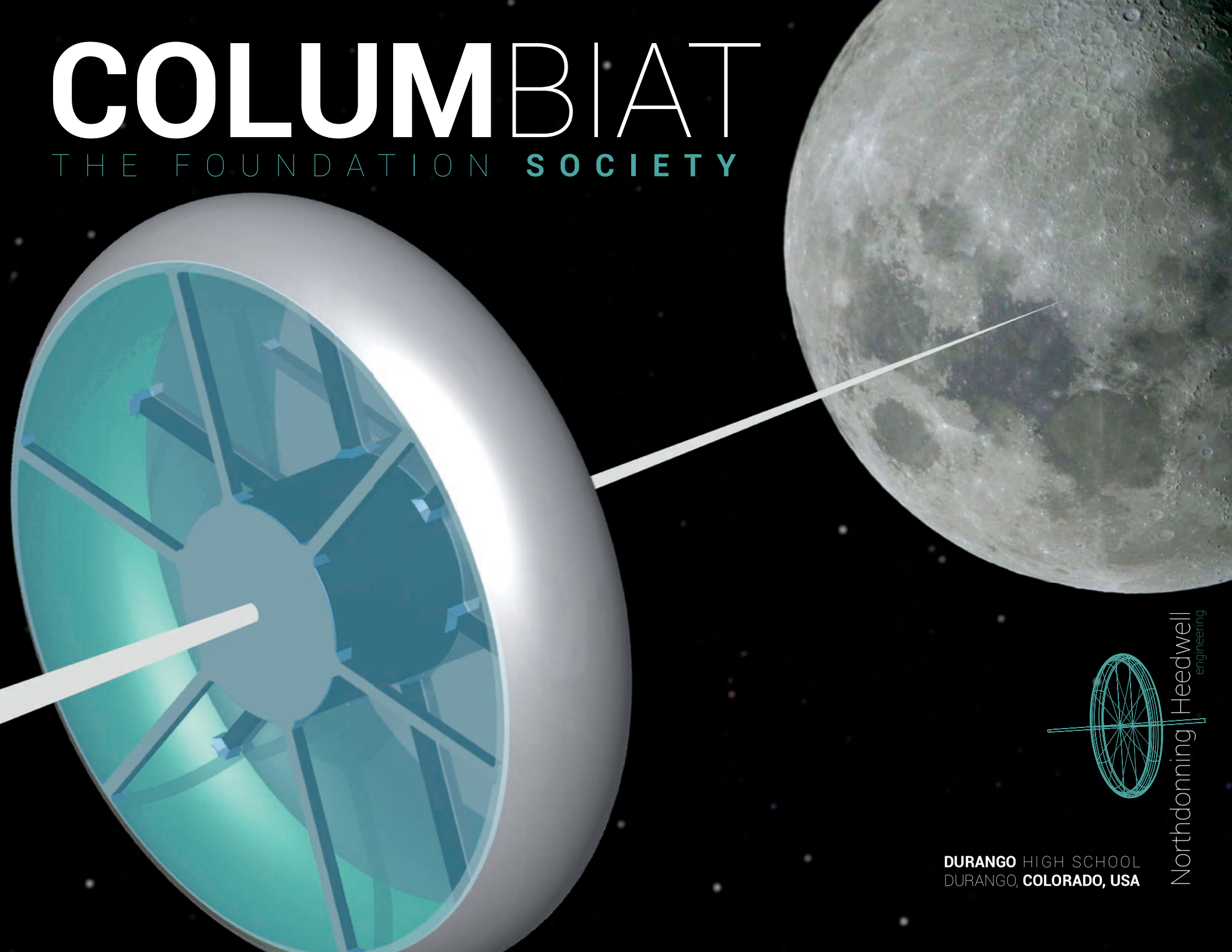
COLUMBIAT

THE FOUNDATION SOCIETY



DURANGO HIGH SCHOOL
DURANGO, **COLORADO, USA**

Northdonning | Heedwell engineering

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

Name of responsible teacher/advisor:	Daniel Garner
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Last day of school before July 2014:	28-May-14

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Names, [grade levels], and (ages) of 12 students currently expecting to attend the Finalist Competition: (we request that participants be at least 15 years old, and not older than 19)

Haakon Sigurslid [12] (18)	Jocelyn Zemach [12] (18)
Bella Bussian [12] (18)	Mallory Byrd [11] (17)
Jesse Rubenstein [12] (18)	Joe Genualdi [10] (16)
Emma Greenberg [12] (18)	Charlie Greenberg [10] (16)
Elle Rathbun [12] (18)	Patrick Leach [12] (18)
Mariah Dorsey [12] (18)	Ben Wilbur (11) (18)

Names of two adult advisors currently expecting to attend the Finalist Competition:

Daniel Garner	Steve Powell

Competition July 25-28, we will be expected to finance our own travel to/from Titusville, Florida, USA.

Daniel Garner	4/16/14
Responsible Teacher/Advisor Signature	Date

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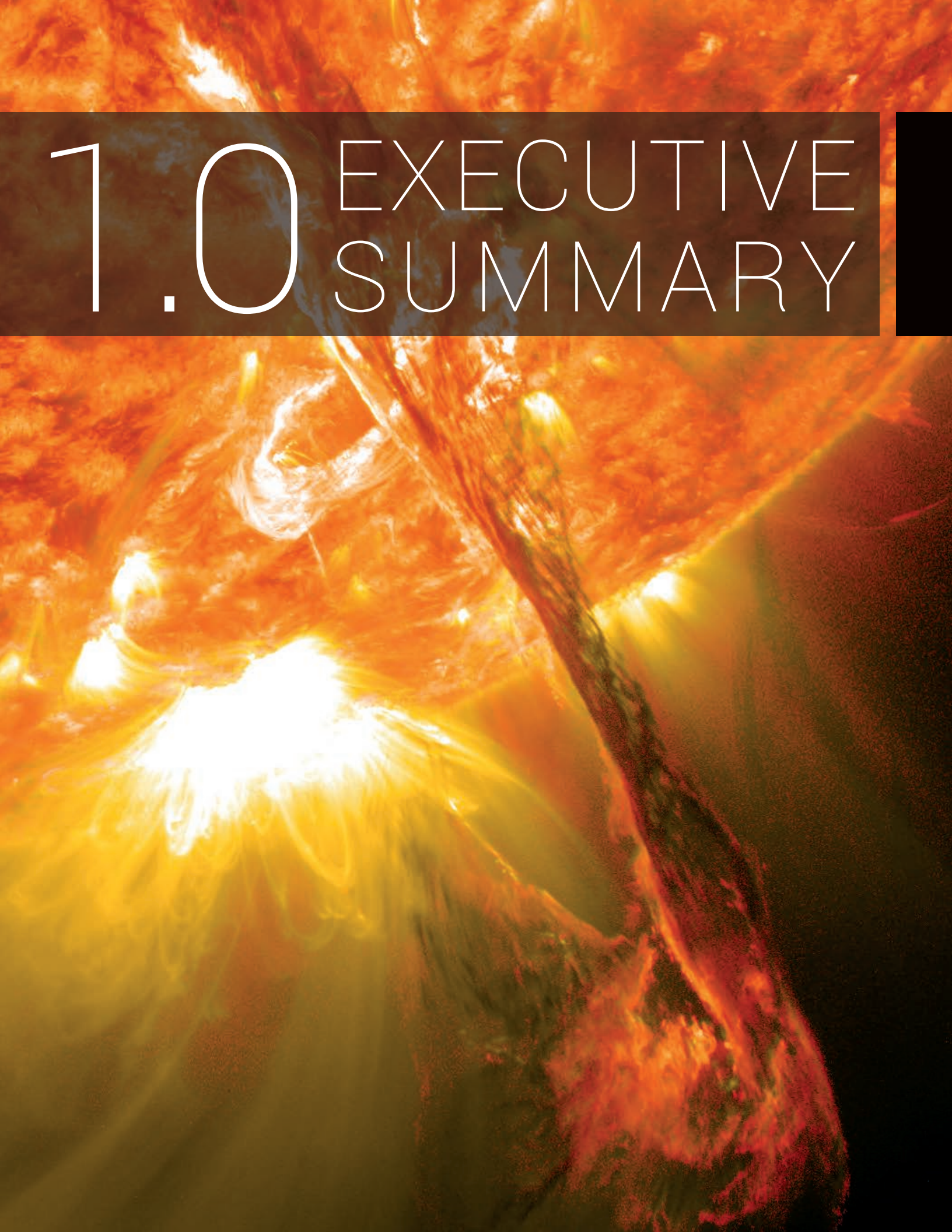


1.0 EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

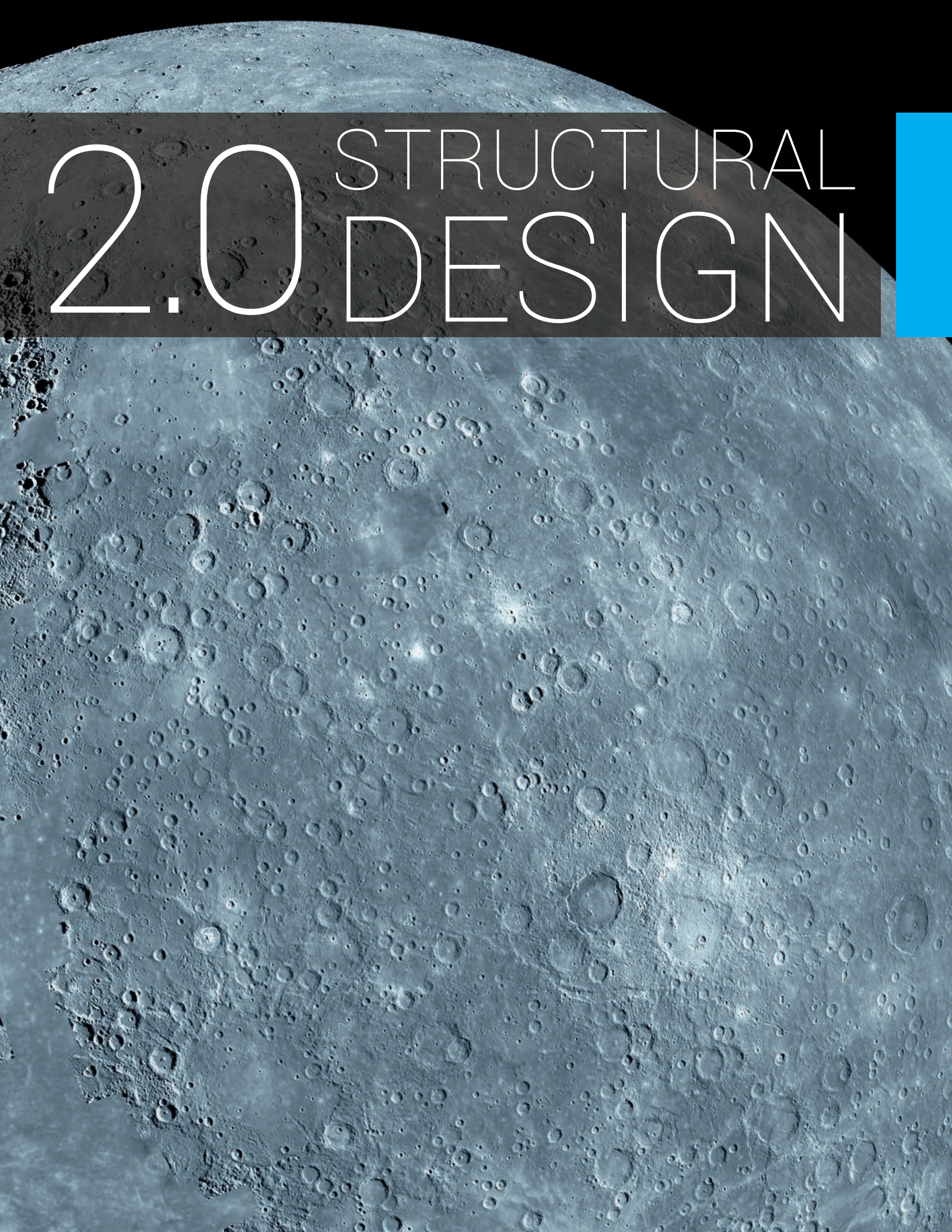
"The probability of success is difficult to estimate; but if we never search, the chance of success is zero." (Giuseppe Cocconi and Philip Morrison) Northdonning Heedwell never misses an opportunity to increase success. Pushing the boundaries of business and investments, Columbiat promotes exploration and innovation to mold the future course of humanity's endeavors.

Columbiat embodies the beauty of the Columbia river coupled with the unique environment of space that fosters the lucrative nature of a banking center. We designed a settlement based on the idea that a lucrative business can thrive and surpass all the existing markets. The harsh space environment poses many threats to our settlement, all of which and more we have taken into account while designing Columbiat. We have designed a luxurious gateway to your future business endeavors, the lunar surface, and beyond. Our fluid transfer of people, cargo, and ideas creates a lucrative and thriving industry, where the security of your investment comes first.

Northdonning Heedwell's most notable examples of forward thinking and innovation within our designs appear within all disciplines:

- Columbiat's structure enables fluid access to all interconnected parts of our settlement. Large windows furnish all aboard Columbiat with unparalleled views of earth and the moon, while their honeycomb structure and layered composition provide structural stability to the whole of the settlement.
- Our unique rotating day and night cycles keep a constant flow of energy throughout the settlement, allowing for continuous work capabilities to foster the most profitable environment. With no need for a peak loading, we capitalize on efficient power systems. Our segmented elevator cab streamlines the docking process, while keeping passengers safely away from any potential harmful exposure in the port facilities.
- Interactive "Adventure Bubbles" grant the freedom to explore the universe, as users have the ability to adventure to any desired destination within the known cosmos.We integrate self sealing hydrogen based polymers into our spacesuits to simplify the donning and doffing process. Our ability to create a comfortable environment facilitates the seamless transfer of ideas within the business canopy and residential areas.
- Holographic technology lays out the world for the user through immersive Holo-Cad buttons and BCI technology, thus streamlining user and machine to effectively run Columbiat. To utilize the excess space cable that extends beyond Columbiat, we designed a near earth transfer station located on the earth side of the elevator to provide a gateway to the rest of the universe.
- Our extensive markets for materials and repairs in our port facilities promote the perfect environment for our own stock market and business ventures. We capitalize on the every growing market of silicon buckysturcture through our ease of access to raw lunar materials.

Northdonning Heedwell appreciates your decision in investing in us to build Columbiat: the gateway to innovative business markets and space enterprises.



2.0 STRUCTURAL DESIGN

STRUCTURAL DESIGN

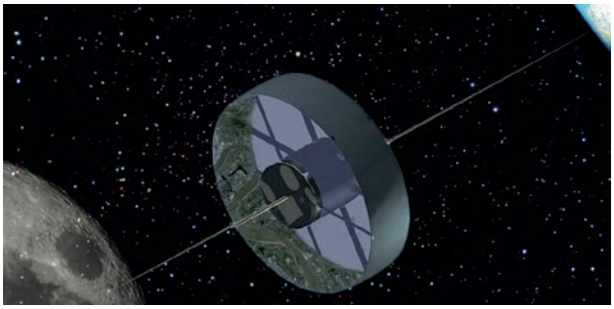
Columbiat's structure encompasses the premier measures in safety and efficiency, while also highlighting the glories of living and working in a space environment. Our expansive port systems enable any size of ship to interface with Columbiat, promoting a dynamic trade industry aboard the settlement; our extensive tessellated windows provide all residents and transients aboard Columbiat with stunning views of space around them, while also shielding them for any harmful environmental factors; our down-areas promote connection and movement throughout the Residential Floor, while also providing a separate and secluded workspace for businessmen and women in the Singapore-inspired Business Canopy; Northdonning Heedwell's Columbiat functions, in whole, to create a home for not just its residents, but its many lucrative business ventures, transient ships, tourists and more.

2.1.1- ALLOCATIONS OF SPACE AND STRUCTURAL FEATURES

Northdonning Heedwell promotes safety above all other aspects in creating a luxurious business environment. Columbiat also provides a spacious work environment in the Business Canopy, while maintaining a comfortable living environment for our residents and seamless transportation between the two.

Our allocation of space within Columbiat ensures a luxurious and productive living environment, while also allowing smooth transport between all sections. Three major sections make up Columbiat: the Operations Core (Ops Core), the Residential Volume, and the Operations Crescent (ref. Image 2.1.1). The Ops Core exists at the center of the settlement as a non-rotating cylinder and provides a central location for docking, transportation of cargo, storage facilities, mainframe computing system and the housing for integral systems aboard Columbiat. Over 3 hundred-million m3 of volume in the Ops Core provides sufficient space for both long-term and short-term storage and all systems management within. The disk-shaped Residential Volume surrounds the Ops Core, with the smaller Operations Crescent around its circumference (ref. Image 2.1.2). The Residential Volume provides a spacious environment for all residents and visitors aboard Columbiat. With an overhead height of 360 meters, and a volume of 1.17 billion m³, the Residential Volume encompasses the residential, commercial, business, and agricultural areas aboard Columbiat, while the Operations Crescent holds a significant part of the operations systems within Columbiat.

Image 2.1.1 Columbiat's orientation allows for unobstructed views of both earth and the moon from the Residential Floor and Business Canopy.



The entire settlement extends 910 meters from the center of rotation to the outer edge of the Operations Crescent, with a total diameter of 1820 meters, and a width of 600 meters. The central Ops Core extends to 400 meters from the point of rotation. Beyond the Ops Core, the Residential Volume reaches from 400 meters to 900 meters in order provide for Columbiat's spacious communities. Elevator-spokes extending from the Ops Core to the edge of the Operation Crescent allow for ease of transport through different sections of Columbiat as well as provide structural integrity for the Residential Volume. Additionally, to insure the Residential Volume maintains integrity under pressurization forces, our structural design incorporates a series of trusses, which extend from the walls across the Residential Volume at a height of 170 meters, to mitigate bowing forces. We believe that form and function should work in unison and have therefore designed our trusses to serve as the base for our business sector in a beautiful 'canopy' above the Residential Floor of the settlement. Located at a 900 to 910 meters radius from the rotational axis, the Operations Crescent provides ease of access for water, waste, and electrical systems.

During construction we fasten large panels of opaque hull together to create a seamless seal with struts and tresses around the Ops Core and the Operations Crescent(ref. Section 2.3.5). In the window sections a framework of tessellated honeycomb made of ferronickel alloy provides added soundness to the our window composition. In all sections of our hull, components with properties providing the maximum radiation, temperature, and micrometeorite impact protection enable a safe environment for all residents and transients aboard Columbiat(ref. Section 2.1.3).

Columbiat encompasses a variety of gravity levels to grant our residents and transients the ability to participate in activities in many varying gravities only found in space. The non-rotating Ops Core remains in zero g for ease of docking and housing of any tasks requiring zero gravity (such as transfer of large cargo or zero g storage). The Agriculture Volume, located within the Residential Volume, aids plant growth and harvesting at between .4 to .6 g's. The Business Canopy exists at .8 g's to deliver the most comfortable environment for all business and commerce. For the health of residents, the bottom of the Residential Volume supplies the equivalent

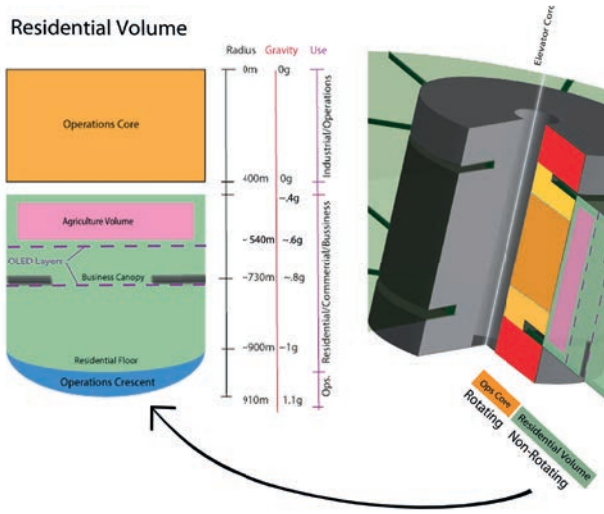


Image 2.1.2 Space allocations provide a surplus of growing room for all ventures aboard Columbiat, while still preserving the accessibility throughout all volumes.

of Earth's gravity to each community. The Operations Crescent receives 1.1 g's, with extra gravity we save energy through less pressure to pump water and waste around the settlement. (ref. Image 2.1.2). A rotational speed of 93 meters per second, at the outermost point, ensures appropriate gravity, while rotating slow enough to avoid motion sickness in residents.

The partially-pressurized Ops Core provides pressurized space for passenger and cargo transport, and ship repair, while also enabling storage facilities to exist in both vacuum or pressurized environments depending on the customer's wishes(ref. Image 2.1.2). Both Residential Volume and the Operations Crescent remain pressurized to 1 atm for the comfort of all of the 25,000 people Columbiat can house at a given time.

2.1.2 TRANSPORT BETWEEN ROTATING AND NON-ROTATING VOLUMES

To accommodate the bustling transport aboard Columbiat, our interface systems between the non-rotating Ops Core and the rotating Residential Volume transport both goods and passengers with maximum regard for safety and reliability. A rail encircling the Ops Core, held in place with stationary struts, provides an attachment point for the connectors extending from the rotating Residential Volume. Two of these rail structures, around the circumference, one on the lunar and the other on the earth-facing side, of the Ops Core, secure the connection between rotating and non-rotating volumes (ref. Image 2.1.3). An Aluminum Magnesium Bromide coating provides a self-lubricating and wear-resistant surface for this interface in addition to an unparalleled low coefficient of friction. The interspersed attachments to the rail provide structural integrity as well as opportunities for refurbished construction robots to easily inspect, repair, or re-coat the rail interface (ref. Section 5.2) .

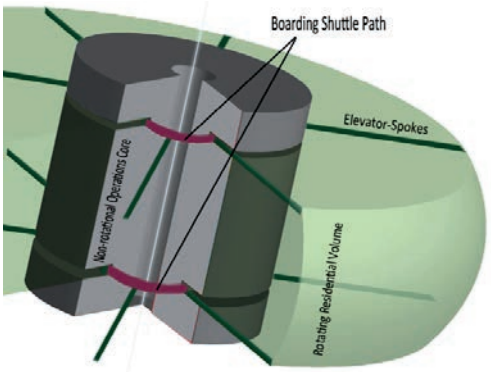
Our Ostium Shuttle System transports passengers from their ships through the welcoming 'light tunnels' in the Ops Core to the connection interface (ref. Section 4.4.1). In the interface shuttles accelerate on rails alongside the rotating elevator-spokes to match their speed in order to board the elevators, and thereby transport passengers and cargo to the rotating Residential Volume.

Twelve main elevator systems operate simultaneously to transport people and cargo to and from the Ops Core and Business Canopy. Every elevator-spoke operates multiple elevators within one elevator shaft. The position of the elevators (ref. Image 2.2.) Allow them to serve as struts to reduce the stresses on the hull and increase structural integrity.

2.1.3 HULL COMPOSITION

The hull of Columbiat protects its residents, structure, and contents of the settlement from radiation, impact, and the stresses of space. As much of Columbiat's exterior provides views of space, the windows use a variety of materials to maximize compressive and tensile strength and overall structural reliability while retaining their desired optical properties. Our extremely sturdy windows, coupled with the support from the high-strength elevator shafts, allow for a majority of clear hull without compromising the strength of the structure. The exterior layer of lead laminated acrylic glass creates a strong shell that guards against radiation and can withstand the extreme temperatures of space; it also provides fracture toughness to withstand impact from space debris or micrometeoroids. In order to combat the

Image 2.1.3 The shuttle system between rotating and non-rotating volumes ensures safety of transport of all passengers and materials transferring though Columbiat.



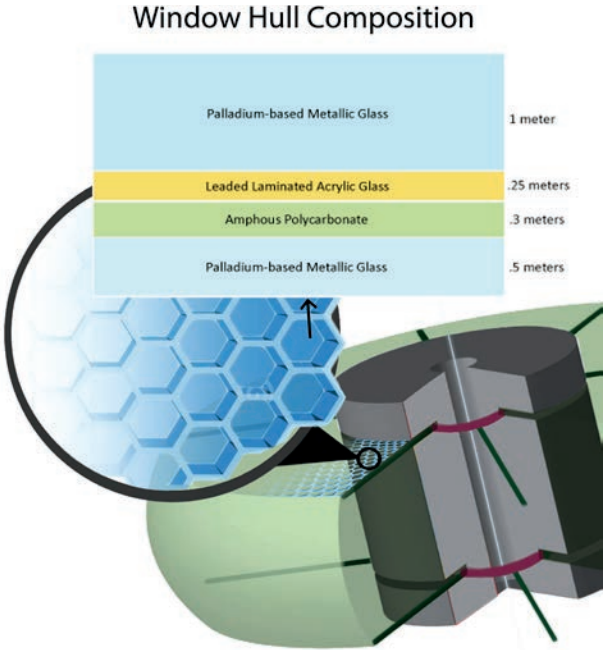
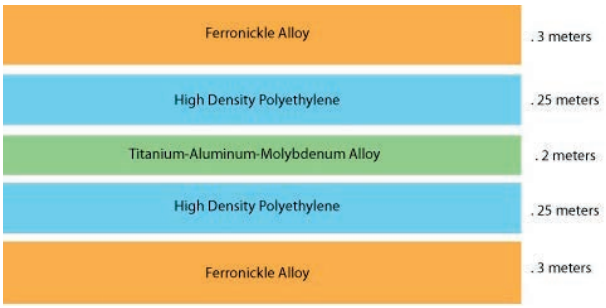


Image 2.1.4 For unobstructed views of the moon, the earth and beyond, our tessellated window design provides all those aboard Columbiat beautifully safe views.

extreme temperatures of space, a layer of D3O gel expands and compresses to counteract the varying temperatures and thermal expansion coefficients within the hull. Next, a .5 meter thick layer of palladium-based metallic glass ensures the windows remain structurally sound with extremely high strength and fracture toughness. The fracture toughness of this layer also prevents debris from inflicting major hull damage. The third layer of amorphous polycarbonate nullifies all harmful radiation in addition to insulating the settlement. Finally, another layer of palladium-based metallic glass procures the redundancy needed to ensure the protection of everything aboard Columbiat from micrometeorite impact (ref. Image 2.1.4).

To reduce cost and materials, the portions of hull on Columbiat that do not require transparent properties incorporate five layers designed to provide structural integrity, radiation and thermal protection, and debris mitigation while utilizing less material. A .3 meter thick layer of ferronickel alloy provides strength and fracture toughness, to prevent debris or micrometeoroids damage. In addition, this layer resists the harsh thermal conditions of space. Next, two layers of high density polyethylene around a layer of titanium alloy ensure structural integrity and radiation and thermal protection. A final layer of ferronickel alloy supports the hull and offers emergency protections (ref. Image 2.1.5).

Image 2.1.5 Columbiat's opaque hull includes materials to protect against the dangers of radiation, extreme temperatures, and debris penetration.



We embed Sensors in the hull to detect potential failures, giving automated systems cues to where and when they should repair or place prevention mechanisms. These sensors also allow rapid response to unforeseen threats to the settlement(ref. Section 5.2.1). After detection of possible threats of weaknesses, contingency procedures act in order to minimize all damage to the settlement. These procedures include the isolation of the damaged volume through the deployment of Electrorheological Fluid Nets (ER Fluid Nets) which also seal any hull breach, and automated system's swift emergency repair of any damaged section (ref. Section 5.2.2). Additionally, several pressure relief valves automatically dissipate pressure if an over-pressurizations occurs. Located in the Operations Crescent, these valves protect more vulnerable sides of Columbiat, while not interfering with views or elevators. In addition to the elevator shafts, a honeycomb of struts forming triangles adds extra structural integrity to the windows. Made from ferronickel alloy, the 10 meter long .2 meter across struts leave views unobstructed and increase the strength of the windows as a whole.

2.2 DOWN-AREA ALLOCATION

Columbiat's down-areas create a spacious living environment for all residents. The centrally located commercial centers on the Residential Floor foster movement through commercial areas, and ease of access to amenities for both residents and transient residents. The Business Canopy also provides a generous space, separate from residents and transients to promote efficient and undistracted business endeavors.

We have sectioned the down-area allocation of Columbiat into two major surfaces: the ample Residential Floor, and, poised above the Residential Floor, the shining Business Canopy. The Residential Floor includes spacious residential areas, centrally-located commercial sectors, and prolific parks to provide communities access to both recreation activities and necessary infrastructure to afford our residents with an effortless living environment (ref. Chart 2.2.1 and Chart 2.2.2). The transportation inside the communities promotes walking or biking on sidewalks to cultivate fluid movement between short distances and healthy lifestyles for the residents.

	ALLOCATIONS	PERCENTAGE OF TOTAL DOWN-AREA
Residential	2,030,000 square meters	38%
Park Space	1,054,000 square meters	20%
Commercial	360,000 square meters	7%
Business	1,979,000 square meters	35%

Chart 2.2.2 Exact Allocations of All Down-Areas.

Chart 2.2.1 Total Split of Down-area Allocation

	ALLOCATIONS	PERCENTAGE OF TOTAL DOWN-AREA
Residential Floor	3,444,000 m^2	65%
Business Canopy	1,979,000 m^2	35%

Surrounding the elevators on the Residential Floor, the commercial areas house hotels for transient visitors along with many of the amenities Columbiat has to offer. The proximity of the commercial areas to each of the twelve elevators creates smooth transport of visitors and materials throughout Columbiat. The large residential areas extend around these commercial areas enabling residents to easily access commercial facilities. However, a small strip of park space separates residential from commercial areas to garner calm communities in the residential areas. The Amplos transportation system connects to the elevator terminals for easy transfer of people between elevators and the rest of the Residential Floor (ref. Section 3.2.7). Our residents have easy access to park space with appealing water features, not only between residential and commercial, but also extending beyond the residential in a large fluid parkspace running through the center of the entire Residential Floor (ref. Image 2.2.1).

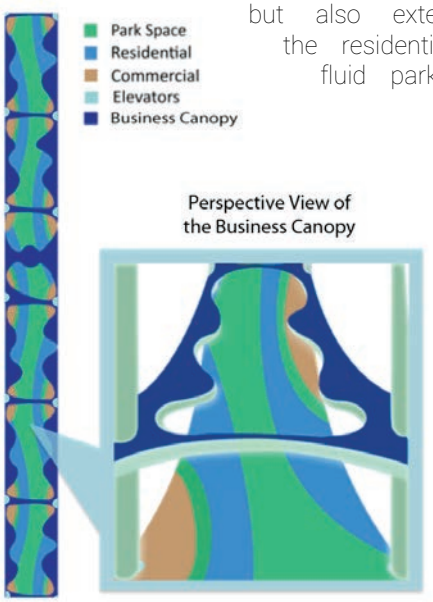


Image 2.2.1 Down-area allocations create centered communities along the Residential Floor and separate-ly tranquil environment for busi-ness in the Business Canopy.

Located 170 meters above the residential communities, the organically patterned Business Canopy separates the official business and banking from the residential and tourism sections, enabling a productive and distracting workspace for businessmen and women. This isolated business area provides business people long views across the settlement and to both the earth and the moon, as well as a comfortable working environment at .8g. Elevators on the lower surface provide our residents and tourists a harmonious connection to our business level and non-rotating center. The Canopy, inspired by Singapore's 'Gardens by the Bay' extends out 1/6th the total width of the disk from each side, and provides the plentiful space for businesses while maintaining long lines of sight for the residents below (ref. Image 2.2.1).

2.3 CONSTRUCTION SEQUENCE

Built from only the finest materials, Columbiat's construction begins with the arrival of our "Matriarch" ship and ends the final spin-up to provide simulated gravity for our settlement. Our construction sequence optimizes the speed and quality of the settlement in order to begin business ventures as soon as possible.

Northdonning Heedwell utilizes a "matriarch" ship to start construction and serve as an early base of operation for the construction of Columbiat (ref. Image 2.3.1). Upon arrival, robots sort and distribute materials from the matriarch to construction areas. The matriarch also carries the subcontracted space elevator extrusion mechanism for construction robot to mount in the center of the Ops Core during construction. Hull constructive materials, such as structural panels for both opaque and clear sections of hull, prepare to flow through manufacturing centers within the matriarch as robotic builders construct Columbiat (ref. Section 5.1.1). As materials move through construction processes, we test and track construction components in order to ensure the highest quality of materials throughout construction and the correct assembly of the settlement as a whole.

Construction robots produce the first major component of Columbiat: the Ops Core. The composition of the Ops Core includes, but not limited to, ferronickel alloy, stainless steel, high density polyethylene, and buckystructure. The Ops Core serves as the basic structure around which we build Columbiat and encompasses a cable attachment system for the space elevator, nuclear power plant, and a ten-ship docking area to serve as a base for the transportation

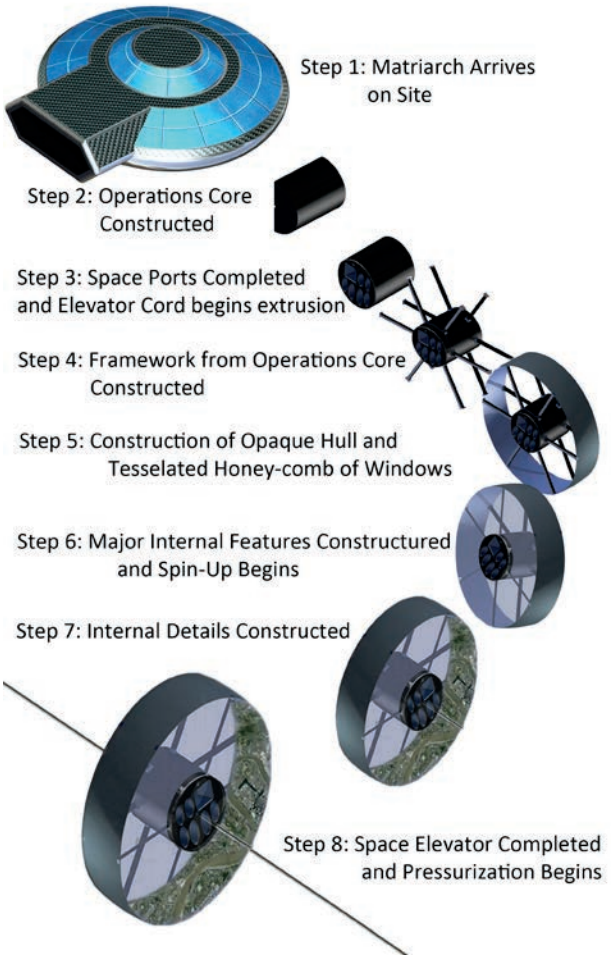


Image 2.3.1 Series of checks and protocols during Columbiat's construction process ensure the settlement is built with the utmost precision and care.

of materials to the settlement as well as storage for the materials needed for the construction of the lunar ribbon. As construction continues, our docking areas not only allow for transport of materials used in settlement construction, but also materials the subcontractor for space elevator ribbon will need for ribbon construction. As the elevator ribbon begins to extrude from the Ops Core, the large vacuum-storage space aboard the Ops Core stores more materials for future ribbon construction, such as bucky structure feedstock and catalyzing agents.

From here, we build the disk framework around the Ops Core extending to the edge of Columbiat. Machines construct all structural beams and brackets necessary to reach the edge of the space settlement on all points of the 910m Residential Volume's radius, including the Elevator-Spoke and support trusses. This framework provides the integral structural support Columbiat needs throughout the construction process and for the rest of its lifetime.

After robots assemble the structural framework, the construction of Residential Volume's hull can begin. Construction begins near the Ops Core and extends outward to the edge of the settlement; robots lay large interlocking hull panels, composed of layer hull components or tessellated honeycomb, to the framework of Residential Volume, and construction robots weld hull panels in place. In the windowed sections of hull, automated systems attach all transparent hull tiles to the tessellated honeycomb and seal them to render the hull air-tight. As the construction of Columbiat continues, the space elevator cable continues to extrude at a rate of 2m per second allowing for completion in one year.

We now begin construction of internal structures: robots construct large structures necessary for various uses in the structure, while openings large enough to ferry materials of major uses through exist(air compressors, boron/uranium, water tanks, transport vehicles, etc.). An Automated Light-based Construction Sequence(ALCS) forms the Business Canopy above the Residential Floor from polymers hardened by light. We also use shavings from the ALCS process to construct topography on the Residential Floor. After this stage, our nuclear thermal rockets, placed around the settlement, begin to come Online(ref. Image 3.4.1). The rockets start to fire, spinning up the settlement to a speed of 93 meters per second: an approximately 90-day to spin-up. With a stable gravity environment the internal construction of the settlement begins.

Once robots seal the internal portion of Columbiat and construct the solid layers of organic light-emitting diode (OLED) panels above the Business Canopy and spanning the open spaces of the Business Canopy over the Residential Floor(ref. Section 3.2.8), we pressurize the whole of the Residential Volume and select portions of the Ops Core(ref. Section 2.1) with an earth-like atmosphere, all the while performing tests on the structure during pressurization and monitoring for excess pressures or problem points. As the oxygen regulation and distribution systems come Online, we test air to ensure its quality and continue to check quality regularly. Contour crafters then construct the finer details of residential and business areas such as housing and human environments. The main nuclear reactor then comes Online to render the settlement self-powered.

2.4 PORT FACILITIES

Columbiat's port facilities dock any size or configuration of ship, either on or around the Ops Core. This ability allows for flow of materials and personnel through our settlement creating a bustling business spaceport.

Columbiat Space Settlement transfers cargo and personnel rapidly and securely for all designs and configurations of ships. The Ops Core on the moon-facing side of the settlement contains two cargo-docking facilities, as does the earth-facing side. In addition, each

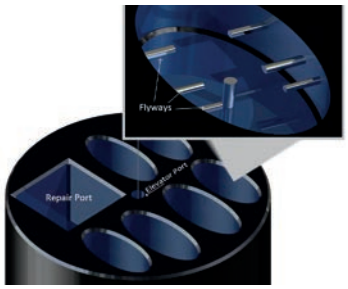


Image 2.4.1 Our ports aboard Columbiat allow many different configurations of ships to dock directly on the Ops Core, and many others to dock off-station in specified locations.

side of the core contains one passenger docking facility (ref. Image 2.4.1). As large ships dock to Columbiat the center of gravity inherently moves off of the L1 point. As docking occurs, a series of thermo-nuclear thrusters we carefully placed around the settlement fire to maintain the settlement position in orbit. A system of weights positioned around the core adjust to preserve a stable center of gravity. Ships larger than the Core's docking facilities park in designated areas approximately1/2km to 2km off of the settlement, where small ships transfer cargo and passengers through Columbiat. Locating the majority of the docking cells in the 0g core reduces time needed to transfer cargo to and from the rest of the settlement, minimizes the machinery needed to load and unload large and heavy cargo and conserves energy and space allocation. The design also conserves space by combining cargo facilities for space vehicles with cargo facilities for the space elevator.

Columbiat passengers spend very little time in the Ops Core, as they move directly to the elevators for acclimation, before continuing on from the Ops Core to the residential areas. The passenger ships dock at one of two passenger cells located in the fourth quadrant of the Ops Core. Both cells dock passenger ships in the same manner by descending into the cell at which point four arms, composed of Monel 400, for its corrosion resistance, extend and secure the ship before three flyways, of adjustable length and curvature, extend to unload passengers. Composition of these flyways includes a jointed aluminum tube with a 1.5m radius to allow for ease of transport, but tipped with ER Fluid in its gel form in order to provide an airtight seal against the ship (ref. Image 2.4.1). The larger cell on the earth facing side is 211m by 278m and the smaller cell on the moon facing side is 262m by 105m, both have a depth of 110m and a dome that extends at a height of 165m above the floor of the cell. We have optimized the size of the cells while still leaving a 10m margin between them once expanded, in order to accommodate a plethora of different-sized ships.

Four other cells, located in the core accept medium to small cargo ships operate in a similar manner to the passenger docking ports. Cargo ships, however, dock upside-down in order to assist the unloading of cargo. Once inside the cell, four arms extend to secure the ship at which point unloading procedures begin and

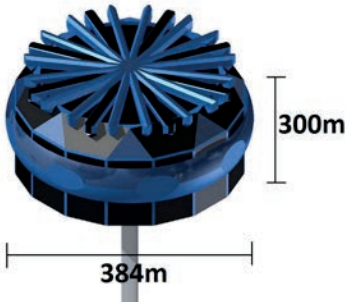


Image 2.4.2 The addition of hexagonal port systems on either side of Columbiat along the space elevator ribbon, afford the opportunity for the expansion of Columbiat's port industry without obstructing other infrastructure.

a passenger flyway extends to unload crew. Each side of the core contains two cells, one measuring 363m by 211m and the smaller being 262m by 105m, both having a depth of 110 and an extendable dome that reaches 165m above the floor (ref. Image 2.4.1).

One of the repair facilities, located in the third quadrant of the Ops Core on the moon facing side, contains large hangar doors which open to let damaged or repaired ships in and out, but close to provide an airtight seal so that repair robots and humans can work on the ship simultaneously. A repair facility 263m by 263m also contains a pyramid dome that rises 55m above the cores surface. Built on the earth facing side in coming years, the future repair facility contains the same dimensions. Another smaller repair located on the end of the space elevator counterbalance, made of BAM (AlMGB14), repairs small vehicles 50m long by 30m wide by 30m tall at full extension. A rib cage like structure encompasses the ship and facilitates the movements of repair robots. Located 10 meters apart the 5 ribs move along rails that span the 30m gap. Two joints on the arm allow for adjustment for different types and sizes of ships. An L shaped robot repair facility 40m by 125m at both legs, located below the ship repair and passenger cell, repair cargo sorting and unloading robots.

Larger ships that cannot dock in the core, suspend themselves between 30° and 60° in relation to the ribbon, 1/2km to 2km off of the settlement. Our off settlement docking allows for normal ship movement around the settlement without blocking lines of sight. The parked ships require our shuttle transport system to move cargo and passengers between ship and settlement(ref. Section 4.3). We designed cargo carrying shuttles to transport two cargo containers while also transporting 100 passengers plus crew. These shuttles dock adjacent to the large repair facility in an enclosed cell with a 35m diameter to provide room for simultaneous inbound and outbound traffic.

Once we near 80% capacity on the current port systems, construction of two octagonal pads begin in order to accommodate this greater need. Suspended around the ribbon, it never comes in contact because of a 5m radius circle located in the center of the octagon. The octagon has a radius of 261m and depth of 300m.

The octagon creates a 200m wide by 300m deep face on each of the octagons eight sides. Built on the earth side of the settlement along the ribbon, the new ports accommodate an additional three passenger facilities, four cargo facilities, and one repair facility. All of these the docks are 180m by 280m on each of the faces. The ships dock on each of these side in the same manner that they dock on the settlement. As they approach, four arms extend to secure the ships before unloading passenger and cargo and a dome extends to protect the ships. These passengers and cargo then travel further into the octagon where one of the eight shuttle ports transport them between the two.

The space elevator docks with Columbiat as the elevator enters between retractable doors spanning the entrance 34.1m by 6.1m. The elevator then travels under its own power 75m into the core where the elevators shuttles detach from the central body. These standard shuttles then automatically dock with the settlement for optimal ease.

2.5 SPACE ELEVATOR ATTACHMENT

The space elevator, a major asset to our business people, docks to Columbiat for efficient movement of lunar material and personnel. The lunar ribbon also attaches in the Ops Core for the safety of our settlement.

Columbiat's seamless connection to the space ribbon, through an adaptable extrusion mechanism within the Ops Core, provides integration and support while still maintaining flexibility and integrity in the Lagrangian 1 (L1) point. Northdonning Heedwell recognizes that the shifting nature of the L1 point may prove an obstacle for the subcontractors employed to design the elevator and its attachment system, however, taking this into account, we provide space in the center of the Ops Core for two separate mechanisms to create the ribbon: one earth-facing and one lunar-facing. To maintain L1 positioning, we have two "reals" that give or take ribbon. Our preferred interface would reside as a cylinder in the center of the elevator corridor through the Ops Core, with dimensions of approximately 10 meters in radius, and up to 50 meters in height(ref. Image 2.5.1). This configuration would allow all docking procedures aboard Columbiat to remain undisturbed, while still providing excess space for the subcontractor to work with if necessary.

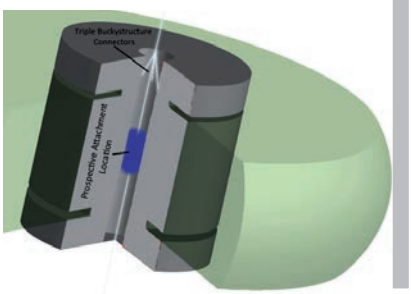


Image 2.5.2 Our allocation of space for the subcontracted space elevator attachment mechanism in the center of the Ops Core allows for the utmost security and ease of access to this delicate processing location.

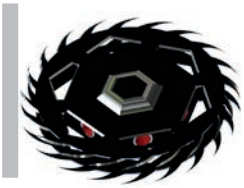


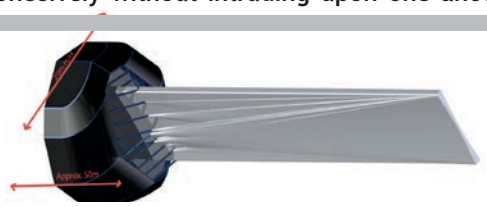
Image 2.5.3 If stresses on the ribbon are detected that could pose a threat to the settlement, a cut-off system, employing both a saw and lasers, can be employed.

Extending from the inner edge, 3,400m long strands of buckystructure connect our settlement to the larger space ribbon. Located in the middle of the Ops Core the 3-buckystructure ribbons attach, evenly spaced, along the inner edge of the core. These then span 400m to the center of the core where they attach to the subcontracted device(ref. Image 2.5.2). Attaching the ribbon with buckystructure allows for slight movement to account for shifts of mass created when docking to prevent the settlement breaking from the ribbon. Locating the attachment in the center of the core eliminates interference with the elevator and docking operations.

We store materials for the ribbon construction centrally in the Ops Core, with a direct connection to the elevator corridor for ease of access to all ribbon construction procedures. Materials come to Columbiat during the second step of settlement construction, after which the subcontractor's construction of the ribbon interface and the ribbon itself can develop along with the construction of Columbiat.

Additionally, in case of emergency, we have designed a system to automatically cut away the ribbon if it poses a potential danger to Columbiat itself. A 1.5m saw, outfitted with high intensity lasers, fires while spinning to produce a series of extremely powerful bursts. These cut the ribbon away from the settlement with utmost expedience and accuracy. Inordinate stress, sagging, or extreme shifting in the ribbon activate the automated cut away, along with manual activation available in the elevator control center to workers with the highest security clearance(ref. Image 2.5.3). We outfit all of our elevator cabs with this type of devices in case of ribbon failure, after which the cab can travel under its own power to the surface of the moon through an autopilot sequence.

Image 2.5.1 Situated within the central elevator corridor in the Ops Core, our allocation of space for the subcontract of the space elevator attachment system allows for different contracts to function cohesively without intruding upon one another.



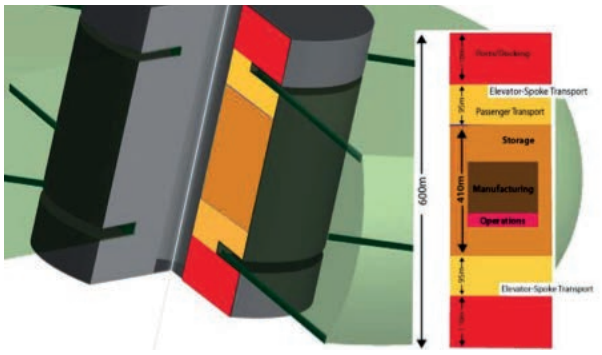
3.0 OPERATIONS AND INFRASTRUCTURE

By seamlessly integrating state-of-the-art technologies with basic human needs, Columbiat optimizes the fluidity of operations while minimizing disruptions in the normal flow of life within Columbiat. Our specialized day and night cycle increase work productivity and decrease the need for peak load energy sources. Expansive materials storage and construction machinery expedite the construction process while sensory testing ensure safety through sub-assemblies. From advanced infrastructure to lavish modifications which cater to your business goals, Northdonning Heedwell capitalizes on efficiency and accessibility, ensuring the security and wellbeing of the residents and your investment.

3.1 SETTLEMENT MATERIALS

Settlement location and resource management on Columbiat maximize application of lunar and terrestrial resources as well materials from Bellevistat and near-Earth asteroids. Columbiat's L1 orbit offers corporate interests ease of access to resources and constant monitoring of valuable claims. Northdonning recognizes the need for productive transfer and use of materials, allowing Columbiat to serve not only as a lucrative banking center but as a hub for the expansion of your future business ventures.

Image 3.1.1 Centrally located materials storage in the Operations Core maximizes the efficient transfer of cargo and materials through the settlement from the space elevator and docking ports during the construction process.



3.1.1 CONSTRUCTION MATERIALS AND EQUIPMENT

Northdonning Heedwell has established the ideal composition of materials to ensure the safety of your residents and minimize construction cost and time. Most of our materials, including nickel, iron, titanium, silicates, and carbon are readily available on the moon and nearby asteroids (Ref. Chart 3.1.1). The proximity of material rich resources significantly reduces transportation costs. From Earth we import the few materials we cannot receive from other sources, such as high density polyethylene (Ref. Section 5.1 for construction equipment).

3.1.2 SHORT TERM AND LONG TERM STORAGE

Short-term and long-term materials storage occurs below the docking stations in the Operations Core to allow ease of access and flow of materials to and from storage areas and cargo ships (Ref. Image 3.1.1). The Ops Core contains the spacious materials storage facility; dimensions of 190m x 600m in diameter provide an expansive area of 95,504,000 cubic meters for cargo and material needs. Prior to the construction of the Operations Core the matriarch provides expansive storage for any construction materials needed for our construction sequence. Upon arrival an RFID tagging system organizes materials for transport and

Chart 3.1.1 Our versatile materials composition protects our residents from many of the problems of space, including radiation, heat fluctuation, and impacts.

MATERIAL	USE OF MATERIAL	SOURCE	QUANTITY
Nickel	Ferronickel alloy hull comp	Metallic asteroid	217,000m3
Iron	Ferronickel alloy hull comp	Metallic asteroid	283,400m3
Ferronickel Alloy	Hull comp.	Metallic asteroid & Moon	486,900m3
High Density Polyethylene	Hull comp.	Earth (Petroleum)	324,600m3
Titanium Vanadium Alloy	Hull comp.	Moon & Earth	64,900m3
Amorphous polycarbonate	Window comp. & Hull comp.	Earth	1,914,600m3
Lead Laminated Acrylic Glass	Window comp. & Radiation Protection	K-type Asteroids & Earth	1,595,300m3
Palladium-based metallic glass	Window comp.	Earth	8,571,400m3
Noncondensable Hydrogen coolant	Ions for thruster propellant	Moon or Earth	25,000m3 + 25m3 biyearly
Photo Polymer	Business canopy and land features	Earth	426,500m3

storage. Clamping arms within the short-term storage areas secure construction materials, and later provide containment for materials in transit. The arms also fasten down bins for the storage of smaller parts and other materials. The long-term storage facilities use a second RFID tag to classify materials before placing them in regulated containment units.

3.1.3 MATERIALS TRANSPORTATION

The Matriarch supplies the main transportation of materials to the Earth-Moon L1 Libration point for construction of Columbiat. Materials move through the Ops Core, where RFID tags facilitate organization of incoming materials and construction robots transport supplies along the spokes to their necessary destination. Other materials arrive to the settlement on transportation vehicles using the Polyphasic Interatmospheric Rocket; our revolutionary system significantly reduces fuel costs through a multimode unit employing synergistic integration of rocket systems. While in Earth's atmosphere, the air-breathing mode eliminates the need for rocket propellant, cutting total weight and transportation costs in half. Instead of traditional fuel, the air-breathing mode uses an oxidizer to compress air to 140 atmospheres before injecting it into the combustion chamber. Once outside Earth's atmosphere, liquid hydrogen propellant fuels the conventional rocket mode for propulsion to the settlement. Depending on the shipping capabilities of the source, the versatile Polyphasic Interatmospheric Rocket attaches to a number of different payloads. It can also facilitate the transfer of materials from nearby settlements and asteroids. The space elevator offers convenient transportation of silicates and other materials from the lunar surface. Using the space elevator minimizes the disturbance of dust on the moon's surface, ensuring safety of our elevator terminal and passengers while moving materials efficiently to our settlement.

3.2 BASIC INFRASTRUCTURE

Columbiat's infrastructure redefines diversity and safety through innovative, redundant systems that ensure constant operation. Simple, yet extremely reliable processes save the Foundation Society the inconvenience and revenue loss incumbent upon systems malfunction.

Chart 3.2.1 Our earth-like air composition maintains comfortable living conditions for residents; excess stored gases offer redundancy in the event an emergency.

GAS	% COMP	KG OF ATMOSPHERE	KG IN STORAGE
N_2	75.50	417,400,000	208,700,000
O_2	23.15	137,040,000	68,520,000
Argon	1.28	5,668,000	2,834,000
CO_2	.0035	168,000	84,000
H_2O	.0465	5,392,000	2,696,000*

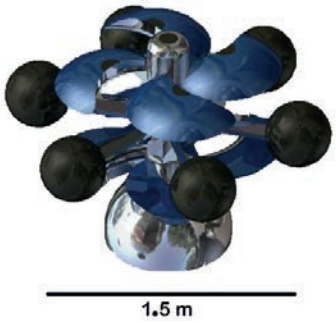


Image 3.2.1 Molecular Zeolite Sieves regulate gas levels, maintaining residential comfort with an air composition similar to that of Earth's.

3.2.1 ATMOSPHERE/CLIMATE/WEATHER CONTROL

To ensure the optimal comfort, health, and safety of our residents, Columbiat maintains an air composition similar to that of Earth's, but without harmful gases (Ref. Chart 3.2.1). In the event of a large energy or system malfunction, we store atmospheric gases to ensure the continued function of our atmospheric systems. Akin to an altitude of 2,000 feet, a standard pressure of .839 maximizes residential comfort through maximum oxygen absorption. All pressurized areas within Columbiat utilize zeolite molecular sieves to filter and regulate gas levels. Their adaptability makes them cleaner and more precise than traditional filtration systems. A redundant electrochemically mediated amine regeneration system absorbs excess carbon dioxide and gases; this system requires little internal reconfiguration of turbines and facilitates lower lean loadings while promoting flexible operation and a high carbon dioxide desorption rate. Our purification system utilizes titanium coated glass rings that react with airborne pathogens to filter the air (Ref. Image 3.2.1). This system is very low impact, producing only water vapor and carbon dioxide which immediately move into our agricultural processes. The main section of our purification resides in the Agricultural Ring; additional purifiers on the roofs of nonresidential buildings minimize the spread of airborne disease and toxins. Low maintenance plant species in residential homes and the Business Canopy play a minor role in air purification and detoxification while enhancing the aesthetic appeal of the home and workplace.

Bodies of water on the Residential Floor and dehumidifiers (placed adjacent to the titanium dioxide filtration systems) collaborate to maintain an ideal humidity of 35-37%. This humidity level alleviates the risk of bacteria, fungi, viruses, and respiratory problems in our residents while allowing automated systems to operate at optimal performance levels without the risk of electrostatic discharge or rust. The dehumidifiers consist of water molecule modified molecular sieves. A pressure reactivation regenerates the molecular sieves when fully saturated, increasing the lifespan and significantly

reducing cost. Synthetic diamond heat sinks, which retain more heat than traditional copper heat sinks, absorb excess heat to maintain a favorable living temperature of 19 to 23 degrees Celsius. Our bodies of water also assist in regulating temperature. Seasonal fluctuations in temperature create a more earth-like feel, offering resident's comfort in the regularity of the changing of the seasons.

	Cal/Person/ Day	Grams/ Person/Day	kCal/25000 people/ 2 weeks	Kilograms/25000 people/2 weeks
Corn	45	10	15750	3500
Fruit	540	120	189000	42000
Legumes	450	50	157500	17500
Rice	110	30	38500	10500
Spirulina	15	5	5250	1750
Sorghum	270	60	94500	21000
Soybeans	430	90	150500	31500
Vegetables	740	175	259000	61250
Wheat	200	60	70000	21000
Total	2800	600	980000	178500

Chart 3.2.2 A balanced and diverse diet promotes health and happiness in our residents; an allocation of up to 2800 calories per day provides ample energy for a thriving business community and residential lifestyle.

3.2.2 FOOD PRODUCTION

Located above the Business Canopy, Columbiat's agricultural aeroponics system reduces water usage by 98%, consumption of fertilizer by 60%, and negates the need for pesticides entirely through increased nutrient uptake and year-round growing capabilities. The Agricultural Ring affords ample space for our agricultural needs and minimizes the risk of contamination by completely separating food production from residential volumes. A nutrient-rich mist environment greatly enhances growth rate and yield while preventing pathogen formation, tripling production compared to traditional hydroponic or soil-based systems (Ref. Chart 3.2.2). Within the residential volumes, zeoponics facilitates the growth of trees, community gardens, and household plants; the additional plant life enhances aesthetic appeal and utilizes valuable space. All plants in the residential volumes are self pollinating or subsist by artificial pollination. Soy and rice products provide a versatile substitute to traditional milks and cheeses, while spirulina, chlorella, and other vitamins provide other necessary nutrients. Bio-printers supply a cost effective and innovative alternative to livestock, offering a nearly infinite array of vegan meat products to suit all tastes. Panels of OLED lighting maintain an optimal light spectrum for plant growth; temperatures of 13-21 degrees Celsius promote crop health. An automated harvesting system runs on rails within the aeroponics grid. Flexible arms use gentle suction and multiple small gripping appendages to gather crops, mitigating human error and reducing damage to crops in the harvesting process (Ref. Image 3.2.2). Temperature controlled storage facilities in the agricultural ring provide adaptable and expansive storage for daily food necessities and contingency supplies. Temperatures of 4-5° Celsius within our packaging facilities aid nutrient retention before distribution. Sheets of bamboo and soy polymers offer sustainable packaging materials that optimize thermal performance and prevent gas absorption, extending shelf life and maintaining flavor and quality. Following processing and packaging, food products travel to the residential volumes through pneumatic pipelines within the elevator shafts and distributed to commercial facilities and residential homes. Grocery stores and personal Holo-Cad devices enable the sale of agricultural products within the communities. In the event of an emergency, a central seed bank serves as a storage facility for a variety of cultivars capable of completely replenishing Columbiat's crops, as well as food supplies to provide food for up to a month of production interruption.

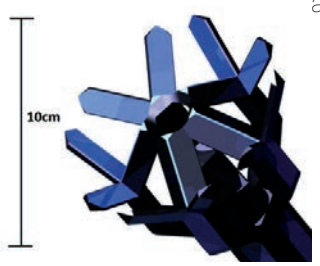


Image 3.2.2 Flexible harvesting arms use gentle suction to gather crops, minimizing crop damage and mitigating human error.

3.2.3 ELECTRICAL POWER GENERATION

A uranium nuclear reactor in the Ops Core generates the majority of our energy and accommodates the base load power consumption of our settlement (Ref. Image 3.2.3). The reactor incorporates a CO2 gas coolant and Uranium fuel pellets, optimizing operation in microgravity. A thorium reactor offers a dependable

Image 3.2.3 We ensure our settlement maintains power through scattered security of the reactors and backup stable thorium reactors.

backup source of power. An advanced system of sensors combined with negative-feedback systems and reinforced containment facilities ensure security of the nuclear reactors. All of our operation systems, including the food processing centers, water and waste infrastructure, and nuclear reactor containment facilities also incorporate the highest level of data and personnel integrity to maximize the security of all our necessary processes. Our rotating day and night cycle reduces the need for alternate energy sources and energy storage for peak loads. Furthermore, transparent solar cells coat the exterior windows of the settlement, providing a backup source of energy for the settlement. In the daily lives of our residents, localized power production offers increased reliability, economy, and security. A multi-faceted system of energy recapture technologies throughout the settlement powers small devices and processes, reducing transmission loss and implementing local control. This system includes the incorporation of piezoelectric collection technologies and other small sources of energy. Lithium-ion batteries within the Ops Core and the residential volumes store energy for contingency uses. To provide plentiful energy for all business, resident, and operational needs, Columbiat's power production systems account for 380,000 kWh each day (Ref. Chart 3.2.3).

Person/Day	15 kWh
Person/Year	5,500 kWh
Settlement/Day	380,000 kWh
Settlement/Year	130,000,000 kWh

Chart 3.2.3 Our central nuclear reactor meets and exceeds our energy needs; solar cells and localized small power systems provide distributed energy production to cut transmission costs and loss within the settlement.

3.2.4 WATER MANAGEMENT

Our expansive water storage allocates each resident within the settlement 113 liters of water per day, a lavish accommodation tailored to the comfort of our residents (Ref. Chart 3.2.4). All distribution and pipelines run through the Operations Crescent, streamlining the circulation process and mitigating human contamination (Ref. Image 3.2.4). Centrifugal water pumps move wastewater away from the residential area to our central water-treatment plant, located in the Operations Crescent. First, the water treatment plant separates the waste water from the solid waste product. From there, three chemical cleansing and filtration processes treat the water (Ref. Chart 3.2.5). The solid waste travels through an anaerobic decomposition process, which creates biogases such as methane. Accordingly, fuel cells attached to the sides of the plant consume the methane, a product of the decomposition reaction, generating 6MW per day, an amount equal to 70% of the plant's daily requisite. The plant's only outputs are clean, carbon neutral emissions and fertilizer. After processing, clean water flows into the bodies of water throughout the Residential Floor. Before redistribution into residences and commercial areas, one of our six neighborhood water treatment plants re-treats the water. As a contingency, a water storage container corresponds with each neighborhood treatment plant, able to supply water in the event of a processing interruption. Each plant can be completely independent and supply water in an emergency.

A second water processing plant in the Agriculture Ring reduces the risk of plant contamination and negates the need for complex pump systems to transfer water upwards from the Residential floor. The agriculture volume also has a separate water storage tank so that food production can continue in the event of an emergency.

3.2.5 HOUSEHOLD AND INDUSTRIAL SOLID WASTE MANAGEMENT

Solid waste management within Columbiat is entirely recycling-based (Ref. Chart 3.2.5). In homes and businesses an automated waste disposal system separates components, which then move to recycling

Chart 3.2.4 Our ample water storage enables the lavish lifestyle of our business men and women while providing a necessary resource for agricultural and operational processes.

ALLOCATION	STORAGE LOCATION	AMOUNT STORED (L)	AMOUNT PROCESSED/ MONTH (L)
Residential	Residential Floor (6 Neighborhood storage facilities)	5,044,000	151,300,000
Agricultural	Agricultural Ring	21,910,000	87,650,000
Operations	Operations Core	Up to 795,500	Up to 795,500
Ship Resupply	Operations Core	Up to 454,500	Up to 454,500

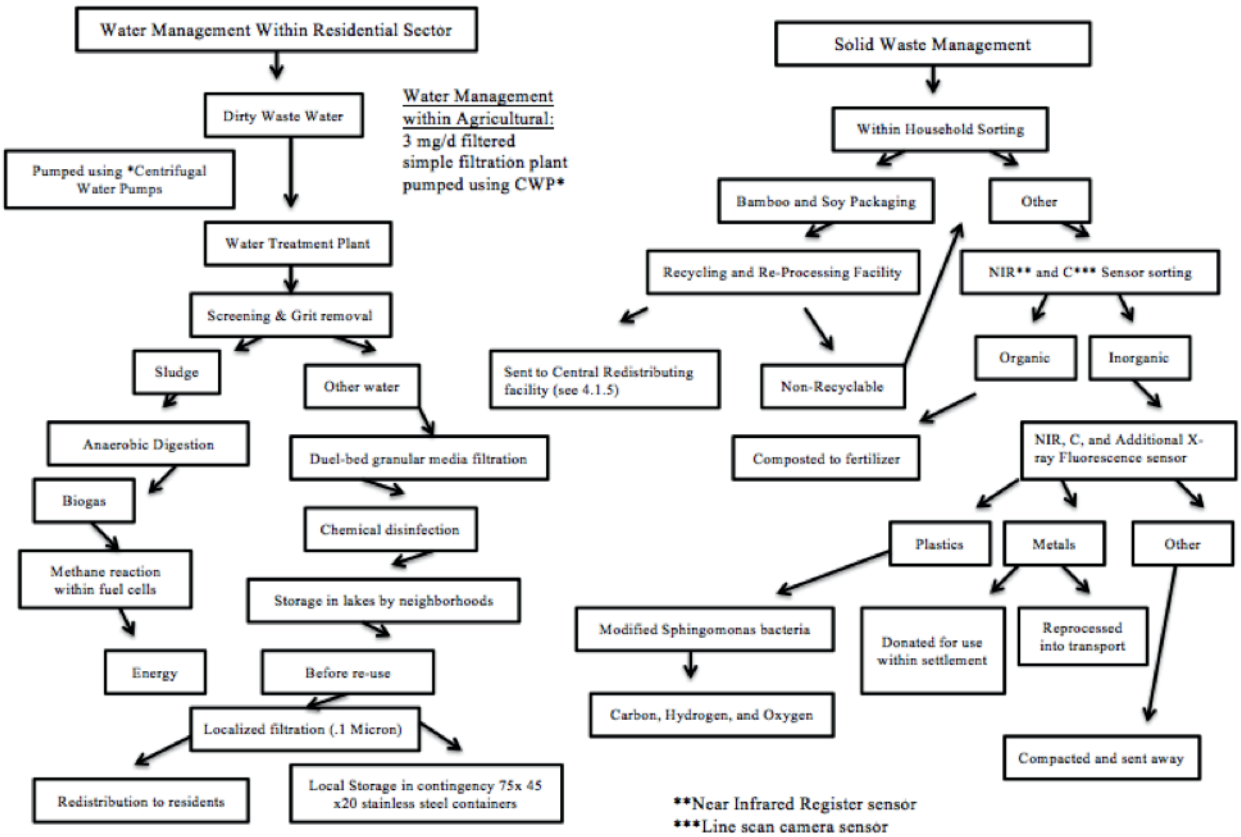


Chart 3.2.5 Our multi-step water and waste processing ensures water quality and resident health while promoting the reuse of materials.

facilities in the Operations Crescent (Ref. Image 3.2.4). Columbiat employs bamboo and soy polymer packaging for most materials within the settlement; our processing plants quickly recycle these waste components, streamlining the waste management procedure. Other waste products move to a second waste plant which separates organic and inorganic waste materials. Our sorting facility utilizes near infrared spectroscopy sensors and line scan camera technologies to systematize recycling. Organic materials become fertilizer and return to Agricultural Ring for use in agricultural systems. The inorganic materials continue into a final processing plant, where x-ray fluorescence sensor detect and sort plastic and metal products out of the remaining inorganic waste. A genetically enhanced plastic eating bacteria breaks down the plastics to create carbon, oxygen, and water. The plant reprocesses metal wastes or send the metal out into the community as scrap metal to create innovative sculptures. Our central distribution facility redistributes all recycled materials (Ref. Section 4.1.5). We crush the remaining unusable waste, compress it and send off the settlement.

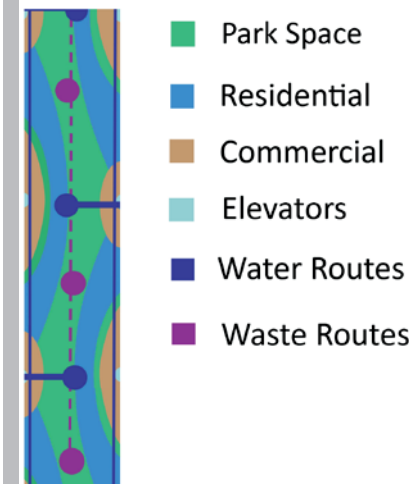


Image 3.2.4 Water and waste management distribution routes within the Operations Crescent optimize efficiency and minimize human interaction, protecting both human health and system integrity.

3.2.6 INTERNAL AND EXTERNAL COMMUNICATION

Modified laser modules establish external communications with Earth, neighboring settlements, and beyond. Capable of transmitting vast amounts of information, our lasers utilize an unobstructed line of sight with Earth and strategically placed satellites to facilitate expedient communication. This system transfers data at 8 tb/s. A system of antennas on the exterior of the settlement receive UHF waves, constituting a fail-safe backup to our laser system.

Within the settlement, Light Fidelity (Li-Fi) connects residents with each other and the settlement network (Ref. Image 3.2.5). Personal communication devices referred to as Holo-CADs provide person-to-

Image 3.2.5 The Li-Fi communication system streamlines transfer of information within the settlement, seamlessly integrating with residents' Holo-CAD devices.

person communication (Ref. Section 5.3). The OLED panels that facilitate the day and night cycle integrate Li-Fi, enabling transmission to each Holo-CAD at a speed of 10 gb/s. In case of system failure a UHF system throughout the settlement offers a high speed method of communication in emergency situations.

3.2.7 INTERNAL TRANSPORTATION

Columbiat residents enjoy a versatile and efficient system of transportation within the settlement. The Ampelos pod system travels throughout the settlement, offering residents a high speed transport system between neighborhoods (Ref. Image 3.2.6). The Ampelos operates within the Operations Crescent, utilizing valuable space below ground. Running on rails within a low pressure tube, this system creates much of its own energy through rotors at the front of the pods and friction from the rails, getting its remaining power from electricity (Image 3.2.7). Special designated pods provide transportation for children to school; these pods ease parent's minds as they know their child will travel safely through the settlement. Within the Business Canopy, a second system of smaller Amplos pods interfaces with the elevators and offers luxurious transportation for business men and women. To move from the Residential Floor to the Business Canopy, large elevators operate within each neighborhood. The Ampelos stations correspond with the elevator terminals, creating efficient transfer of residents throughout the settlement. Commuters enjoy expansive views of the settlement on their way to work through the glass paneling of the elevators .

Image 3.2.6 The Ampelos system and a myriad of paths throughout the settlement facilitate transportation for residents within and between neighborhoods.

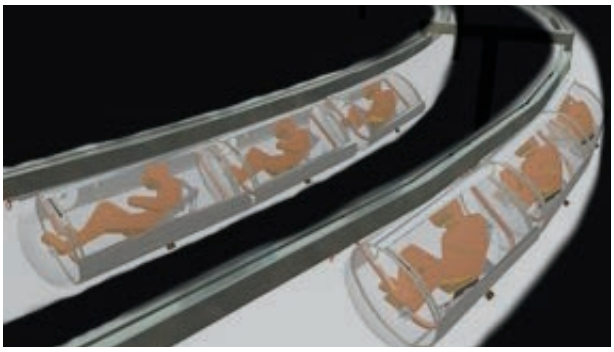


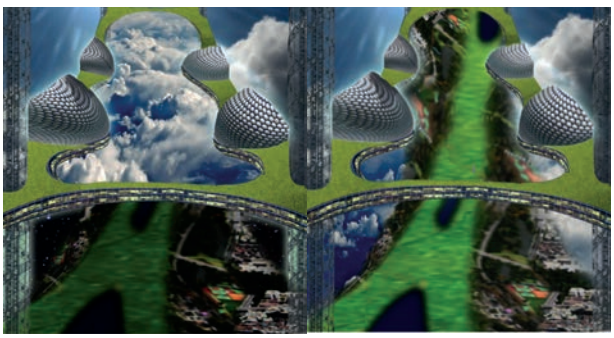
Image 3.2.7 The Ampelos pod system operates within the Ops Crescent, utilizing otherwise wasted space; special pods for children offer safe transportation to and from school.

Personal transportation devices offer variety for movement across shorter distances and through neighborhoods. Our residents may choose between a foldable bike or a two wheeled electrical platform called a Rider, but always have access to both. A multitude of paths and walkways encourage residents to walk or ride to their destination.

3.2.8 DAY/NIGHT CYCLE PROVISIONS

Columbiat's unique rotating day and night cycle facilitates constant business productivity and minimizes stress on our power production facilities, through the constant rotation of day and night around the settlement and separation of the Business Canopy (Ref. Image 3.2.8). OLED panels throughout the residential volumes perpetuate the natural circadian cycle and produce unparalleled ambient lighting. OLEDs require little energy and provide a natural and psychologically therapeutic light during natural hours of the day . The panels attach to the underside of the Agricultural Ring and across the open section of our Business Canopy. The panels on the

Image 3.2.8 The separation of our business canopy from residential areas fosters a continuously thriving business sector while maintaining a conducive circadian day and night cycle in residential areas.



HOUR	BEGINNING LIGHT INTENSITY	% CHANGE/ MINUTE
06:00-08:00	5%	.625
08:00-10:00	80%	.042
10:00-11:30	85%	.033
11:30-12:30	88%	.017
12:30-14:00	90%	-.022
14:00-16:00	88%	-.025
16:00-20:00	85%	-.333
20:00-06:00	5%	0

Image 3.2.6 Our rotating day and night cycle promotes a natural rhythm within the settlement; this chart details the light percentages for one third of the settlement.

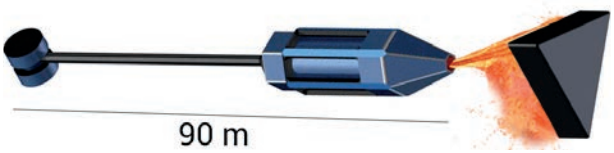
Agricultural Ring project the main day and night cycle sky, with cloud variation and different weather patterns to simulate Earth-like conditions. During the night, the transparent OLED panels spanning the open section of the Business Canopy become opaque, preventing light from other sections of the settlement and the continually operating businesses above from interfering with the sleep of our residents. To maximize productivity, the day and night cycle gradually moves around the torus in thirds; in one third of the torus it is night, in another it is morning, and in the final third it is the afternoon (Ref. Chart 3.2.6).

In the instances when the sun shows through the windows, OLED panels filter sunlight by becoming more opaque, balancing OLED projections and sunlight to maintain light intensity while still enabling residents to see out of the windows. All of our OLED panels can become fully transparent to allow residents natural views of space.

3.3 CONSTRUCTION MACHINERY

In coordinating specialized automations for zero-g hull construction and contour crafters for interior assembly, Northdonning Heedwell maximizes the speed of our multi-phase construction sequence. We recognize the enormity of constructing our settlement in the least amount of time while maintaining the highest caliber standards; in order to balance these constraints we have created subassemblies and sensory testing to ensure the viability of our materials and create a fluid process that capitalizes on not only efficiency but also adaptability to the strenuous space environment.

Image 3.3.1 We transform raw materials into completed construction quickly safety remains vital as materials go through several testing processes during the conversion.



3.3.1 PRIMARY CONSTRUCTION MACHINERY FOR CONSTRUCTING THE SETTLEMENT

We utilize a variety of robotics and machinery to construct the entirety of Columbiat with the utmost speed and safety. Beginning with the exterior hull tiles, melting and refinery systems melt raw materials from the Earth, moon, and other sources into pure form. From there we use a centrifuge (we bring up with the matriarch) to combine alloys and introduce desired impurities into the materials. The centrifuge moves along a rail system to pour materials into a series of molds left cool. We give time for each layer of the hull to dry slightly before pouring the next layer, then fuse the layers together with pressure and electrodes on the interior of the molds. Once the tile piece completely dries, we RFID tag the piece and transport all the materials along a rail system to cargo-containers, which then attach to the back side of the construction robotics. These robots then place all the tiles in interlocking patterns with the aid of welding to solidify our hull. For the interior construction we utilize photopolymer to effectively create the Business Canopy, with the combination of reused construction robotics and contour crafters (these print housing from the ground up) we create the housing and buildings of Columbiat. We reuse unused photopolymer from the Business Canopy to create land features along the floor of Columbiat's residential and parks space (Ref. Section 5.1)

3.3.2 MATERIALS, COMPONENTS, AND SUB-ASSEMBLIES

Northdonning Heedwell realizes the importance of constructing Columbiat with speed, yet not compromising the integrity of the settlement, therefore we designed subassembly procedures and tests of equipment to streamline the construction process (Ref. Image 3.3.1). Once we tag the tiles with an RFID tag the sensors within the tiles send all the information to the RFID chip. Every construction robot and cargo bay has an RFID scanner which allows us to get real time data about how accurately we construct Columbiat. The construction robots place the hull components in an interlocking tile pattern where all corners of every tile covers another tile, and finally the construction robots wield the pieces in place. The construction robots construct the operations core first to allow for ribbon attachment and docking to begin taking place, then we build the elevators out. From there we connect the elevators together to form a torus. With the torus complete we finally construct the

windows to seal up our pressure vessel Columbiat. After sealing the hull and ensuring all tiles remain viable we begin interior construction. We use a bamboo pulp and a metal pulp mixed to print housing through the contour crafters. We utilize a lens to harden photopolymer with the sun's rays, then wash away the undesired polymer into cargo containers for use in creating land features in Columbiat. Construction robots on the elevators carry the Business Canopy pieces to locking position above the residential floor. We send SanoBots in for the final touches on the interior of housing, building, and equipment in the business center.

3.4 PROPULSION

Our cutting edge nuclear thermal rockets initiate and maintain a steady gravity and living environment on Columbiat. The balanced distribution of thrusters around the settlement reduces mechanical stress on hull components and allows the settlement to correct in accordance with the moon's apogee and perigee as well as the docking of large ships.

Within Columbiat we simulate gravity by implementing a rotational speed of slightly over 110 meters per second; this ideal speed creates 1g in the residential area without rotating too quickly, therefore decreasing the Coriolis Effect. We achieve this speed using Plutonium-238 fueled Nuclear Thermal Rockets (NTR). NTRs produce an extreme amount of heat which transfers its energy to a hydrogen coolant which then expels into space, initiating rotation and maintaining Columbiat orbital position in the Earth-Moon L1 point (Ref. Image 3.4.1). Each NTR can produce 1,330 pounds-thrust. Because of their high thrust output, we need only 12 thrusters placed evenly around the operation crescent to meet our needs. Spin-up takes 90 days. Unlike engines on narrow center conduits, in which torque threatens to overwhelm the design's structural integrity, the balanced distribution of thrusters alleviates mechanical stress imposed on Columbiat.

Image 3.4.1 Nuclear thermal rockets provide the thrust and acceleration to spin up Columbiat and maintain rotation.

Plutonium-238 powers the NTRs, while the hydrogen creates thrust. The large three-compartment system eliminates all radioactive waste. Hydrogen provides a better alternative to Lithium fuel because lithium is more likely to coat the solar cells and windows on Columbiat, reducing visibility and eliminating our solar collection capabilities. Re-purposed construction robots collect the limited amount of propulsion emissions from spin up and any discharge while maintaining stability in the L1 point.

The L1 libration point is not stationary, as the orbit of the moon varies by almost 50,000 km. To stay in the gravitationally neutral point, Columbiat must move up to 16,000 km in two weeks. The NTR's provide a gentle thrust which is undetectable to residents but can keep Columbiat in the L1 at the moon's apogee and perigee (Ref. Section 2.5). As docking large vessels inevitably alters Columbiat's rotation, the NTRs also systematically fire to re-align rotation. Magnetoplasmadynamic thrusters using noncondensable hydrogen propellant offer a system of redundancy in emergency situations and in the case that our NTRs fail.

3.5 ELEVATOR CAB

Columbiat's unique Luna Lift offers expedient transfer of people and cargo to and from the lunar surface. Our spacious elevator cab allows passengers to travel in luxury, enjoying access to many in-transit activities as well as beautiful views of the Earth, moon, and the entire settlement. Capitalizing on safety and comfort, our segmented cab design streamlines the docking process, mitigates the risk of passenger exposure to cargo and the harsh environment of space, and allows for luxurious accommodations.

3.5.1 ELEVATOR BOARDING

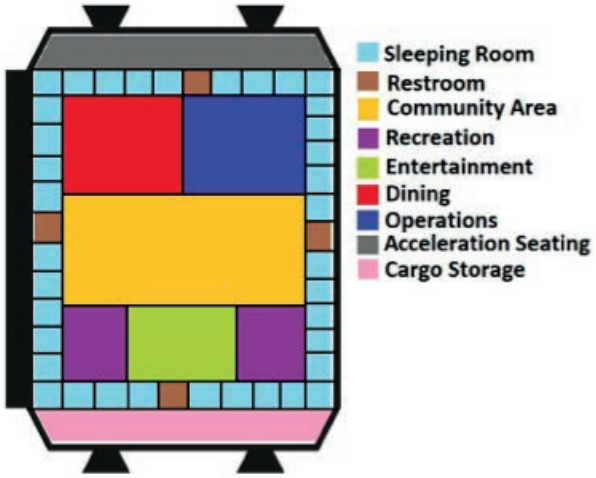
Northdonning Heedwell designed the space elevator cab, or Luna Lift, to cater to the utmost comfort and security of our passengers on their thirteen-day journey (Ref. Image 3.5.1). Our unique segmented cab design incorporates three sections: the shuttle cab, main elevator hotel, and cargo bay. The shuttle cab enables safe transport of passengers and perishable items to their lavish quarters on the main elevator segment, while the separate cargo bay eliminates risk of harmful passenger-material interactions during the journey. The separation of elevator components streamlines

the docking process for passengers and cargo alike; upon arrival on Columbiat, the cargo bay and shuttle cab move to their respective port facilities, maximize offloading efficiency and reducing the exposure risk for our passengers. The large elevator hotel does not dock unless it requires repair.

Travelers enter the shuttle segment of the cab through one of our elevator terminals, either on the lunar surface or Columbiat itself. After passenger boarding the shuttle segment attaches to the main segment of the cab, or the Luna Lift hotel. During the acceleration and deceleration periods passengers remain in the shuttle segment; harnesses secure the passengers for their protection. Once the cab reaches a steady speed of 250 mph, passengers move through an airlock (Ref. Section 4.3.5 for details) into the main elevator cab, where they will spend the remainder of their journey enjoying the luxurious accommodations of our mobile 0g hotel (Ref. Image 3.5.2). The shuttle segment also transfers water, food, and other necessities to resupply to the main elevator hotel. The third segment of our space elevator contains cargo storage for materials transfer from the lunar surface to Columbiat, as well as the waste management for the main space elevator cab. Upon connection of the cargo segment to the Luna Lift, the impact causes valves within the hotel to lock with their counterparts in the cargo bay, ensuring complete a completely secure seal of the waste management system.

The three segments of the elevator cab connect using a metal to metal connection. Upon contact, clamps interlock to maintain a secure connection of the compartments during travel to and from the settlement. The connecting clamps have a hard carbon coating at all junction points to reduce friction during transit.

Image 3.5.2 Spacious community areas and multiple recreational facilities make the thirteen day trip fly by!



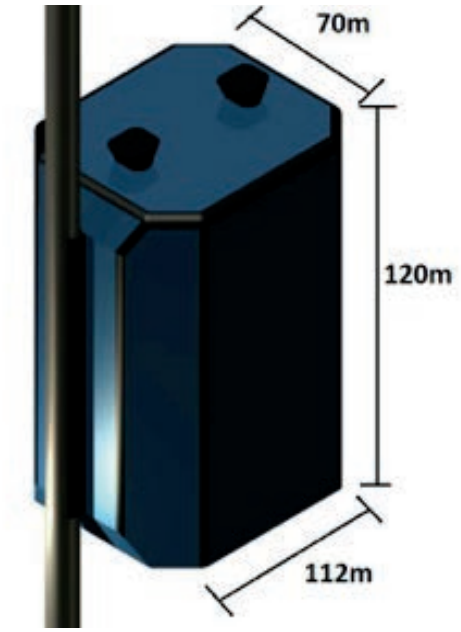


Image 3.5.1 Speeding up and down the space ribbon, the exterior materials of the Luna Lift such as high density polyethylene and hydrogen rich bucky structure material protect the travelers inside from harmful radiation.

3.5.2 ASCENDING AND DESCENDING THE RIBBON

In order to ensure the elevator cab journeys smoothly to and from its desired destinations and travels at exactly 250 miles per hour with no more than 1g acceleration, we employ an electric motor. The electric motor and Lithium Ion batteries are located within the Luna Lift to protect them from the extreme conditions of space. When the Luna Lift decelerates as it nears its destination, the elevator engages regenerative braking to help recharge the batteries. The batteries are fully recharged at Columbiat or the moon port. This lightweight system can easily reach our optimal speed of 250 mph and produces no emissions that would linger along the elevator ribbon. We connect the Luna Lift to the ribbon with a monorail attachment.

3.5.3 HULL COMPOSITION

The Luna Lift's hull has a similar hull composition as Columbiat, with .2 m of space resistant Ferronickel Alloy to insulate and provide fracture toughness. High Density Polyethylene (.4 m) and Titanium-Aluminum-Molybdenum Alloy (.3 m) protect passengers from radiation as well as strengthen the hull of the Luna Lift. A layer of hydrogen rich bucky structures provides further thermal insulation and shields from the harsh conditions of space.

4.0 HUMAN FACTORS AND SAFETY

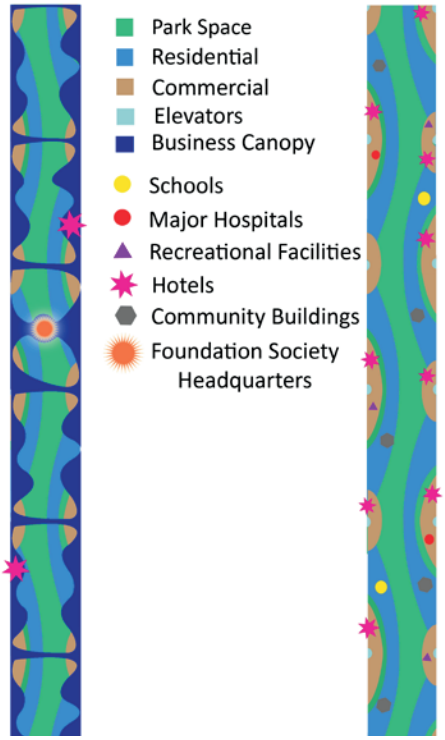
As visitors enter Columbiat, our thriving city greets them with a unique space culture. Lining the .8 gravity level, the naturalistic architecture of the Business Canopy grants maximum productivity for workers in the soothing canopy environment. Bodies of water and vast green areas guarantee a tranquil atmosphere for residents, while our recreational facilities ensure opportunities for exploration and well-being. With housing designs ranging from chic to cozy, we meet all architectural and lifestyle desires. The conductive polymer of our spacesuits make donning and doffing incredibly efficient, while securely sealing users from harmful environments. When voyaging to the moon and back, passengers will never feel the wear of travel due to the deluxe ambiance of our Luna Lift, which keeps comfort and safety as a first priority.

4.1 COMMUNITY LAYOUT

Our community layout grants privacy and accessibility through our Business Canopy, commercial, park, and residential areas. Park space passively separates visitors and permanent residents, while business men and women work in their own level and in their own time zone to assure a non-interrupted, lucrative environment.

A business level resides above the residential and commercial areas that not only separates operational work from residential and transient areas, but enhances excellent views of the settlement's ground level. Overlooking magnificent bodies of water and green areas, our enclosed Business Canopy grants maximum productivity with uninterrupted work capabilities. Lighted park space outside the buildings offers a calming break for businessmen and women, as day/night cycles do not apply to our Canopy. The Foundation Society Headquarters rests in the middle of the Canopy, bestowing Foundation members with overarching views of Columbiat where luxury meets productivity. From below, the Canopy appears as an undulating frame to the sky, giving a calming feel to residents and visitors.

Image 4.1.1 Our community layout emphasizes distinct business, commercial, residential, and park areas. Each section contains amenities to enhance an individual's experience and provide privacy, while simultaneously allowing for easy access.



4.1.1 AMENITIES AND SERVICES

Columbiat offers a multitude of amenities for residents' comfort and enjoyment (Ref. Image 4.1.1). Communities offer access to advanced technology, like our Holo-CAD device, which streamlines many experiences for residents and visitors (Ref. Section 5.3.1). Many restaurants lie within the communities, offering varied cuisine choices. Near the windows, many of the restaurants offer magnificent views of the space surrounding the settlement, whereas other restaurants dot the intermittent bodies of water to create a more laid-back atmosphere. Columbiat has two K-12 schools within two of our six individual communities. Students access the schools through the Ampelos Transportation System. The Ampelos Transportation System has a specific car for students equipped with seatbelts for the safety of the settlement's youth (Ref. Section 3.2.7).

Throughout Columbiat, many diverse entertainment options await visitors and residents. Numerous "Adventure Bubbles" line approximately .2 gravity on the outer edge of the Operations Core along the elevator (Ref. Image 4.1.2). These pods support interactive exploration of a virtual reality of the known universe through Holographic (Ref. Section 5.3.1) and Brain Computer Interface (BCI)

Image 4.1.2 BCI and holographic technologies allow residents to explore a virtual reality of our universe through three dimensions in our Adventure Bubble Entertainment System, from virtually walking on Pluto to 'swimming' through a supernova.

technologies. BCI uses electroencephalography, or the recording of electrical activity within the user's brain waves, to interpret thoughts and create a more authentic and interactive experience. Our "Adventure Bubbles" warrant the investigation of anything within the universe. We also can use this technology to repair and maintain equipment on distant celestial bodies (Ref. Section 5.5.3).

Each resident and visitor has access to space games in microgravity to ensure individualized entertainment of everyone on Columbiat. Ranging from navigation to space versions of freeze or laser tag, humans can partake in mental and physical challenges. All games yield a fun and collaborative environment where residents and visitors can master the art of navigating through microgravity.

At Columbiat, we recreate the elegance of the Columbia River through our tranquil bodies of water, intermittent throughout the settlement. Other bodies of water with rapids and more movement provide a safe source for physical recreation through canoing, kayaking, and other water-based activities with a constant filtration of the water (Ref. Section 3.2.4). Not only a source of recreation, these bodies of water allow an escape for business men and women and residents from daily stresses. The green areas' natural and soothing effects calm residents and visitors and give Columbiat an earth-like feel. The vast park space on the residential floor provides areas for sports, like soccer and football, where facilities in the .2 gravity area serve as a place for low gravity games. For entertainment outside the settlement, hull climbing on the interior of the Ops Core offers a thrilling and fun experience, while spacesuits and buckystructure tethers keep them safe (Ref. Section 4.3.2, 4.3.3).

In order to monitor residents' health daily, we give each resident a Holo-CAD embedded within their clothing to ensure their well-being. Our Holo-CAD systems have unobtrusive medical monitoring capabilities that passively monitor heartbeat, blood pressure, body temperatures, breathing patterns and pulse. The constant screening of vital levels allows for the early detection of a medical problem, therefore helping to prevent illness. If the Holo-CAD senses an unnatural change in the body, the device alerts the resident and quickly sends for help from the multipurpose SanoBot (Ref. Section 5.3.1). SanoBot initiates any preface work before a physician arrives by either stabilizing the person or immediately transporting them to a hospital. The SanoBot allows for the fastest and most efficient care available, while a physician follows up for human contact, aiding in the psychological comfort of each person. The Holo-CAD automatically sends its recorded information of the resident to medical centers that serve as the central information point for each patient in the hospital.

Through preventative care and speedy responders, the likelihood of necessary hospital care remains low. However, in the unlikely event someone requires serious medical attention, our two 1000-person hospitals possess the advanced technology to care for each resident in any medical emergency they face. Columbiat's two full service hospitals facilitate care for serious needs and surgeries, as well as four medical centers for check-ups and other services, like dental and physical therapy. Areas within the acclimation units (Ref. Section 4.4.1) give visitors a place to rehabilitate from long visits to 0g through distinct exercise routines that slowly and comfortably rejuvenate the person. We have robots that perform surgeries through BCI controls from a physician within the settlement, to create the most precise surgeries. Since each surgery presents as unique, incorporating BCI technology allows humans to adapt to the situation, with the robot carrying out the actual task unless the patient specifies otherwise.

Personal Holo-CADs aid in the individualized use of recreational facilities by showcasing custom workouts for each resident based on the monitoring of each person's health to combat any negative effects of exposure to 0g. The recreational facilities, located within three of our commercial areas, provide a fun, engaging environment for people to maintain their longevity and engage with community members. Built-in BCI technology within certain rooms of our recreational facilities allots opportunities for residents to exercise in a more earth-like environment. These exploration rooms simulate routes and trails of mountains, forests, or any place the residents want to discover. With any terrain available, users can train for their next excursion to mars or the moon, to gain familiarity with the area.

Chart 4.1.1 Columbiat's Agricultural Ring efficiently produces the majority of all needed consumables from toiletries to clothing for the health and happiness of our residents.

ITEM	ANNUAL REPLENISHMENT	SOURCE
Food	25,550,000 kCal/year	Operations, Agricultural Ring
Paper	Replenished according to need	Operations, Agriculture Ring
Clothing	Made from Bamboo, replenished and ordered from Holo-CAD according to need	Operations Core, Agricultural Ring
Toiletries	All soap, toothpaste, and other hygiene products are replenished according to need	Operations, Agricultural Ring

4.1.2 CONSUMABLES AND DISTRIBUTION

The settlement produces most of the necessary materials for consumables (Ref. Chart 4.1.1) in the Operations Core, Crescent and Agricultural Ring. Using hemp and bamboo plant fibers, we manufacture paper, clothing, furniture, and toilet paper. The use of these highly fibrous plants allows us to develop more materials while using less resources. Clothing comes in diverse, customizable sizes, painted with paramagnetic paint, allowing it to effortlessly change color and pattern. Virtual shop centers within each neighborhood permit an opportunity for residents to obtain all of their consumable needs in an interactive and community-orientated environment. If they choose not to order consumables from their houses. Each center presents consumables through screens that residents can order via their Holo-CAD. This process mitigates the spreading of germs and provides ease of access to any consumables in a social surrounding, preventing an excess of products in grocery stores and eliminating the need for storage. Pneumatic tubes send smaller items, like food and clothing, to centers within each neighborhood where residents can receive them.

4.1.3 PUBLIC AREAS

Central parks enclosing the residential area house peaceful community garden spaces for every neighborhood, to promote community interaction. Trees line public park areas to promote peaceful interactions. Integrated natural sounds, like chirping birds, create melodious noises, for a more natural atmosphere. Excess photopolymer creates landscaping and a more dynamic settlement, appeasing to the eye (Ref. Section 5.1.3). One open community building within each of our six communities, appropriates free space for residents to use in any function. These buildings also permit storage space of necessities in case of an emergency and have their own pressure and air circulation systems (Ref. Section 5.2.2).

4.2 RESIDENTIAL AREAS

Our housing designs reflect the luxury and liveliness of Columbiat, while our neighborhoods within communities create unity and interaction between residents. Innovative architectural designs emphasize relaxation, individual expression, and optimization of space living.

From residential areas, the peripheral windows allow for views of the sun, moon, and earth (Ref. Image 4.2.1). Looking above, residents see through the center of Business Canopy to the OLED sky that, as evening approaches, changes opacity along with the windows (Ref. Sections 3.2.8).

4.2.1 ARCHITECTURAL DESIGNS

All housing designs reflect the desire for efficient, open spaces balanced with privacy and solitary retreats

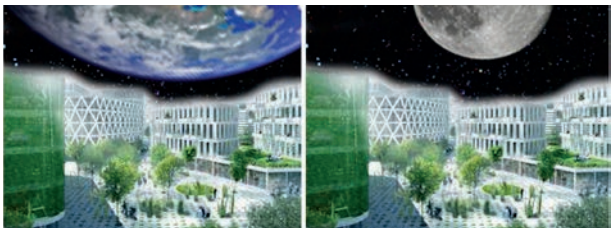


Image 4.2.1 From residential floors, windows allow for spectacular views of the earth and moon, creating an awe-inspiring, humbling effect.

by incorporating open floor plans, smart glass and small enclaves attached to the main rooms. The basic structures consist of wood pulp, enabling the creation of a wide variety of shapes while retaining strength and durability. In between the wood pulp supports, we place plant-based polyurethane rigid foam to help resist any excess moisture and protect against mold. A layer of high density polyethylene furnishes a soundproof environment. An electricity and light-conducting nanocellulose layer adorns all walls. Since the material remains clear when not in use and can incorporate electronic displays, the nanocellulose does not impede a resident's view and also gives him or her the ability to turn the entire house into a theater or painting. Residents can customize their homes to any desired color or variety of images. Housing comes with the option of a hot tub for a relaxing atmosphere. Houses range from a mixture of metallic paneling and glass to wood paneling in order to suit a variety of architectural preferences. The metallic and lightly painted structures evoke feelings of light, space and modernism. More wooden structures with soft lights and warm colors help the residents feel cozier and relaxed.

Palladian House (Ref. Image 4.2.2)

A Venetian inspired home, this design offers a spacious floor plan and manifests safe and luxurious living for married couples, singles and families (Ref. Image 4.2.3) On the lower of two levels, the main entrance opens onto a lavishly open floor plan. Furniture allocation offers optimum viewing of the nanocellulose wrap-around screen or an exterior view through a large picture window. In the far corner of the main room, a smooth white wall hides the bathroom from sight. Opposite the bathroom, a large room offers absolute flexibility for the occupants. Whether as a child's bedroom, activities room or theater, the extra room grants much-needed

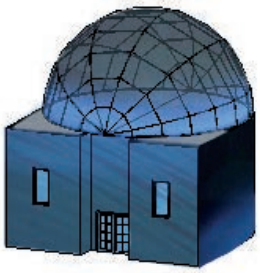


Image 4.2.2 An aesthetically-pleasing giant dome resides in the center of the Palladian, allowing light to filter freely into the home.

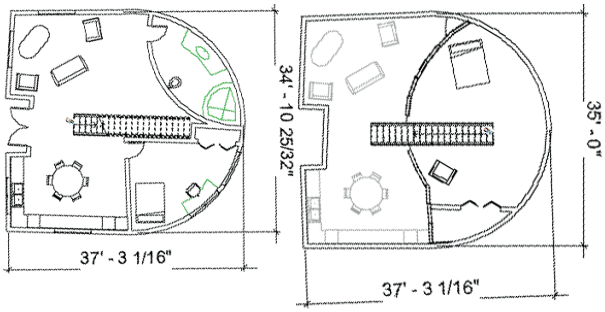


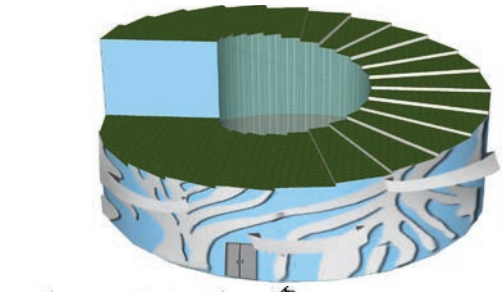
Image 4.2.3 Palladian's first floor presents a large welcoming room with easy access to dining, resting, and hygiene areas, while the dome from above gives residents magnificent views of the illuminating sky and space for a sublime effect.

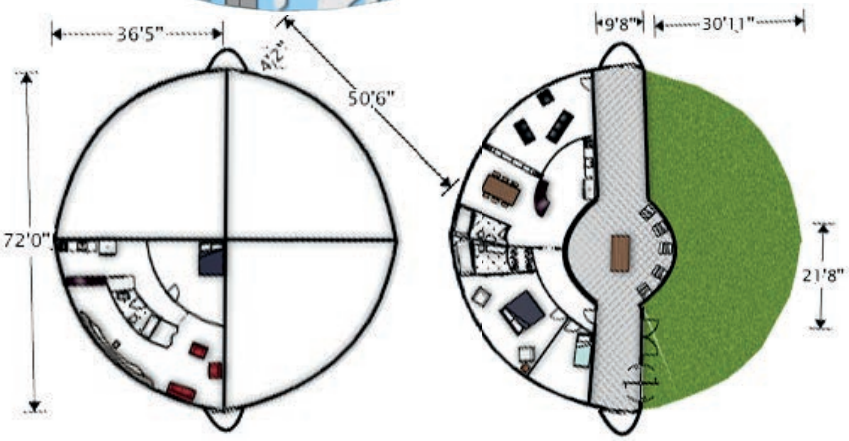
versatility for residents. Stairs cut straight through the center of the room, providing a strong, modern center point and easy access to the upstairs bedroom The second floor acts more like a platform, allowing light to flow from the dome to the bottom floor.

Harmony Community Living (Ref. Image 4.2.4)

For residents who desire a community based area, the circular style of the Harmony Complex facilitates interaction between residents. The two exterior elevators connect the three residential floors, the third floor being a penthouse and a smaller community area (Ref. Image 4.2.5). Vast windows direct sunlight into the home, creating a vibrant living environment. Windows have OLED capabilities, allowing each resident to control their interior environment (Ref. Section 3.2.8). The lawn and gardens atop the complex leads to a public patio. The naturalistic ambiance of the Harmony complex reflects that of Earth, to accommodate the need for a tranquil environment.

Image 4.2.4 For those inclined towards community living, the Harmony complex promotes interaction and cooperation through a circular design.





Lucem Family Home (Ref. Image 4.2.6)

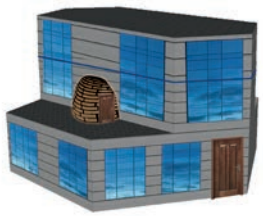


Image 4.2.6 Family friendly, the Lucem home produces a friendly and welcoming environment through tall windows and strong architectural features.

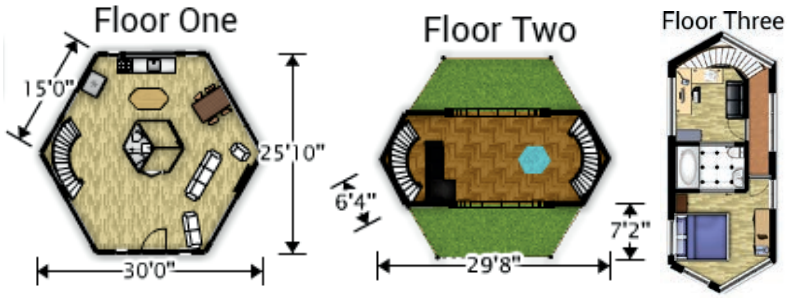


Image 4.2.7 Spacious dining and lounging areas promote communication and interaction between families.

The Lucem Family Home constitutes the perfect place to raise a family. This two-bedroom, two-bath house establishes a warm and comfortable atmosphere through an open lower level (Ref. Image 4.2.7). Staircases on one side of the hexagonal shape lead to the serene environment of a hot tub. A plethora of windows provides maximum light, enlarging the space. The middle level attaching to both garden spaces has an alternating wood and glass panel wall, giving residents privacy yet also natural light. Two rooms on the second floor present comfortable living and office spaces. For an efficient use of space, the hexagonal shape of the design alternates in a honeycomb-like shape, supporting easy expansion.

Image 4.2.5 Each complex grants privacy through easily controllable transparency of the vast windows. Spacious rooms promote interaction.

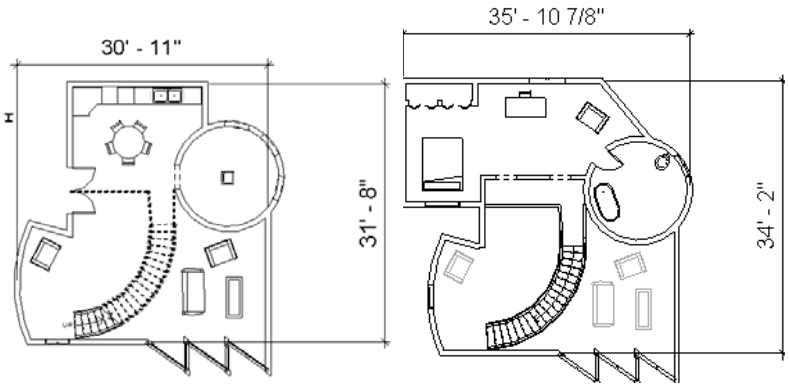


Image 4.2.9 Through a unique combination of architectural shapes, this home includes more enclosed areas to allow privacy while also providing easy access to all areas of the house.

Image 4.2.8 Amidst Columbiat's space and modern influenced architecture, the Back to Earth Getaway is a hidden gem, complete with beautiful wood paneling and high windows.

Back-to-Earth Getaway (Ref. Image 4.2.8)

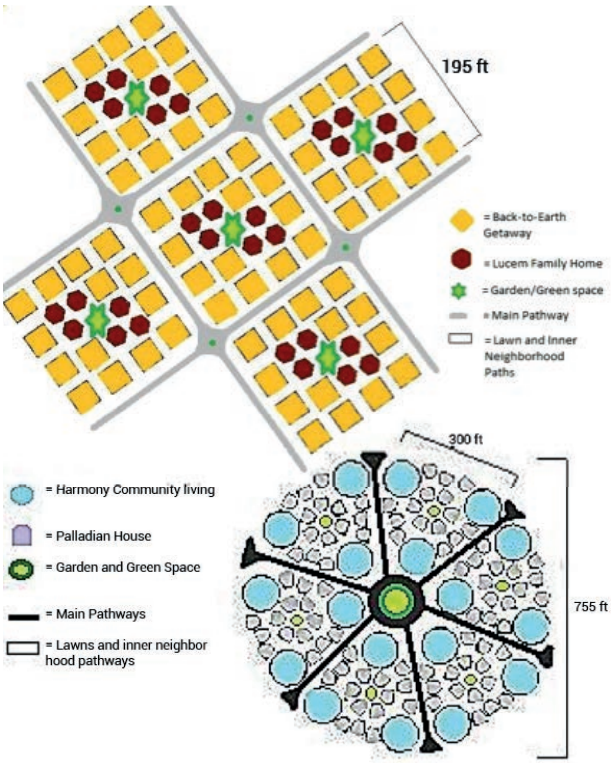
For those people feeling less comfortable in the space environment, we designed a familiar, comfortable home. With wood paneling covering every surface, the Back-to-Earth Getaway gives a warm, earthy vibe. Unlike other floor plans, the Getaway features a plethora of smaller, enclosed rooms so residents can escape from an overabundance of stimuli. Upon entrance, a large room still encourages socializing and guest comfort. Three smaller rooms branch off of the large room: a bedroom, bathroom and meditation room. A gently curving staircase, wrapping languidly around the main room, offers access to the upstairs bedroom. The partially enclosed living room and dining/kitchen areas carry a comforting yet contemporary feel (Ref. Image 4.2.9). Floor to ceiling triangular windows extend from the main room, allowing ample, comforting light to pass into the room. An abundance of different shapes throughout the house, like the round door leading into the spherical meditation room, breaks up the house in a contemporary style without overwhelming the resident.

4.2.2 COMMUNITY DESIGN

Inside the larger communities, we arrange houses into circular neighborhoods around a small central garden (Ref. Image 4.2.10). Prior to settlement colonization, residents answer a questionnaire. The survey reveals shared interests between residents, and we group residents so they can bond within a similar crowd. We also place differing neighborhoods near each other so citizens can expand upon their individual interests to promote unity within Columbiat. In addition, we place neighborhoods with certain interests (like movies) near the amenity most closely related with that particular interest (like a theater). All residents, however, can quickly and easily access all community buildings via their foldable bikes.

Residents choose between two types of architecture: simply modern or pleasantly cozy (Ref. Chart 4.2.1). Each type of architecture dominates three of the six residential areas. This way, residents with similar tastes in architecture can enjoy constant immersion, while our diversity creates an interesting environment for residents. Hospitals, parks and other public areas display decorations and features in similar style to the houses, as a complimentary aura flows throughout communities.

Image 4.2.10 Six residential areas of Columbiat alternate between modern and simply sophisticated neighborhoods.



NAME	TYPE OF RESIDENCE	ARCHITECTURAL DESIGN	SQUARE FEET	AMOUNT OF DESIGNS IN SETTLEMENT
Palladian House	Married or Singles	Modern/ Chic	1100	5660
Harmony Community Living	Singles	Pleasantly Cozy	Individual apartments: 1000 Entire compound: 7200	310
Lucem Family Home	Married/Family	Modern/ Chic	1950	1150
Back-to-Earth-Getaway	Married or Singles	Pleasantly Cozy	1150	5660

Chart 4.2.1 The distribution and numbers of different architectural influences guarantee satisfaction for all Columbiat's residents in our residential areas.

Chart 4.2.2 Multiple types of furniture, made of bamboo produced from our own settlement, provide all residents with their desired furnishings. Some furniture, made from lunar regolith, gives residents a variety.

TYPE OF FURNITURE	Chair	Sofa	Table	Desk	Bed
ESTIMATED NUMBER	Resident: 87220 Business: 2300	R: 12745 B:	R: 12745 B: 1000	R: 25490 B: 2300	R: 15545 B:
SOURCE	Bamboo	Bamboo	Bamboo	Bamboo	Bamboo

4.2.3 FURNITURE

Various types of furniture give residents many options in their housing and business environments (Ref. Chart 4.2.2). Due to our extended contact with the lunar surface, hardened lunar regolith forms furniture for a variety of looks and textures. Residents utilize the easily accessible music and electronic systems through the nanocellulose layer within each house. Residents can customize their house in furniture style, color, and theme when styling their house. We can make many types of furniture to conform to various preferences.

4.3 SPACESUITS AND SAFETY SYSTEMS

Safety presents a top priority with regards to our residents' lives. Our spacesuits safeguard each user within any environment. We pride ourself in the unique design of our donning and doffing procedure, which highlights efficiency and security of all residents.

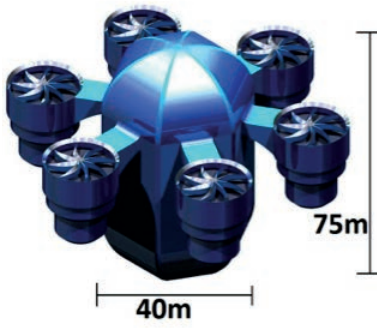


Image 4.3.1 Roving Shuttle Systems transport people comfortably and materials efficiently to any area of Columbiat in a safe environment. The RSS has a capacity of 200.

4.3.1 SYSTEMS FOR HUMAN OUTSIDE OF ARTIFICIAL GRAVITY

Roving Shuttle Systems (RSS) administer transport to any area in Columbiat with low or no gravity environments, such as the ports, Operations Core, and hull of the settlement (Ref. Image 4.3.1). These vehicles, made of silicon carbide, metal alloys, smart glass windows, and versatile hydrogen-rich buckystructure for extreme radiation protection, transport materials and people. Electrochromatic smart glass with liquid crystal technology enables the glass to withstand extreme temperatures. Each vehicle contains straps for individuals to secure themselves in low gravity for safety. The oxygen and hydrogen fuel cell technology powers the RSS. These highly reliable power devices allow fluid transport of people and materials to any area within the hull or on hull exterior surfaces. Contingency power methods include outer linings of thermo photovoltaic cells for journeys outside of the hull. Each RSS enables the transport of 200 people, yet for other missions, which do not require as many people, smaller versions of the RSS hold up to 20 individuals.

4.3.2 SAFE ACCESS TO PARTS OF SETTLEMENT

For safe access to any area, Northdonning Heedwell presents uniquely maneuverable spacesuits, Roving Shuttle Systems (RSS), and transport systems shuttle people from the operation terminal facilities to acclimation elevators (Ref. Section 4.4.1, 2.1). To arrive at

Image 4.3.2 North-donning Heedwell's innovative spacesuits allow for ultimate dexterity, comfort, and safety through BCI technology and intricate layers.

the acclimation elevators, the transport systems travel through a tunnel which allows for a speedy journey. Silicon buckystructure cables tether the spacesuit to the settlement through sealing fibers in the spacesuit. RSS transports enable all around access to all areas, and contain silicon buckystructure tether support systems for attachment to interior and exterior hull surfaces.

4.3.3 SPACESUITS

Our Spacesuits enable humans to work or play outside of the settlement with efficiency, mobility, and safety (Ref. Image 4.3.2). The entire suit consists of twelve alternating tightly woven layers of elastic, hydrogen based polymers (self sealing utilized in donning/doffing processes), polyethylene, nanocellulose, and flexible strands of silicon buckystructure for fabric nets to maintain ultimate radiation protection, heat regulation, and flexibility. We embed electrodynamic dust shielding into the fabric, along with a liquid glass coating, which creates an electric field to mitigate dust and greatly reduce any particle accumulation.

Sensors constantly monitor pressure and the suit regulates the pressure to be around .29 atm. Circulation and ventilation tubes of amorphous polycarbonate and hydrogen infused layers of nanocellulose in the first layers of the spacesuit work to maintain body temperature through encased liquid nitrogen. Nanocellulose constitutes an easily controllable screen and interface for the human to control and monitor levels in the suit. Within the helmet, a cap lined with external electrodes contains BCI technology for fluid control of the spacesuit. The visor includes multiple layers of wireless, induction charged infrared transmitters above the cortex which receive neuron signals through BCI interface to communicate with Columbiat. Vitals, radiation, and dust levels project on the screen so users may view and adjust settings in the suit.

Small tanks attach to the spacesuit's back to hold life support systems. In addition, nitrogen boosters power a small jet pack should the tethers fail. Small vents throughout the suit allow sweat and carbon dioxide to escape. In the event of a puncture or emergency, integrated isoprene silica aerogel filled fiberglass cells seal around the intruding object and/or reseal the damaged area. Silicon tubes in the lower half of the suit lead to a synthetic waste storage system.

Within the Operations Core, 20 spacesuit pods store 200 spacesuits. Each pod has a circular design to aid in the ease of pressurization (Ref. Section 4.3.5). Storage centers, equipped with scanners, relay any damage information and dust levels to determine if the suit needs repairs. The suits, properly stored in compartments, elevate to increase space efficiency. Automated systems refill oxygen tanks and support systems for the spacesuit.

4.3.4 DONNING/DOFFING PROCEDURE

Northdonning Heedwell introduces a unique, unobtrusive donning and doffing procedure which emphasizes ease. Donning and doffing procedures occur through sensory systems embedded in the donning and doffing room. The sensory system quickly determines the shape of the personnel entering a space suit and presents the correct sized suit. Within the room a semi-permeable membrane holds space suits, presenting them in the correct direction of the user. The wearer enters the membrane and places arms and legs through designated portions of the spacesuit (Ref. Image 4.3.3). A mild electric current conducted through the polymer membrane, harmless to humans, makes the polymer rigid. The current forces the suit to seal and subsequently knit together on contact with self sealing polymer fibers, whose unique design seals and unseals to different corresponding currents. Scanners examine and safely secure the entire suit. Upon re-entry, the membrane system removes the suit with a similar mild electrical current. A dome lined with electrodes lowers closely over the suit, which then sends vibrations and spins to remove lunar dust through electrostatic and magnetic technology from the suit upon each re-entry.

4.3.5 AIRLOCKS

Each airlock consists of three chambers. The interior chamber connects to the settlement and contains spacesuit storage facilities, while the exterior chamber allows for access to the exterior of Columbiat. The central chamber contains the acclimation area. When a human enters the central chamber, a metal airlock door closes between the central and interior chambers to seal and pressurize the area. Once the central chamber doors seal, vacuum pumps draw the air out of the airlock to preserve atmosphere. Additional doors, available on either side (in case of loss of pressure, emergency, etc.), Immediately and automatically in case of system failure. Then, the door opens to

Image 4.3.3 Columbiat's exceptional donning and doffing processes present a non intrusive, easy, innovative method which guarantees a perfect fit for each individual.

Image 4.4.5 With the comfort and ease of visitors and residents as a top priority, each facility's layout features interactive technologies that emphasize an inviting environment.

the exterior chamber, and a final safety door provides an exit to the exterior of the settlement. When users come back into the exterior chamber, dust mitigation systems, including electromagnetic wanding, electrostatic shields, and acoustic levitation, completely clean any debris from spacesuits. Doors then open to the central chamber, and seal before pumps flow atmosphere into the central chambers. Users then exit their spacesuit out of the other side of the polymer barrier, keeping the user completely separate from any harmful debris.

4.4 VISITOR ACCOMMODATIONS

A lighted tunnel portraying Columbiat's pristege greets visitors upon arrival, creating a welcoming environment. Innovative, precise sensory systems aid in monitoring and security features, while our visitor accommodations and commercial areas allow for financial fluidity and facilitation of a bustling metropolis.

4.4.1 PASSENGER ARRIVAL AND DEPARTURE AREAS

Arrival and departure areas facilitate an awe inspiring first impression of our establishment among the stars. Welcome centers within the facilities establish feelings of openness and luxury (Ref Image 4.4.5). Upon arrival, travelers enter the arrival and departure areas within the Operations Core (Ref. Image 4.4.1). Our terminal facilities are large, easily pressurizable circular structures made of amorphous polycarbonate, metal alloys and corning glass to ensure safety from the unpressurized regions of the surrounding Operations Core. The Ostium Shuttle System transports passengers from the arrival and departure facilities to the acclimation elevators. On this short journey, a lighted tunnel greets them with projected holographic images of an overview of the Foundation Society,

Image 4.4.1 Impressive, welcoming arrival and departure terminals produce a smooth transition from the Luna Lift to the acclimation elevators.

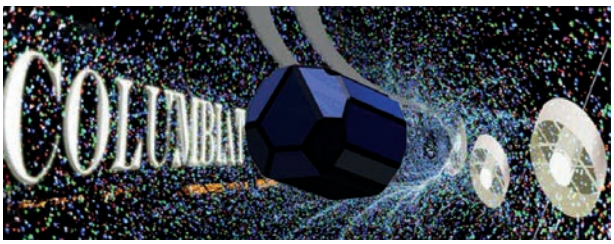


Image 4.4.2 A magnificent, streamlined light tunnel and transport system supplies a connection from the arrival facilities to the acclimation elevators. Projected holographic images introduce humans to the stunning past and present of Columbiat and The Foundation Society.

Columbiat's construction progress, and other space endeavors of Columbiat like a mini space tour (Ref. Image 4.4.2 and Section 2.1.2).

Each elevator has four acclimation units, or areas for the customer to adjust to new gravity levels (Ref. Image 4.4.3). Acclimation units house 100 people per unit and have all necessary living essentials similar to a hotel. Upon entry, people travel to their individual sleeping quarters and area. Hexagonal privacy units

Image 4.4.3 Four acclimation units located along the .2, .4, .6, and .7 gravity levels enable a secure transition for every human being from 0 g to Columbiat's commercial, work, and residential areas.

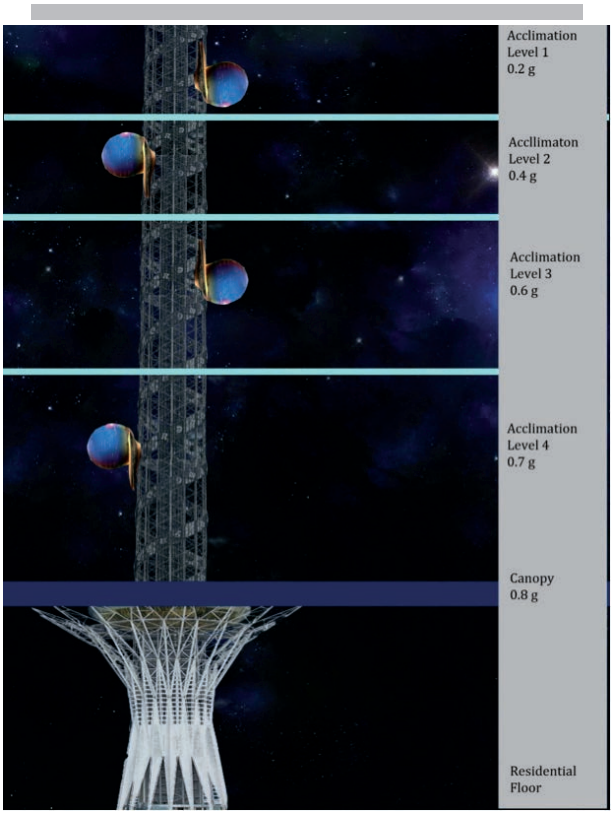


Chart 4.4.1 Personal Holo-CADs monitor visitors and create customized acclimation times according to body analyses and vital levels. Therefore, the time periods listed above are subject to change from person to person. (Ref. Section 5.2.3). After individuals spend the allotted time in an acclimation unit according to their Holo-Cad, they move on to the next acclimation level until they finish their acclimation process.

GRAVITY LEVEL TRAVELING FROM	GRAVITY LEVEL ARRIVING IN	TIME PERIOD IN ACCLIMATION LEVEL	ACCLIMATION LEVEL
0	.2	18 hrs	1
.2	.4	14 hrs	2
.4	.6	12 hrs	3
.6	.7	6 hrs	4

stack on top of each other to increase space efficiency and provide architectural strength. Each sleeping quarter contains holographic features, which individuals can alter to their needs. A communal area in the center of the unit contains eating areas, socialization spaces, and recreational equipment. Holographic centers and gaming systems that line two walls utilize BCI technology for interactive play. Sensors within the Holo-CAD monitor the health of individuals to determine how well they are acclimating, while each acclimation unit also contains two health care professionals and all necessary medical equipment for any upcoming needs of the visitors (Ref. Chart 4.4.1).

In case of an emergency, oxygen tanks and life system features enable security to anyone in transit or in acclimation units. Steel and Plexiglas handrails supply safety and stability. Domed for pressure and atmospheric regulation, extendable metal alloy and interfacing Plexiglas walkways connect elevators to individual acclimation units.

4.4.2 VISITOR ACCOMMODATIONS

Upon entering the commercial area after the acclimation process, visitors experience the thriving Columbiat metropolis. Each of the twelve commercial sections showcase restaurants, hotels, shops, movie theaters, amphitheaters, symphony halls and galleries. With the best facilities and opportunities for unique gravity culinary techniques, Columbiat houses the best restaurants of varying cuisine. Photo and art galleries in each section reflect their inclinations towards traditional or modern art, creating an atmosphere superior to Earth with our differing gravity levels. Botanical gardens create a soothing, restful environment. Holographic directories project from Holo-CADs to grant directions to visitors. Virtual keyboards at restaurants allow for streamlined ordering and convenient communication. Shops and galleries reflect both space and earth-like features for the overall comfort and interests of residents and visitors. Above, our Business Canopy reflects a state of the art, pristine environment for businessmen and women (Ref. Section 2.1). Throughout our settlement, Northdonning Heedwell presents innovative and inspiring architecture (Ref. Section 4.2.1).

Image 4.4.4 Public areas of Columbiat's hotels emphasize interaction and spectacular views to reflect both the luxurious amenities inside and the wonders the settlement provides outside.

The layout represents a sophisticated progression of consumer needs. Restaurant and shops greet visitors outside of the arrival facilities. Curved streets construct a fluid course for visitors to explore Columbiat's commercial districts. Columbiat contains twelve hotels, with ten in residential areas and two in the Business Canopy. Business hotels apportion rooms for visiting business men and women only. Sophisticated glass paneling opens up the lobby areas, with light brightening the room (Ref. Image 4.4.4). The hotel designs include color variations through Electrochromatic smart glass, which users can manually alter for their preferences. The interior contains elevators to each level. Each room reflects minimalistic, feng shui designs for a large amount of natural light to bathe the room, which allows for a harmonious flow of energy and good air circulation.

Luxurious amenities, such as 3-D mirror televisions and RFID sensors in Holo-CADs for room keys, furnish complete freedom and easy identification. A state of the art oxygen bar supplies flavored oxygen through small tubes to users. This fun activity shortens disorientation, discomfort, and ensures a faster acclimation to humans who have just arrived from low gravity. Corning glass panels enable user controlled transparency levels of the darkness or lightness of their room. Each room presents high density polyurethane sound proof walls and a vast speaker system for auditory entertainment. Each hotel contains rooms of 350 sq ft and ascends in ten feet levels to allow for the best visualization of Columbiat.

4.4.3 SAFETY WITHIN THE COMMUNITY

A non-intrusive sensor system lines Columbiat's residential and commercial areas. This vast, sophisticated security system monitors everything from pressure and temperature levels to population fluxes. The integrated technology aids as a security system, able to digitally recognize a person's identity by measuring gait of the individual. By utilizing the heat sensors in the commercial area, Columbiat monitors the visitor population specifically. Any drastic change in sweat levels, breathing patterns, pupil dilations, and aggravated vitals depicting emotional distress such as ill content flags our sensory security system to inform of a potential security situation. Subsequently, Columbiat flags them, their Holo-CAD device restricts access to any area and if their behavior is extreme, SanoBots come to assess the situation and act as the police force with human security assistance if necessary.

A large park system enhances a subtle and aesthetically pleasing barrier between commercial and residential areas. The activities of visitors remain separate from residents, yet, we still have pathways perfect for residential bikes that allow permanent residents access to the thriving commercial areas if they desire. (Ref. Section 4.1.4).

4.5 SPACE ELEVATORS

The unique Luna Lift enables an efficient, fluid commute from the moon to Columbiat. Advanced atmospheric and storage systems aid in a seamless journey to our settlement, while passengers enjoy the spacious living and social areas of the Luna Lift.

Our Space elevator, Luna Lift, puts safety and comfort first in our residents' journeys to the moon. Fully equipped as a functioning hotel, the space elevator gives passengers a fluid ascent and descent to the neighboring celestial body. Our unique three segmented design (Ref. Section 3.5) seamlessly allows for a safe 1g experience during acceleration and 0g during the six day trip (Ref. Image 3.5.1). During the short acceleration period, harnesses safely secure passengers in the shuttle to ensure comfort and protection (Ref. Section 3.5). After the elevator reaches 250 mph, the passengers remain in 0g for the remainder of the thirteen day trip. Handrails throughout the elevator assist in movement and helper bots assist passengers in case they are uncontrollably suspended in the 0g environment.

The elevator cab has 80, 2.2mX1.6mX1.6m rooms, with an intelligent layout to accommodate 0g living. Each room has luggage storage and interactive holographic displays for maximum space efficiency, while also providing an area for privacy. These holographic displays and personal Holo-CADs ensure entertainment and work all in one, by allowing traveling business men and women to communicate and conduct their business from the privacy of their room, for an efficient mobile workspace. A family friendly section attaches two sleeping rooms in order for parents and children to be together.

Our soft, cocoon-like bedding encourages sleep in 0g and conveniently attaches to any of the available five walls in each room, allowing maximum flexibility and comfort (Ref. Image 4.5.1). The sixth wall, encased with high density polyurethane for sound proofing, rolls up into the wall and acts as the room's doorway to give occupants access to community areas. Ten community bathrooms utilize slight suction to ease the microgravity bathroom process. After each use, microbot cleansing systems disinfect the bathrooms and hotel area to ensure cleanliness throughout our space elevator. The bathroom and sleeping rooms line the exterior of one of the living quarters (Ref. Image 3.5.1). The intelligent design of our hotel resembles a honeycomb structure, eliminating hallways and reducing excess living space, while simultaneously allowing for individualized, comfortable spaces for each passenger.

Passengers eat and socialize in the community center. We offer a diverse diet to the passengers on the Lunar Lift, and serve all foods in sealable bags to reduce airborne food. Passengers can inhibit their own movement during meals by securing themselves in bench like structures within the eating area. We discourage free floating during meals to reduce difficulties of eating in 0g and provide an earth-like atmosphere for comfort and psychological ease. For their own health, passengers must exercise for an hour per day to help combat muscular degeneration. 0g games, theaters, packaged food buffets, and interactive holograms highlight just some of the features available to our passengers. In addition, one business center facilitates personal interactions and meetings.

To meet each passenger's needs, Columbiat stores water, food, and pressurized oxygen on the elevator's cargo shuttle. Luna Lift houses enough supplies to sustain the passengers for 18 days. Luna Lift uses electrochemically mediated amine regeneration to process the carbon dioxide and only uses the pressurized oxygen in case of emergencies. The cargo hold stores water and waste to ensure humans never come into contact with waste materials.

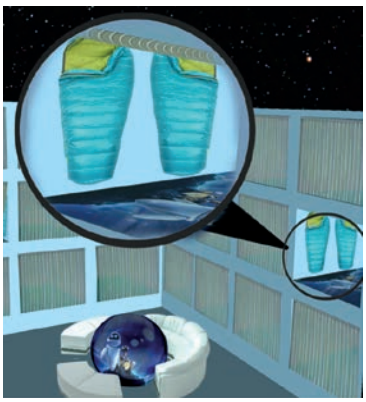


Image 4.5.1 The Luna Lift enables all passengers to sleep, work, eat, and interact with others safely in zero gravity through unique bedding, holographic technology, recreational activities, and more.

5.0 AUTOMATION DESIGN AND SERVICES

AUTOMATION DESIGN AND SERVICES

We pride ourselves in the streamlining processes within our settlement; from construction to networking services, we create a fluid transfer of ideas and data. Columbiat's chief operation as a banking center drives the operation of our settlement. Versatile construction robotics complete Columbiat in little time through conforming to the shape of the hull. We integrate automations into Columbiat with our personal automation and computing devices. The incorporation of SanoBot makes mundane tasks obsolete for humans. Our redundant yet diverse back up systems keep Columbiat's network secure and run through all possible failures. All our systems work in concert to ensure the security of your investment, Columbiat.

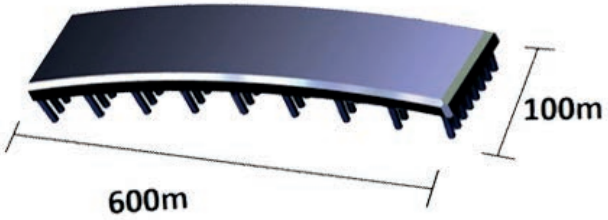
5.1 CONSTRUCTION

Northdonning Heedwell has designed an innovative automated system for construction of Columbiat with the emphasis on fluidity, security, and return on investment. With our use of the versatile construction robotic arms and connectivity of the arms we manufacture Columbiat with swift precision and skill.

5.1.1 CONSTRUCTION

We recognize the immense challenge of constructing Columbiat; we designed robots work as manufacturing centers, building the settlement in layers beginning with the skeleton (ref. image 5.1.3-5.1.1). We design the construction robots specifically with a pair of robotic arms attached to a thick layer of hydrogen rich buckystructure material, RAGuard and titanium vanadium to ensure robotics remain functional during solar flares. Each of the sheets, that we have the arms attached to, can connect to other arms on all sides of the rectangular sheet. Six-hundred arms, three-hundred pairs, make up one manufacturing center. With the connectivity of the construction robot arms we can easily replace and repair broken or damaged robotic pieces (ref. Image 5.1.1). The forward have grips to place anything from poles to tiles in interlocking patterns in place, while the rear arms have welding equipment and sealants as to fix the settlement exterior in place. Each construction robot hinges to another metal sheet of robotic arms totaling two-hundred arms to construct the exterior of the operations core. The arms break into four groups that manufacture the operations core. Once we complete the operations core the construction robots build the elevators which double as our transportation of materials and spokes to our settlement. In addition, the robots connect together into two large manufacturing centers to complete the exterior torus. At this point the two large manufacturing centers split once again into four groups to contour of the shape of the windows. One group of arms begins to construct the top windows of the settlement while the other beings to construct the bottom windows of the settlement. By constructing the settlement in our specifically designated order, the robotics don't require at transportation method as they make the settlement as they go; essentially not having to move and just moving the settlement around them, until the construction of the windows begins.

Image 5.1.1 Construction Robot: With the ability to couple to a number of other construction robots, they can combine to span the width of the settlement's torus to manufacture the settlement in record time.



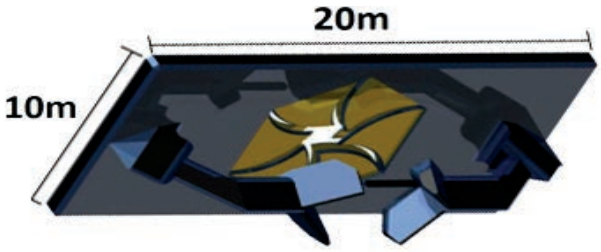


Image 5.1.2 Construction Robotic Arms: Since all construction arms are identical we can replace and repair all robotics with ease of exchanging parts.

5.1.2 TRANSPORTATION

For transportation of goods during the construction process, we designed a large cargo hold that can attach on to the side of the robotic arms. These cargo containers have attachments that multipurpose in attaching to the construction arms and the elevators in order to transport goods around during the construction process. Since we tag all construction equipment with RFID tags, we integrate readers into the cargo containers to sort materials for ease of placement during construction. The container has self modulating robotics on the interior only at the base of the container in order to contour to any shape or size of the equipment inside the container. The self modulating robotics also grants us the ability to move materials through the containers with ease as the self modulating robotics can move with an undulating flow, moving the materials within the cargo bay so that robotic arms can extract the materials and use them in construction.

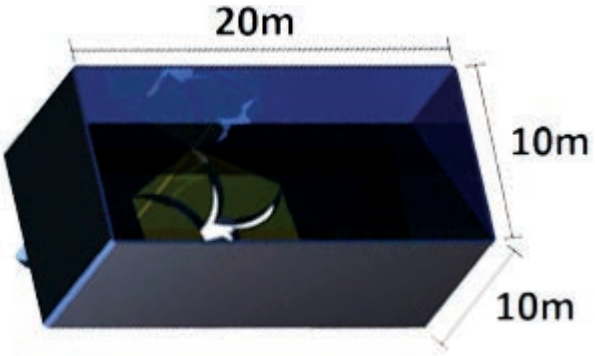


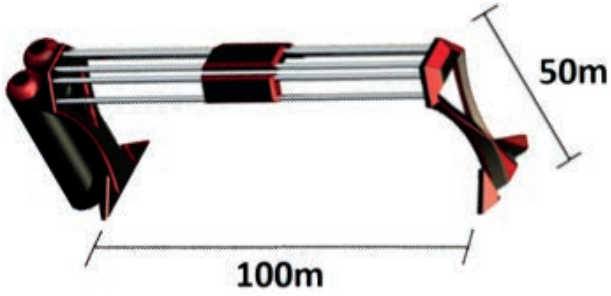
Image 5.1.3 Cargo Container- Since we coat the interior of the containers with self modulating dodecahedrons we can move the construction materials through the cargo bay without the use of a robotic arm.

Once we complete the construction process, we reuse the containers to store cargo from incoming ships and extraneous materials in general.

5.1.3 INTERIOR CONSTRUCTION

Since the interior construction of Columbiat needs to happen the fastest we created a smooth system of contour crafters and photo-polymers to finish internal construction in cost saving time. As a main feature of our settlement, the business canopy requires our utmost attention. By using a light prism to filter light in the direction we desire, our Automated Light-based Construction Sequence (ALCS) uses the sun's UV radiation filtered through a prism into a photo polymer to harder certain features of the polymer. After we harden the desired features of the polymer to create the canopy, we wash the rest of the polymer into collection bins below the canopy structures. We use the rest of the photopolymer to create land features along the base surface of our settlement; we mold the polymer to our desired shape and direct UV light rays towards the polymer to harden it (ref. Section 4.1.3). Once we create the canopy we lift the pieces up using the already in place elevators and arm pieces used to construct the exterior of the settlement to fashion and solidify the canopy pieces in place. After we solidify the canopy, we begin construction of buildings and houses below the canopy using contour crafters (ref. Image 5.1.4). For some buildings and establishments, we carve into the photo polymer using re-purposed exterior finishing robotics.

Image 5.1.4 Contour Crafters: These three-dimensional building printers allow us to move through the interior construction phase with ease.



5.2 MAINTENANCE, EMERGENCY REPAIR, AND SECURITY OF SYSTEMS

After we complete the construction of Columbiat, maintaining integrity of the settlement becomes our greatest priority. Our extensive contingency plans and strict protection of critical data, allow Columbiat to remain secure and operating full capabilities, therefore minimizing the possibility of catastrophic failure.

5.2.1 REPAIR AND MAINTENANCE

We, Northdonning Heedwell designed a cost efficient and streamlined repair system to foresee possible problems in an effort to stop failure before the event. We integrate the sensory system (reference 5.3.4) into the settlement grants us the ability to constantly monitor every aspect of our settlement. On the hull of the settlement we employ stress and strain gauges, heat sensors, sensors for contraction and expansion, pressure gauges, and other miscellaneous sensors. On the interior of the settlement we have similar sensors along with atmosphere sensors, heat sensors, humidity sensors, and others. Our our analysis of our sensor allows us to predicts when materials have a chance of failing. For repair and replacement of materials on the exterior of the settlement we leave a fleet of construction robots which run along the external rails on the settlement, the arms of the robots reach any tile or problem we could need, and the cargo container allows the robots to travel back to prescribed locations for future repairs. We realize the difficulty of attempting to contain the rocket exhaust that our thrusters produce in initiation and maintaining settlement rotation. In order to counteract these contaminants repurposed reconstruction robots with ice collection attachments detain and store in the cargo bin for reuse later in Columbiat. To combat repair and maintenance on the interior of the settlement the SanoBot contains all the necessary materials to repair existing structures (ref. Image 5.3.1). If our sensory system predicts a failure in any structure or device we send SanoBots to repair the potential failure.

5.2.2 CONTINGENCIES

Since it is essential our settlement remains active at the highest capacity, predicting and preventing possible failure becomes our utmost priority. On the settlement, we have many safeguards for events such as fire, hull breach, power failure, communication failure, and air contamination. Our sensory system (reference

ROBOT	FUNCTION	NUMBER
Construction Robots	Settlement Creation + Repair	1200
Safe Houses + ER Walls	Emergency Contingency	100
Holo-CAD	Information Sharing + Coms.	30,000
Work Pods	Work environments	10,000
Servers	Provide Network for settlement	24
Contour crafters	Interior construction	50
Cargo Containers	Holding construction materials	1200
Robot Overhaul Robots	Repairs incoming robots	50

Chart 5.2.1: All our robots work in concert to maintain the integrity of our settlement.

5.3.4) attempts to predict and prevent failures, yet we must prepare for the event of an unlikely failure. If we detect a fire in an area we alert the SanoBot, it promptly arrives on scene, and we raise the humidity level to attempt to keep the fire low. SanoBot projects an oxygen suffocating foam from arms in the robot which stops the flames by cutting off their oxygen supply. In the rare case of a hull breach in our settlement, we seal off the breached area with ER fluid walls. Bucky structure nets let ER fluid to flow over the top side of the net. Once the ER fluid completely covers the net we send an electrical shock through the ER fluid making it rigid and sealing. While the ER nets seal off the damaged area to reduce pressure loss, we send SanoBot to begin repair on the interior spraying a temporary self hardening foam to eliminate atmosphere loss. Simultaneously external construction robots converge on the breach with replacement tiles for longer term repair. We also suck all the water from our bodies of water in Columbiat to ensure the water does not ruin the settlement. Residents evacuate the breached area into insulated and individually pressurized community buildings throughout the communities. These buildings have their own air recirculation, radiation protection, food and water supply, generators, and housing space. In the event of a power failure of our base load reactors, we flip power immediately over to the combination of solar cells, and the "hot back up" thorium reactor differing from the original uranium reactor. All of our back up power sources have geographic security as we locate them in different places in the settlement. The redundant, yet diverse back up systems ensure the settlement runs at full capacity in the event of power failure. In case of a communication failure with earth, several steps are in place. First, we reset systems in case of a needed reset. We save all data attempting to communicate to earth, and relay it over to the back up, yet secure, UHF radio wave system. For internal communication breakdown we also utilize the UHF radio waves instead of Li-Fi connectivity to ensure a secure connection and transfer of data. In the unlikely event of air contamination we evacuate all people to the safe houses, and begin the filtration of air particles along with introducing new atmosphere.

5.2.3 FLARE PROTECTION

We prize ourselves in our robots ability to function in solar flare activity. We coat all external robotics in a hydrogen rich bucky structure layer, with an underlying of RAGuard material. On top all the layers coat robotics in a layer of aluminum foil to reflect light and heat away from robotic components. These two layers create an impregnable system to anything from micrometeorites to radiation from solar flares. For temperature insulation, we apply a layer of aerogel, this creates a light and cost effective layer to protect the components of the robotics. Each robot grounds to the settlement, so the settlement's hull absorbs the power of the solar flare.

5.2.4 ACCESS OF CRITICAL INFORMATION

To access authorized areas, personnel go through noninvasive steps to gain access to critical information or control of robots. The access levels range depending on the permission granted to the person (ref. Chart 5.2.2). The first layer of security,a DNA analysis, heart beat monitor, blood pressure sensor, all take from Holo-CAD. With the first level of security residence can gain immediate access to entry level information. The second layer of security we incorporate facial vein mapping, which analyzes the veins in your face, which we have found the veins are unique to each person; this level gains residents access to things like housing designs. To gain access to extremely critical data,the third layer combines analyses of a person's ear lobe and retina scanning. We can perform all security checks at a distance creating a streamlined system concerning access to critical data. We use the levels to ensure the identity of the person in question. Although people have to travel through a certain walk way, people can travel at any velocity and any amount of people as we can perform security measures at a distance. In the unlikely event that a person attempts to break into certain facilities our sensory system alerts the SanoBots which then swarm the facilities to detain the criminal through the use of tranquilizer darts. In the even more unlikely event that a person breaks through the system and begins to destroy other facilities, the computer shuts down the system, with manual system shutdown buttons placed in other critical facilities. Our security systems gives us the confidence that critical

LEVEL OF SECURITY	SECURITY MEASURES	ACCESS GRANTED TO...
LEVEL 1	DNA scanning, heat sensor, and heart beat monitor from Holo-CAD	To personal devices, interactive housing, and work spaces.
LEVEL 2	Along with the previous level, facial vein mapping	Housing designs, general robotics in settlement
LEVEL 3	On top of the previous level, vein ear mapping, and retina scanner (all at a distance)	Critical information, banking accounts, settlement stability, space elevator operations.

Chart 5.2.2: With each new level of security comes a high level of physical security and repercussions for breaking the rules.

data remains a privilege for only cleared personnel.

5.3 AUTOMATIONS FOR ENHANCED LIVABILITY

Hollow, yet internally reflective fiber optic networking allow Columbiat to transfer data at the fastest speeds available today. Our networking creates an impermeable system through two different networking systems to separate critical data physically and digitally. Levels of encryption, server bouncing, and backup modules ensure Columbiat's digital integrity.

5.3.1 AUTOMATION TO ENHANCE LIVABILITY

Our all new Holo-CAD (Holographic communicating advanced device) creates a completely immersive computing experience along with streamlining all operations on the settlement (ref. 5.3.1). The Holo-CAD, a button-like device we build into the user's clothing, projects a holographic display that ionizes the water molecules in the air for three dimensional immersive display. Each Holo-CAD takes in voice commands, recognizes the specific user through voice recognition, and immediately gives the user the correct amount of access we prescribe. The Holo-CAD can control personal automations within the home and the workspace, giving personal control and accessibility virtually anywhere in our settlement. We embedded sensors into the entire settlement to create a streamlined environment. We integrated sensors into the walls of housing that double as stress gauges, heat gauges, and tracking the amount of people who enter the building, with and without their Holo-CAD's, with their Holo-CAD we can decide to that person's name and how healthy the appear, sensors appear in the exterior of the hull with heat and stress gauges, we also integrate sensors into the floors of all buildings tracking data of people's gait and how heavy their step comes down. All the sensors send all the data they receive back to the mainframe computer, which then decodes the information, and now if someone begins to show signs of sickness we can send medication and or help before the person even knows they have fallen ill. The Holo-CAD monitors users heart rate, blood pressure, oxygen levels, and other minor conditions so in the rare case of an emergency, the SanoBot quickly responds and conducts cursory medical procedures, we alert doctor immediately in case the resident requires additional need, doctor comes to help the resident. We can prevent fire and predict when exterior hull panels may, in the unlikely event, fail and replace and repair the existing ones, before the event of failure. We can do this through interpreting the data the sensors collect, if heat levels rise significantly in a certain area near a building we can send help and increase the humidity in the area

Image 5.3.1 Holo-CAD Immersive three-dimensional holographic technology seamlessly integrates residents into our Settlement.

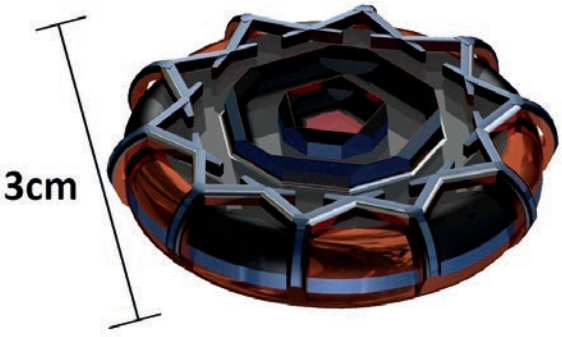
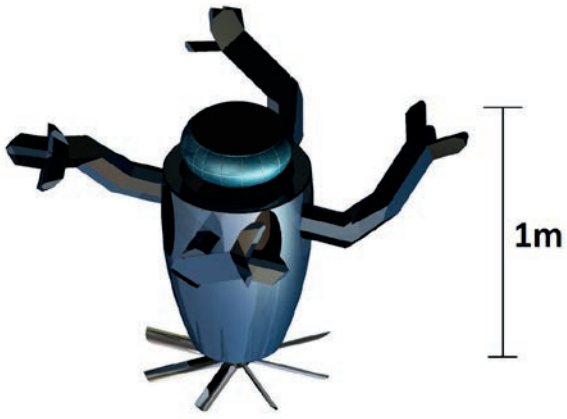


Image 5.3.2 SanoBot Our all purpose SanoBot does everything from simply movement of materials to first response to medical situations.

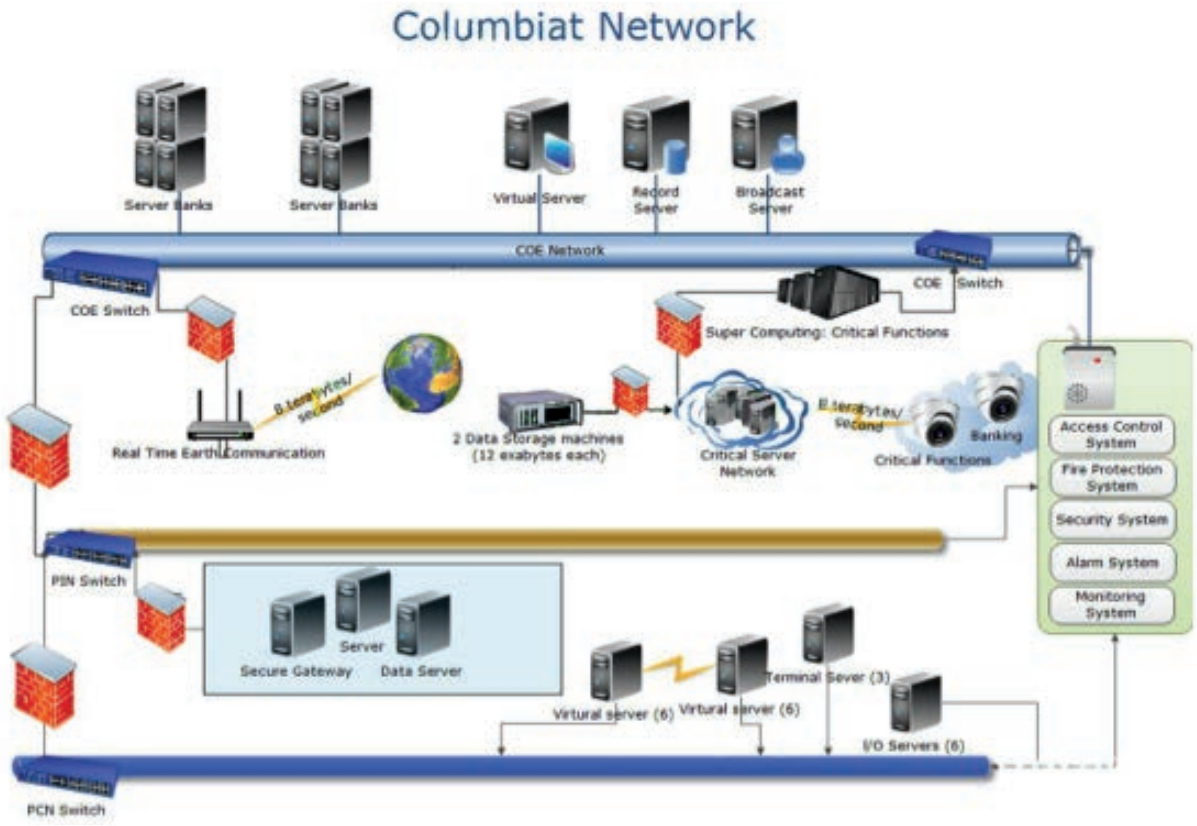


to help prevent fire, if the stress gauges show high strain and stress, and predict statistically likely stress fractures, we can replace those exterior tiles more often than others. The streamlined sensory system within the settlement predicts and brings attention to possible concerns calling for action, which in turn creates a more secure and higher performing settlement (ref. Chart 5.2.1).

5.3.2 PRODUCTIVITY IN THE WORKPLACE

For more efficiency and more productivity in the workplace, especially in the concentrated banking environment, we integrated holographic technology with BCI (Brain Computer Interface). We designed dry electrodes located above the user's head, but not invasive, to pick up brain waves giving the user the ability to control a completely immersive holographic, and three dimensional display, with the power of thought. Not only does the technology make for an inexpensive solution, but also increases the rate at which workers can produce. The electrodes in the form of a small glass piece that hovers just above the users head. Workers can transfer information from their BCI environment straight to their Holo-CAD to retain work outside of the work place.

Chart 5.3.1 Networking diagram: Through the use of virtual servers and cloud like computing we ensure security while simultaneously keeping the entire settlement connected.



5.3.3 CONVENIENCE IN RESIDENCES

To ensure convenience for residences in Columbiat, we designed an interactive system of distribution, cleaning, and repair throughout the settlement. We locate store around the settlement and near residential areas where residents can order goods from and have Sano-Bot deliver the goods with in seconds, thus reducing the time without goods or services. We located automated dishwashing and clothing washing units in the bottom of each residence's housing. For maintaining a clean settlement and housing units, we use electro dynamic shielding to move dust to the edges of rooms where more pneumatic tubing which collects the dust for reuse. To serve as a regular repair and maintenance robot we created SanoBot (ref. Image 5.3.2), the circular shape stores supplies and hover fans control movement. Two omni-directional arms coupled with autofy robotics the ends of the arms complete any task required. The SanoBot connects to the Holo-CAD creating ease of commands from residents, so that they can control the robots as needed.

5.3.4 PROTECTION OF PERSONAL DATA

Here at Northdonning Heedwell our innovative system ensures that your data stays safe and private. We equip all residents with their own Holo-CAD device in order to connect to servers all around the settlement. Replacing fingerprinting as a safer and more effective method of identification since each device can read

its owners DNA by analyzing skin cells. In addition to analyzing DNA, each Holo-CAD contains a heat sensor, heartbeat sensor, blood pressure scanner, to monitor body activity (Ref. Section 5.2). Through analyzing users DNA, we ensure the utmost security when accessing personal data, the device also ensures the security of various locations around the settlement depending on age or rank, keeping personal data safe.

5.3.5 NETWORKING

Our networking designs form the most secure system through redundancy and diversity, but more importantly; the integrity of your investments (ref. Chart 5.3.1-5.3.2). In order to keep critical operations and data safe we have three networking systems, one networking system controls only the critical data, one system deal just with storage and integration of data, while other controls general operations and the community functions. The separate systems create physical as well as digital safety so no one person could breach one network from the other.

Our first network the, CEO (Corporate Operating Environment) network, controls all the critical functions. The second network, PIN(Process Information Network), our data storage and integration into the system. The final network, PCN (Process Control Network), controls the general network around Columbiat. Our main servers receive data, analyze and transfer the data to the appropriate recipient. We connect the servers through fiber optic cables, thus providing real time communication with speeds up to 73 terabytes per second for critical operations due to new optical fibers permitting us to transfer data faster than ever before. New optic fiber designs enables extremely low loss of data over very long distances, unlike normal optical fibers made with silica glass, which causes light to travels a full 31% slower, whereas this new design, made up of mostly air, can transfer data at 99.7% the speed of light. We provide many servers to distribute a cloud-like computing network , the servers simultaneously collect data to evaluate (especially in the CEO, critical data, network as the sensory system of the settlement connects to this network). Servers provide expedient data connections with up to eight terabytes of data transfer per second, the entire settlement has the ability to run off of one server, bandwidth decreases in the unlikely event that Columbiat loses a server. With all the servers we can space the servers evenly around the settlement gaining geographic security. The servers talk to smaller robots and other systems through Li-Fi and a backup of UHF radio waves (Ultra High Frequency). For additional security, we bounce data off many different servers before reaching the mainframe, servers, and personal computing devices, creating a virtually impregnable system against hackers. We also equip every server with different levels of encryption starting from basic levels up to three to five different types of encryption for critical data, which the encryption keys change every twenty-four hours. The rotating encryption greatly reduces the likelihood that a hacker could read the encrypted data. For data storage on the critical data network we have computers, which constantly update information and hold up to twelve exabytes of data each. For real time communication to and from earth and the space elevator to our settlement, we go through the critical network through data transfer from lasers All of these systems working in unison guarantee our residents stay connected to their world and their personal data remain safe during any incident.

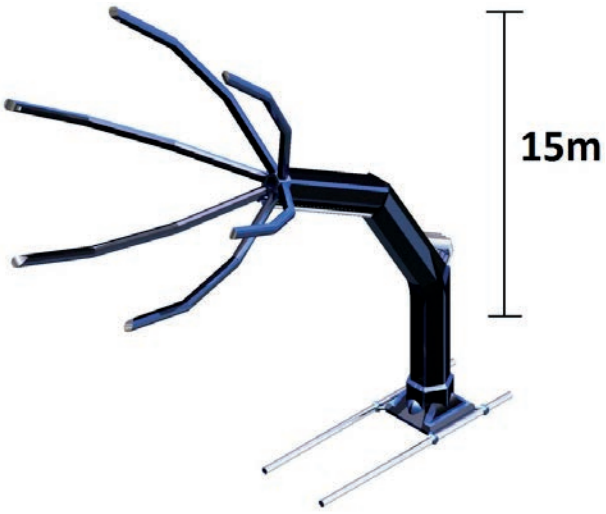
5.4 LOADING AND UNLOADING INTERFACE

Columbiat graces business executives with stellar technology and convenience. Docking Interface Systems Controls standardizes docking for Columbiat and gifts our residences with lightening fast cargo transfer time, thus enhancing profitability for all. Strategically placed DISCs abundant throughout our settlement create a fluent movement and flow of all types of cargo.

5.4.1 AUTOMATED CARGO LOADING AND UNLOADING

We at Northdonning Heedwell designed the highly sophisticated Docking Interface Systems Control (DISC) (ref. Image 5.4.1), which facilitates our primarily loading and unloading interface between cargo of all shapes and sizes. Since Columbiat expediates a plethora of cargo, our DISCs eliminate the obstacle of differentiated cargo transportation and standardizes cargo movement about Columbiat. Six telescoping arms, six meters in length, attach to a shaft with two fully rotational joints to give full flexibility. These six

Image 5.4.1 Unloading Cargo Arm With extendable appendages we can unload cargo of any size or shape.

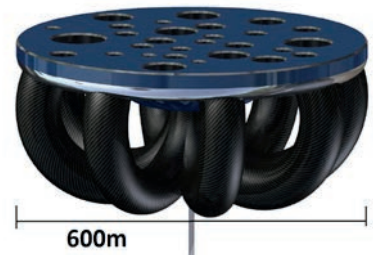


arms secure our cargo by attaching in a hexagonal pattern with two arms on top, two on bottom, and one on each side. Our method of attachment clamps onto the cargo without accident gives the DISC fully rotational ability. While fully rotational, our DISCs also extend to a maximum of 45 meters and collapses to a small 5 meters. The mechanism further attaches to a circular joint in the floor to locomate about the docking area. An RFID reader gifts our DISC with the ability to read information rapidly and without error. After the DISC reads the RFID tag, it moves the cargo to the designated location using rotating lasers to plan out an optimal path. If needed DISC's transport cargo to transport pads on rails, to take to alternative storage and repair facilities. For loading and unloading of material for ships larger than Columbiat docked in space near Columbiat, we utilize larger cargo tug ships to effectively transfer materials to and from space vehicle.

5.4.2 TRANSPORT TO AND FROM REPAIR AND OVERHAUL FACILITIES

We created the Transpad robot transport system to transport robots requiring maintenance and overhaul to and from the repair and overhaul facilities explicitly from docking areas (ref. Image 5.5.3). The pad consists a circular platform, with a 5m radius. Grasping the robots, and keeping them stationary, four locking arms hold the robots in place during movement. The transport pad travels over a thin layer of liquid teflon over a central track for minimal friction and increased resilience. Liquid teflon creates a barrier, protecting the rail from dust damage and anything creating unwanted friction on the rail. Constant contact on the track itself allows for ease of movement as well as providing control over the moving Transpads. Two electric motors propel the transpad down the rail at a relatively slow speed for the security of the cargo. The power for the motor comes from the rail itself, saving on battery weight and unnecessary connections. In the occasion that one electric motor fails, the other can still provide movement until repairs can be completed.

Image 5.4.3 Space Transfer Station- With ease of transfer at the end of our space cable we can gross the most profit from near earth space transfer.



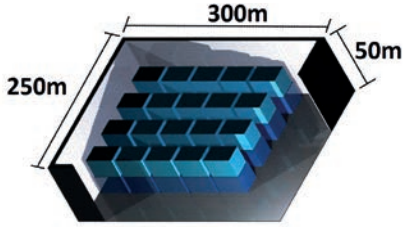
5.4.3 WAREHOUSES FOR TEMPORARY STORAGE OF GOODS AND BULK MATERIAL AND INVENTORY MANAGEMENT

Every business requires enormous amounts of inventory to fully operate without incident we at Northdonning Heedwell recognize this large challenge. Products stream out of a company while income flows back in. We expect nothing less for business executives filtering in and out of Columbiat. The flow of business executives, among numerous location advantages, attracts fluid business transactions and profitability in many aspects. Our temporary storage facility houses an additional four DISCs to organize the cargo, much like a shipping freight yard has cranes to move freight. These DISCs place the highest demand cargo on top while they place lower demand cargo lower according to need for access. Products quickly transfer from and to convenient warehouses located directly underneath our docking ports (ref. Section 3.1). Rails that run along the temporary storage facility electrify the ER fluid ports after the additional DISCs set the cargo in the correct location locking them in place to limit wobble and tilt. When a ship requires cargo containers located underneath other containers, two or more DISCs work in tandem to unearth the requested container and replace the containers after the storage area clears.

5.4.3 ACCOMMODATIONS FOR ALL NEAR-EARTH VEHICLE TRANSFER

Northdonning Heedwell proposes that we utilize the extension of the space cable beyond our settlement reaching close the earth's longer range orbital paths (ref. Image 5.4.2). At the end of the cable we propose a space vehicle transfer pad, that permits near earth space vehicles to transfer from vehicles to travel back into the earth's atmosphere, and to vehicles that take people further into the depths of space. The pad serves as a gateway to the rest of the universe as it can hold up to 30 ships to dock to the pad with tunnels connecting docks to allow for ease of transfer of people and materials. Connecting the docks together when ships dock people can traverse from one to ship to the other without going into the harsh space environment and no pressure. We also propose to locate minor repair

Image 5.4.2 Cargo Hold We streamline cargo organization through putting high priority goods with easiest access.



facilities in tubing along the on the underside of the Docking pad, for extensive repairs ships must fly down to dock with Columbiat itself. Through ease of transfer of ships we revolutionize the space exploration domain, allowing for reduction of materials required to come off of earth.

5.5 INCOMING REPAIR FACILITIES

Visiting ships bring robots requiring maintenance and overhaul; our automated facilities smoothly provide all repairs to each robot in need. First, transporting the robot to the repair facilities, multiple systems in place ensure no dust or contaminants make their way inside the settlement. Once in the repair facilities, we repair and overhaul each robot using unique and progressive equipment perfectly suited for the job.

5.5.1 ALLOCATED SPACE FOR ROBOT REPAIR AND CLEANING FACILITIES

In the operations core, we situate the robot overhaul facilities relatively close to the docking areas. The juxtaposition of docking and overhaul facilities creates shorter transport time, and a quicker turnover time for robots away for repair. Robot maintenance facilities consists of a 125m square, with an 85m square removes from one corner, creating an "L" shaped room. The room has a height of 15m allowing ample room for robot overhaul and repair (ref. Image 5.5.1). Within this room, automated systems clean, repair, and overhaul any robots that require repairs. We locate repair facilities in zero G for ease of manipulation and suspension. The entire room conforms to the specific robot, in essence small pillars that have the ability to extend and retract over all surfaces. The conforming room creates any feature or platform to hold, manipulate, or aid any robot in the room, thus streamlining the repair process for any robot of any size. The effectiveness of the repair facilities reduces costs for damaged robotics.

5.5.2 DUST MITIGATION AND CONTAINMENT SYSTEMS

We at Northdonning Heedwell designed the pathway to and from the facilities, as well as the maintenance facilities in a slight vacuum to help prevent the spread of any contaminants that may be present on the robots. The Filters remove all particulates from the air through the use of reusable wire-mesh filters on the air intakes (ref. Image 5.5.2). This allows for constant contaminant removal with little recourse usage, making a cleaner and more functional environment. Periodically along the path to the overhaul facilities, and before entering the facilities, the robots go through several airlocks for the removal of all dust and contaminants. At each airlock, weighted electric motors attach to the pad and vibrate the pad and the robot at a very high frequency. The process shakes off all the dust and contaminants that are on the robot. In each airlock we also wave electromagnetic wands over robots collecting magnetized dust. The airlock contains the dust for disposal.

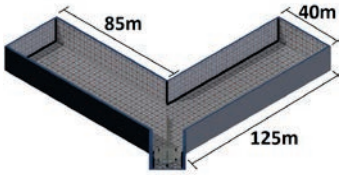


Image 5.5.1 Robot repair facilities The facilities move to fit the certain robot for repair to ensure the most effective repair.

5.5.3 ROBOT REPAIR AND OVERHAUL SYSTEMS

Located near the docking spaces we use similar technology as the adventure bubbles, where the coupling of BCI and three-dimensional holographic display can connect to long range robotic systems. From this technology, we can virtually fix robotics millions of miles away on asteroids or ships. For robots that we cannot fix from long range, at Columbiat we have conforming repair facilities. The facility combines already determined faults and on ground sensory systems to perform all necessary repairs. Arm systems and other system move about the entire room with no human interference to conform to the shape of the equipment in the room. Pneumatic arm systems with three appendages perform all repairs necessary in a timely manner. The pneumatic arms have four joints and an Omni-directional head with an all-purpose attachment made from conforming robotics as well as standard tool heads, thus allowing for any repairs at any angle. Northdonning Heedwell reuses the construction robot arms that we used during the construction phase to save materials, resources, and money.

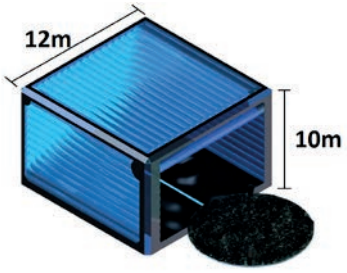
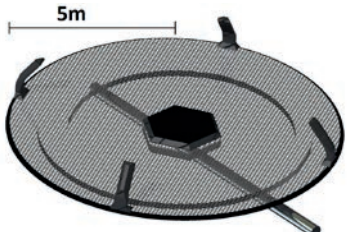


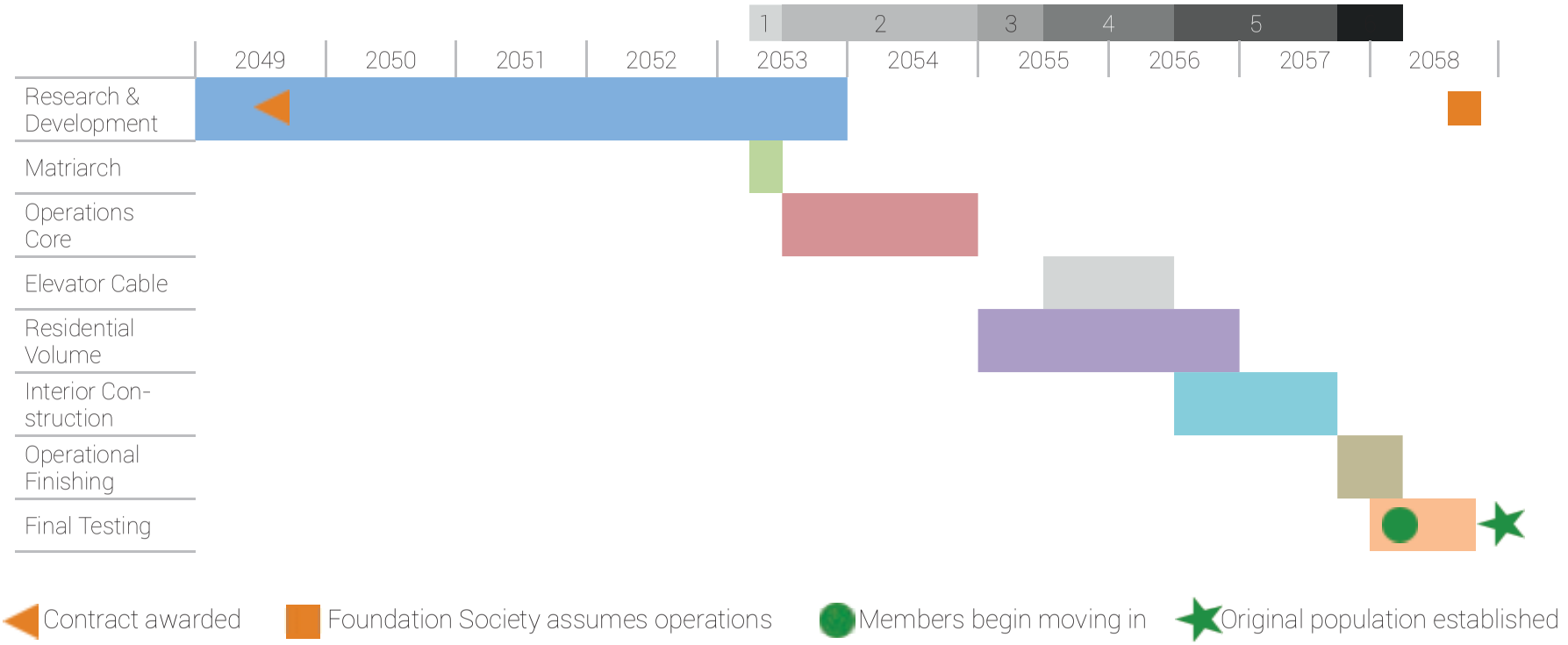
Image 5.5.2 Dust mitigation Our dust mitigation air locks along the transportation pathway allow for reduced transport time.

Image5.4.3 Trans-pad The trans-pad's design of expanded titanium vanadium allows it to shed dust, while maintaining unhindered structural integrity.



6.0 SCHEDULE AND COST

SCHEDULE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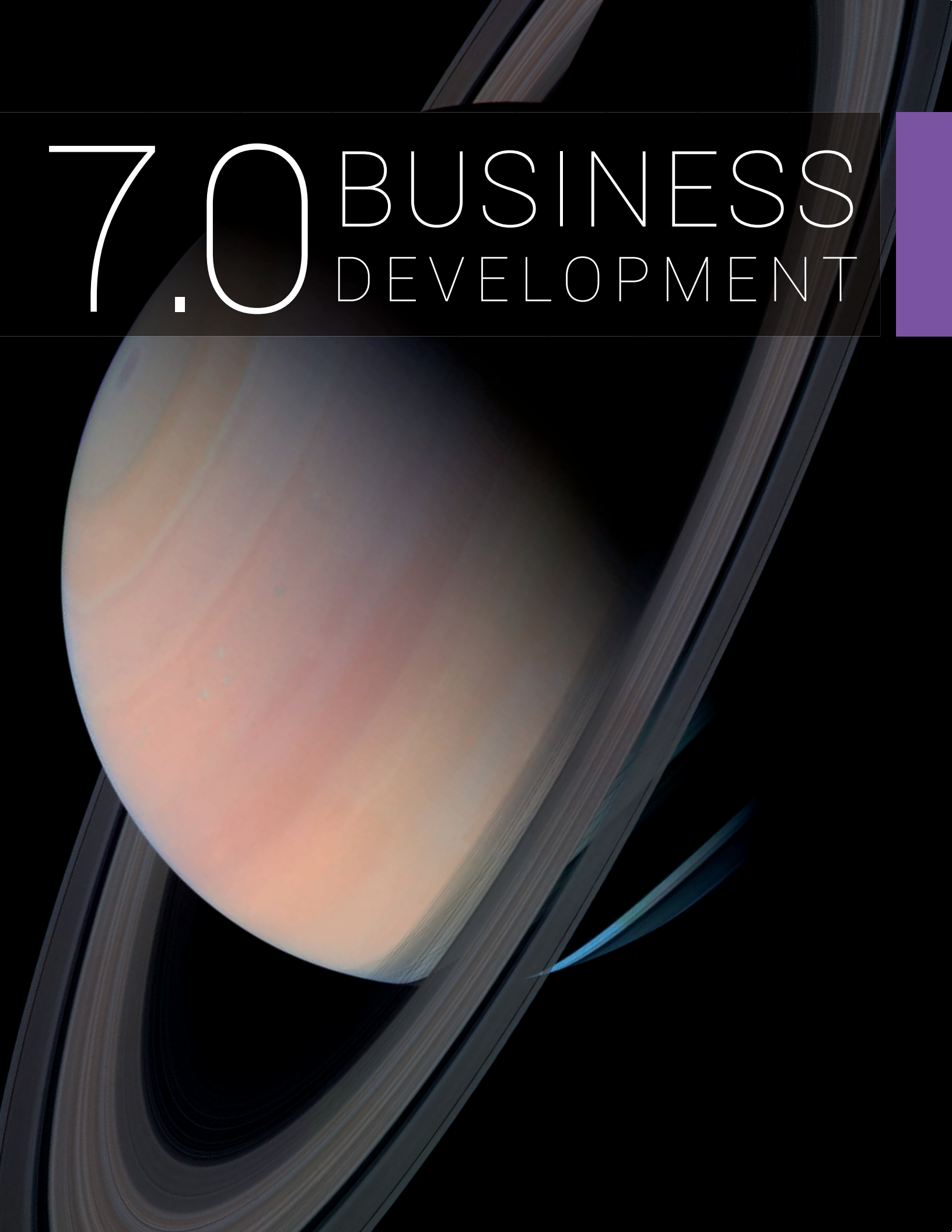
Research & Development
Matriarch
Operations Core
Elevator Cable
Residential Volume
Interior Construction
Operational Finishing
Final Testing
Contract awarded
Foundation Society assumes operations
Members begin moving in
Original population established

COST

PHASE	ITEMS	COST OF ITEM	EMPLOYEES	COST OF PHASE
INITIAL RESEARCH	Humans	$6,000,000,000	4000	
	Materials	$23,000,000,000	N/A	$29,000,000,000
MATRIARCH				
	Robots	$1,798,000,000,000	N/A	
	Materials	$398,000,000,000	N/A	
	Humans	$4,000,000,000	1900	$2,200,000,000,000
DISK				
	Construction Equipment	$139,000,000,000	N/A	
	Materials	$630,000,000,000	N/A	
	Humans	$4,000,000,000	1900	$771,000,000,000
HULL CONSTRUCTION				
	Machinery	$112,000,000,000	N/A	
	Materials	$876,000,000,000	N/A	
	Humans	$3,800,000,000	1700	$991,800,000,000
INTERNAL STRUCTURES				
	Machinery	$110,000,000,000	N/A	
	Materials	$920,000,000,000	N/A	
	Humans	$3,000,000,000	1000	$1,033,000,000,000
BUSINESS CANOPY				
	Machinery	$106,000,000,000	N/A	
	Materials	$586,000,000,000	N/A	
	Humans	$2,600,000,000	800	$694,600,000,000
PORT FACILITIES				
	Machinery	$397,000,000,000	N/A	
	Propulsion	$800,000,000,000	N/A	
	Materials	$1,378,000,000,000	N/A	
	Workers	$3,000,900,000	1200	$2,578,000,900,000
HULL SEALING				
	Machinery	$5,000,000,000	N/A	
	Materials	$775,000,000	N/A	
	Workers	$123,000,000	200	$5,898,000,000

TOTAL COST:	$8,302,989,000,000

7.0 BUSINESS DEVELOPMENT



BUSINESS DEVELOPMENT

Northdonning Headwell strives to create a fluid and secure platform for interplanetary trade and extraterrestrial banking endeavors. No settlement will be more lucrative, more magnificent, or more versatile in ability to handle cargo and goods from our current and future settlements. We achieve this fluidity in our docking and cargo handling, quickening handling speeds and allowing timely import and export; this security in our business and financial management through state of the art computer syfers and intricate security procedures; and this lucrativity in our port duties and business base. You will save money too, by wisely taking advantage of in situ resources like Silicon Buckystructure and by setting up infrastructure for patent lawyers in space technology research and development facilities.

7.1 TRANSPORTATION NODE AND PORT

No existing settlements parallel our ability to handle resident and cargo flux. Our fluid docking and cargo system as well as our flexible and housing and entertainment abilities allow us to handle overflow personal and freight with ease.

7.1.1 DOCKING AND WAREHOUSING

Located in the Ops Core, our docking system allows us to handle cargo of any quantity place or size (Ref. Section 2.4). Our transportation and storage system organizes our cargo to allow easy access at the pertinent times and flexibility in shipping schedule (Ref. Section 5.4.1 and 5.5). Do to RFID tagging, inventory organization and automated fulfillment systems It takes less than five minutes for freight containers from anywhere in our warehouse to load onto a docked ship, this swift transit allows us to handle more ships a day decreasing our cost margin.

7.1.2 TERMINAL FACILITIES

Our terminal Facility welcomes our passengers to Columbiat in comfort and style (Ref. Section 5.4.1 and 5.5). Passengers awaiting connections can reside in our welcome center until they can take one of the three passageways to the elevator spokes, port docking, or elevator docking centers (Ref. Section 4.4.1). We support communication through the Holo-Cad in terminal facilities so that business people can get work done while waiting. Furthermore we provide restaurants and vendor boutiques as well as spas and bars so travelers can interact with new and exotic friends.

7.1.3 RECREATIONAL ACTIVITIES

Here on the Columbiat we offer a very wide variety of activities for visitors (Ref. Section 4.1.2). Because of our unique position in space we offer water based experiences, dining options, and zero G games only available to those who visit our settlement and thus encouraging tourism and profit not only for our recreational facilities but every business on our settlement (Ref. Section 4.4).

7.1.4 OVERFLOW TEMPORARY VISITORS

We designed adjustable suites that can split into multiple private rooms in our 12 hotels to allow for up to 5000 temporary visitors during times of high travel the initiation of operations (Ref. Section 4.4.2). We handle equipment for lunar housing and construction in our cargo processing facility as well as manufacture lunar construction materials in our buckystructure manufacturing facilities.

7.2 COMMERCE AND FINANCIAL CENTER

To entice future business we designed our facilities above the standard bar by accommodating fluid transport of ideas and resources while maintaining high security in our cyber and physical domains.

7.2.1 OFFICE FACILITIES

At Northdonning Heedwell, our business focuses primarily on efficiency and productivity. We created buildings to house all business types in a unified design language that we centered around organic "bulbs". Each design is adjustable for each companies need with moving and reconfigurable walls to allow open work spaces and collaborative of the privacy of individual offices. We provide eight, 150 person buildings at 18300 square meters. Each 150 person office building is made of three "bulbs" and extends above and below the business canopy with a 7800 square meter footprint at the level of the business canopy and a level of 5200 square meters above and below the business canopy. Sixteen other facilities, also composed of three levels, are 5200 square meters at the canopy and 3500 square meters on the two other levels. These hold 100 persons and are made of two "bulbs". We composed thirty businesses of one, two-story "bulb" that are 7000 square meters total. Sixty facilities contain 1500 square meters and accommodate 5 people. We made these of one, one-story "bulb". These facilities are both aesthetically pleasing, space efficient, and psychologically pleasing for business employees onboard Columbiat.

7.2.2 BANKING

Columbiat's banking facilities provide the ability for seamless transaction while maintaining convenience for our customers. Each residents' Holo-CAD device monitors simple banking matters.. Additionally, four banking centers located on the business canopy enable residents to meet with financial professionals to examine and manage on their portfolios in depth. From our unique position in space businesses tend to have and

trade assets especially having to do with emerging tech, rare elements, and rocket propulsion. Columbiat's corner of the market in this field lays the groundwork for a space industry stock exchange centered here on Columbiat, enabling venture capital endeavors right on the location of business.

7.2.3 FOUNDATION SOCIETY HEADQUARTERS

The new Foundation Society headquarters reflects the interstellar reach and innovation that The Foundation Society represents (ref. Image 7.2.1). Reflected through the commonality to the other business structures, we designed the headquarters structure as four "bulbs" that reach three floors above and three below the business canopy. This "bulb" structure allows the modularization of individual sections of the foundation society company along with the capacity for an open floor plan to facilitate the active transfer of ideas between foundation society members. This headquarters contains 6300 square meters on the two floors closest to the business canopy. The second floor both up and down contain 4200 square meters and the top and bottom floors contain 2100 square meters for a total of 25000 square meters of space for the 300 Foundation Society employees, allowing optimum space for any endeavor at which you may embark.

7.2.1 Our elegant design of Foundation Society Headquarters parallels the structure of our other business offices while standing as the crown jewel of our settlement

7.2.4 COMPUTING CENTERS

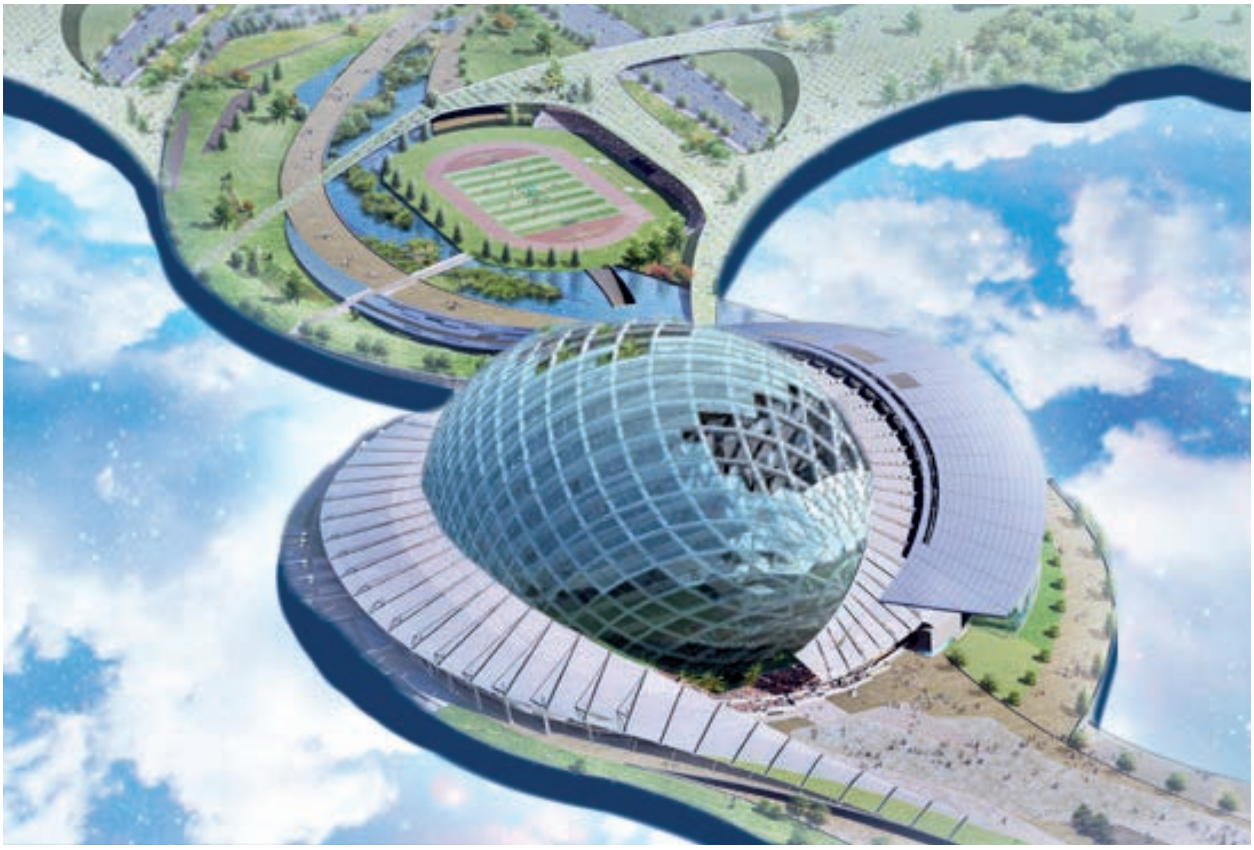
Columbiat's communication systems allow fast and state of the art interconnectivity of our businesses. Companies communicate through LIFI backed up by UHF in case of system failure (Section 4.2.6). Our high speed system enables companies to seamlessly transfer data within the settlement. In protecting intellectual property and company strategies our networking design keeps business data secure and able to adapt to new and ever-changing threats (Section 5.3.5).

7.3 SPACE ELEVATOR OPERATIONS CENTER

Our Space Elevator operations center creates a comfortable, safe atmosphere with omnidirectional views of ribbon production. The display systems also increases workplace fluidity and productivity.

7.3.1 ELEVATOR RIBBON CONSTRUCTION CONTROL CENTER

The Columbiat Elevator Ribbon Synthesizer contains a control center that provides a panoramic view of both the synthesizer and the ribbon, as well as interactive and intuitive control systems for the construction crew. The viewing system provides panoramic views of



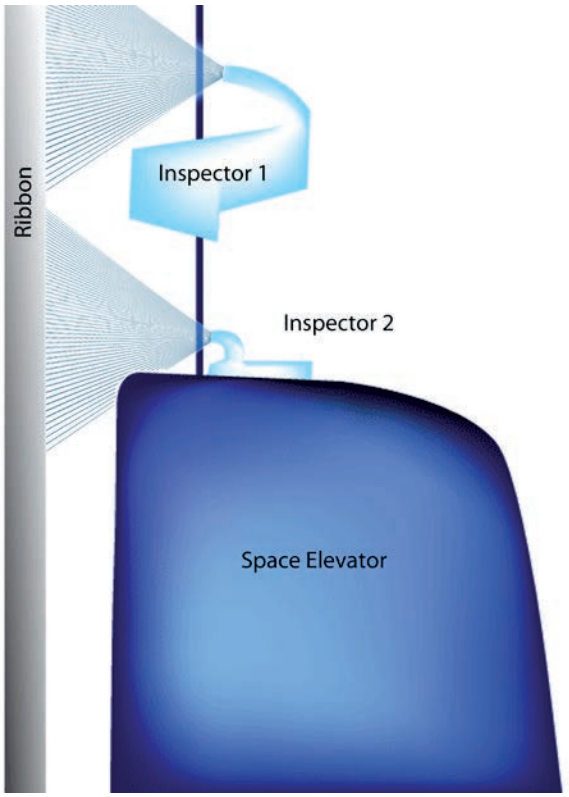
the extrusion mechanism. These windows have an ultra-thin nanocellulose display coat,which makes the microgravity production easier than corning glass.

The Nanocellulose Coating provides an interactive technological display that gives essential information to the personnel inside the control center. If sensor systems detect a failure in the production system, the display directly illuminates the area in question outside on the synthesizer, which maintains crew vigilance. This system the All life support systems have several backup systems and the cab houses a full buckystructure emergency medical system. In the case of synthesizer failure, the crew module jettisons from the synthesizer and proceeds to fly fully automated to the construction matriarch.

7.3.2 CAMERAS AND INSPECTION CRAWLERS

As the center of the settlement and our lifeline to the lunar surface, maintaining the integrity of the Bucky-Structure ribbon is a paramount concern. Our inspection robotics system will be an efficient unified repair system that integrates inspection systems and elevator systems. Inspection crawlers will piggyback elevator systems for constant ribbon vigilance. Crawlers will have a system of 30 micro-stalk cameras mounted on individual servos (ref. Image 7.3.1). This close inspection information is combined with a large camera to ensure the entire ribbon is fully inspected. When an imperfection is detected by the inspectors sensory systems, the crawler will detach and operate on the damaged portion. When the problem is fixed, the repair crawler will go dormant until an elevator reconnects with the crawler. When connected to the elevator the Crawler's battery systems are charged until next detachment. The robot has a very specialized Buckystructure attachment system that is designed specifically to grip the ribbon. The outside of the crawler has a hard nanocellulose outer core, and a layer of nanocellulose gel inside of that. The gel will both keep the robots electronics and hydraulics at optimum operating temperature, but also absorb impacts, and soak up vehicle fluids to prevent contamination in case of failure.

Image 7.3.1 Inspection Crawlers use multiple-sensor systems that drastically decrease safety hazards through constant vigilance and maintenance



7.3.3 FACILITIES FOR AND DEPLOYMENT OF MAINTENANCE AND REPAIR SYSTEMS

At Northdonning Heedwell we focus on efficient, clean, storage systems and high speed deployment of needed emergency service and repair systems. Upon arrival, the piece of machinery is partially enveloped in a multiphase traveling electric field fabric by a robotic appendage system. An electric current is run through the fabric, causing the dust and other contaminants to rise into the air. Then a suction system collects the contaminants. The propellant is ejected outside the settlement, while the silicate-rich lunar dust will be used to produce bucky structure. Once thoroughly dust free, the robot type will be identified, and it will be carried to a separate facility containing only robots like itself. Once inside the containment facility, the robot will be put into a shelving system, which will run a full diagnostics check. If there is a robot in need of repair, it's "chubby" will contain tools made specifically to service that model of robot. This system enables the entire fleet of robots to be neatly stored, and also allows for many robots to receive maintenance at one time, drastically reducing turnaround times of broken robots.

7.3.4 MONITORING PASSENGER COMFORT AND ACTIVITY

In Columbiat space elevator systems, we are always working to improve passenger comfort and overall experience. To monitor major vital signs, the elevator systems will use a camera-based, light sensitive monitoring system. This monitors changes in skin reflection and monitors heart rate, breathing rate, and arterial dilation. These will be distributed across the ship along with passive pheromone sensors. These sensors detect pheromones that are given of as a response to fear, motion sickness, or comfort. When an individual enters his or her own cabin, a mood modification system displays the appropriate lighting, smell and noise.

Appx A OPERATIONAL SCENARIO

OPERATIONAL SCENARIO

Camera begins panning out on the business canopy. The metallic business centers gently glisten as the earth rises through the window on the right. Camera zooms into the organic domes of the Foundation Society Headquarters. The camera zooms through glass windows into a luxurious office. A businessman is lounging at his desk in a black chair.

Businessman: When I was a child, I would look up into the night sky and watch as the ISS flew overhead; now, almost 50 years later I look up into the night sky and see the earth rising from the stars. In Columbiat, we provide more than just a beautiful living space; we readily support the creation of lucrative business opportunities. Columbiat provides a safe, comfortable home for our families and investments, serving as an oasis for entrepreneurs to endeavor and innovate within booming markets.

The camera pans through the business canopy, over businesses and parks. Businessmen and -women work in offices, eat in local restaurants and walk through the park spaces.

Businessman: The raised Business Canopy creates a workspace untarnished by the stresses of daily life. When I ride the elevator located in the center of my community, I can separate my business life and my family life, so I can enjoy and focus on each individually. The raised Business Canopy is located at .8 g. I love the spring in my step from the lower gravity, and I value the lowered stresses on my body at work. Whenever on the Canopy, my colleagues and I enjoy the relaxing effects that have proven beneficial to my health.

The manicured parks are perfect to clear my head between meetings, and unlike the parks in the residential areas, these spaces are quieter and more calming. The elevators are located in every community, making it quick and easy to go home for lunch or meet for more casual events. The Business Canopy has a variety of restaurants and take-out spots too, all of which produce delicious food without taking excessive time out of my day. All of the food is grown and processed on Columbiat.

I have grown so accustomed to living on Columbiat; living with ever-present technology seems like second nature. Every office has interactive touch screens on the tables or walls, customizing themselves to the users' personal needs. The BCI (Brain Computer Interface) technology reduces the amount of time it takes to prepare elaborate presentations and charts to almost nothing.

Columbiat creates an environment in which all aspects of life come together, in which humans and technology work in a productive unity.

The camera captures a panorama of the vast windows with Earth in its view, then zooms in on mother meanders along a light white path holding the hand of her seven-year-old son and a baby in her other arm. To their left a clear blue lake sparkles; to their right a large park space lined with shady trees. The mother separates from her son to pull out a blanket from her bag and lay it across the soft green grass in the dappled shade of a tree. Meanwhile the son sits down on the blanket and points excitedly to three orange kayaks which glide in a line across the surface of the water.

Mother: Before we moved to Columbiat, I was a kayaker, and my husband was a banker. That was the second thing that popped into my brain when my husband told me we were moving to Columbiat: kayaking. The first thing, of course, was the excitement- moving into Columbiat was an opportunity we had only ever dreamed of. But a close second was that I was going to miss my river. I didn't grow up on any river as grand as the Columbia river, but I grew up on a river and I learned how to kayak at six, just like my son Alex has.

She pauses to hand Alex a Holo-CAD with a book projecting from it.

Mother: I ordered this from his pre-school using my Holo-CAD this morning, it delivered instantly. Who knew getting books could be so easy? That the whole process could be so user-friendly? My husband and I moved here because of the banking opportunities, and I originally feared that successful businesses would be all there was to Columbiat. I was proved wrong the first time I walked into our house, the Lucem Family Home; the house was luxurious, with an extra bedroom and bathroom, and a jacuzzi in the middle. There were so many windows lining the walls the space felt full of light, yet we were able to control our privacy with a simple command through our Halo-CAD.

Three months into living in our new home, I found out I was pregnant, or really my Holo-CAD found out before I did and notified me. It then let me know of available times for when I could meet with a doctor, and, upon my request, scheduled me in the first possible appointment. I was so excited, and now I know how lucky I am to live in a settlement this technologically advanced. Seven months later, my Holo-CAD detected an abnormality in my vitals and called for a SanoBot, which then transported me immediately to a nearby hospital where surgeons were able to operate. Nowhere on Earth could I have received such immediate adaptive care; the technology here saved my life.

Alex will begin second grade this year, and we could not be more honored to call this settlement our home.

An elevator dings as it reaches down to ground level, and a stream of people in professional attire board and get off the gleaming machine until the doors close and the elevator speeds away, up to the business canopy, to deliver its charges into their workday. Meanwhile, in the elegant lobby of a hotel two blocks away, a man in a blue button-down shirt and khakis sips from a latte while messaging a friend via his Holo-CAD. Camera pans to this man through large glass windows as he verbally silences his Holo-CAD and turns to the camera.

Sometimes life gets difficult, and you just need a break. I decided I needed some time to get away from it all, and I figured what better place to go than the famous Columbiat? The first time I set foot on Columbiat, I knew I made the right decision in coming. From touchdown in the docking facilities, everything went smoothly. The welcome facilities were elegant, and I immediately received my temporary Halo-CAD, which recognized me and automatically personalized itself to fit my needs. The shuttle system that transferred me from the docking ports to the acclimation area was breathtaking, and gave me the first taste of the luxury I would experience within Columbiat. It took other travelers and myself through a tunnel of holographic light which projected the story of Columbiat. After that, we took an elevator to our first acclimation area, which are similar to small, lively towns. Each hotel had a slew of restaurants, shops, and recreation areas. Because the acclimation area is for guests who need to adapt to full gravity, there are medical facilities in every gravity level, specialized in mitigating the negative effects of long-term 0g. Because my trip was so short, my Holo-CAD told me I needed to only stay a day in a midzone gravity level of .4. My Holo-CAD helped facilitate a smooth transfer between these rest stops along the way to my final destination, the expansive Residential Floor of Columbiat.

The morning of my departure from the acclimation center, my Holo-CAD notified me I was ready to continue my journey to Columbiat. Upon my request, my Holo-CAD summoned an elevator and gave me an approximate time of arrival. When the elevator double doors opened for the first time, I caught my glimpse of the Business Canopy. The Canopy is an organically woven balcony, high above the Residential Floor, with pathways full of people striding between business headquarters to banks through neatly maintained stretches of luscious park spaces. People transferred between this level and the

next, until the doors dinged again and rolled shut, bringing us to our final destination.

The Residential Floor of Columbiat immediately outside of the elevators is a busy metropolis, full of cafés, restaurants, hotels, and many other amenities accessible to each resident and every tourist. The big-city feel I discovered, upon walking out into the major part of the settlement, amazed me. I thought, Even here in space, there is a city life and culture as vibrant as anywhere on Earth. From that realization, I followed my Holo-CAD's directions to my hotel, mesmerized by the gigantic windows with pristine views of space along the both sides of the settlement.

My Holo-CAD automatically checked me into the hotel, and I walked through the rotating glass doors into a comforting expanse of couches and lounging tourists, communicating via Holo-CAD, or simply resting and enjoying the views of space.

This space has been where I spent time between appointments with friends, dinners at restaurants, and my favorite activity: venturing between the multiple "Adventure Bubbles." These bubbles stretch around the Ops Core at .2 g and give me total creative liberty with imagining and living any situation in the universe. The system interacts directly with my brain and holographic systems within the bubble create a world flawlessly catered to my each and every whim. I have traveled across the surface of Pluto, climbed mountains on Mars, and crawled through craters on Neptune, all through this unparalleled creative adventure tool.

It's hard to believe I've already been living here, in Columbiat, the most spectacular place, for two months. It's even harder to believe I'm headed home tomorrow. My experiences here have been incredible! As I prepare to leave, the only thing I know for sure is: I will be back.

The camera pans up the space elevator and zooms out when it reaches the settlement. The settlement slowly rotates with the array of stars glistening in the background.

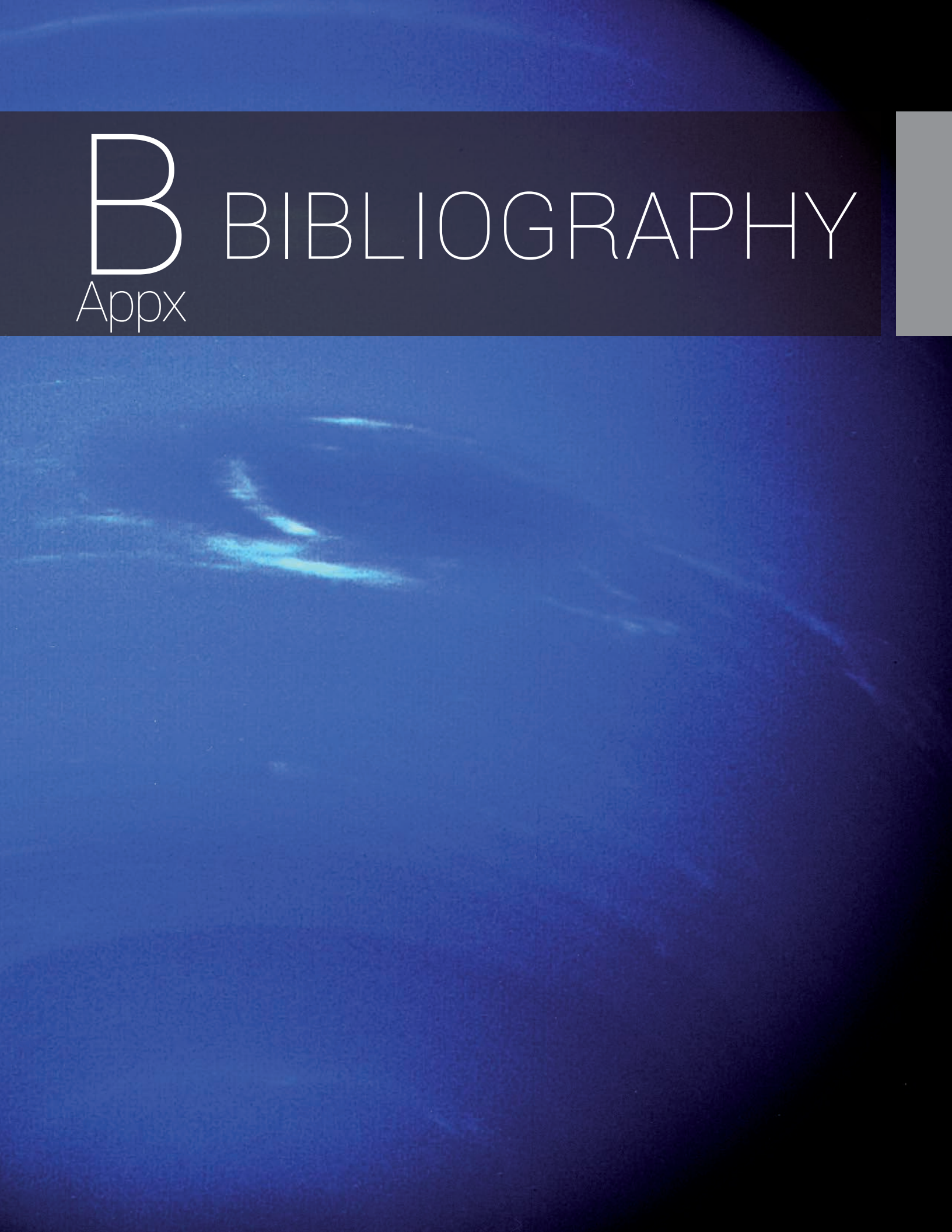
Female Engineer Voice: Columbiat was designed with safety, fluidity, and luxury. The hull is 1.3 meters thick and made of the strongest and most radiation resistant construction materials known to man. Columbiat is, astonishingly, mostly windows, which offer great views of space and create the illusion of more room within the settlement. The parks are scattered with natural land features to create a earth-like feel. Additionally, the day and night cycles mimic earth's sky while allowing natural views of the earth and the moon. The Business Canopy is not only an ingenious place for business, but actually doubles as structural support. The elevators that run to the Ops Core and the Agricultural Ring also double as structural reinforcement.

Within the settlement, the Residential Volume rotates around the Ops Core. The Ops Core houses docking, storage, welcome facilities, and manufacturing areas to meet the demand of the residents and visiting ships. We choose to dock in the Ops Core because the 0 g, non-rotating mass is easier for all ships to dock. Additionally, we accommodate more locations around the settlement to enable ships of any size to interface and do business with Columbiat.

We designed Columbiat with emergency preventative measures built in, but we understand that an emergency can still emerge. We have addressed fires, hull breaches, blight, atmosphere contamination, and power failure. Additionally, we can section off portions of the settlement with electrorheological fluid nets and pump atmosphere in or out. Every community has a large safe house, stocked with food, water, and atmosphere that can house of the population for 8 days.

Columbiat is the pinnacle of human ingenuity and design. We created a safe, thriving business community to provide a sanctuary for the businesspeople who want to invest in the new frontier of the universe.

Appx B BIBLIOGRAPHY



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Appx C

COMPLIANCE MATRIX

COMPLIANCE MATRIX

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2.0 Natural views of Earth and the moon	Image 2.1.1	2
2.1 Identify large enclosed volumes and their uses and gravity levels	Image 2.1.2 Section 2.1.1	2,3
2.1 Show dimensions of major structural components and design features	Image 2.1.2 Image 2.1.3 Section 2.1.1	2,3
2.1 Construction materials for major hull components	Image 2.1.4 Image 2.1.5 Section 2.1.3	4
2.1 Structural interface between rotating and nonrotating sections	Image 2.1.3 Section 2.1.2	3
2.1 Rationale for selection of rotational rate and artificial gravity magnitude(s)	Section 2.1.1	2
2.1 Pressurized and unpressurized volume environments	Section 2.1.1	3
2.1 Protection from radiation and debris penetration	Image 2.1.5 Image 2.1.4 Section 2.1.3	4
Minimum requirement: overall exterior view of settlement, with major visible features, showing rotating and nonrotating sections, pressurized and non-pressurized sections, and indicating functions inside each volume.	Image 2.1.1 Image 2.1.2 Image 2.1.3	2,3
2.2 Allocation and dimensions of interior 'down surfaces'	Image 2.2.1 Chart 2.2.1 Chart 2.2.2	5
2.2 Drawing labeled to show residential, industrial, commercial, agricultural and other uses	Image 2.2.1	5
2.2 Orientation of 'down surfaces' with respect to overall settlement	Image 2.2.1 Section 2.2	5
2.2 Vertical clearance in each area	Section 2.1.1	5
Minimum requirement: overall map or layout of interior land areas, showing usage of those areas.	Image 2.2.2	5

2.3 Process required to construct the settlement w/ assembly sequence	Section 2.3	5,6
2.3 Specify when artificial gravity will be applied	Section 2.3 Image 3.4.1	6,16
2.3 Eight intermediate steps of settlement assembly	Image 2.3.1	6
2.3 Method of initiating rotation for gravity	Section 3.4	16
Minimum requirement: drawing(s) showing at least eight intermediate steps of settlement assembly, and method of initiating rotation for artificial gravity.	Image 2.3.1 Image 3.4.1	6,16
2.4 Docking and unloading/loading of four cargo ships and one passenger ship	Section 2.4 Image 2.4.1	7
2.4 Long-term docking for one ship requiring emergency repair	Section 2.4	7
2.4 Future expansion to double this capability	Image 2.4.2	7
2.4 Interface for future expansion and configuration	Image 2.4.2 Section 2.4	7
2.4 Cargo transfers	Section 2.4 Section 5.4.1	7,33
Minimum requirement: drawing(s)/map(s) showing location of port area(s) for handling incoming and outgoing ships, and cargo transfer facilities in a typical docking bay for visiting ships.	Image 2.4.1 Section 5.4.1	7,33
2.5 Attachment system for space elevator ribbon	Section 2.5 Image 2.5	8
Minimum requirement: show the attach system to the space elevator ribbon, with specification of the preferred attachment interface dimensions.	Section 2.5	8
3.1 Source of materials	Chart 3.1.1	9
3.1 Transporting and storing materials	Section 3.1.3	9
3.1 Construction Equipment	Section 3.1.1 Section 5.1.1	9,28
Minimum Requirement: Charts or table identifying types and amounts of the various materials and equipment required for the settlement construction process, and from where and how those materials and equipment are shipped.	Chart 3.1.1	9
3.2 Atmosphere/climate/weather control- identify air composition, pressure, and quantity	Section 3.2.1 Chart 3.2.1 Image 3.2.1	10

3.2 food production- including growing, harvesting, storing, packaging, delivering, selling	Section 3.2.2 Image 3.2.2 Chart 3.2.2	11
3.2 electrical power generation-specify kilowatts distributed to habitable areas	Section 3.2.3 Chart 3.2.3	12
3.2 Water management- specify required water quantity and storage facilities	Section 3.2.4 Chart 3.2.4	12
3.2 Household and industrial solid waste management specify recycling and/or disposal	Section 3.2.5 Chart 3.2.5	13
3.2 Internal and external communications systems-specify devices and central equipment	Section 3.2.6 Image 3.2.5	13
3.2 Internal transportation systems- show routes and vehicles, with dimensions	Section 3.2.7 Image 3.2.6 Image 3.2.7	14
3.2 Day/night cycle provisions- specify schedule and mechanisms/ operations for providing it	Section 3.2.8 Chart 3.2.6 Image 3.2.8	14,15
Minimum Requirement: Dimensioned drawing(s) showing systems which provide required infrastructure, and, as appropriate, their configuration.	Image 3.2.3 Image 3.2.4 Image 3.2.6 Image 3.2.7	12,13, 14
3.3 Primary Construction Machinery for Constructing the Settlement	Section 3.3.1	15
3.3 Materials, Components, and Subassemblies	Section 3.3.2	15
Minimum Requirement: Drawing of primary construction machines and how the machines convert and manipulate raw materials or structural components into finished form.	Section 3.3.1 Image 3.3.1	15
3.4 Propulsion to establish rotation	Section 3.4 Image 3.4.1	16
Minimum Requirement: Show drawings of propulsion system, location and interface with the structure. Propellant type. Propellant storage, and identify thrust produced.	Section 3.4 Image 3.4.1	16
3.5 Design elevator boarding	Section 3.5.1	16

3.5 Have enough room for 2 cargo containers	Section 3.5.1 Image 3.5.2	17
3.5 Specify method of ascending and Descending the Ribbon	Section 3.5.2	17
3.5 Show attachment to ribbon	Section 3.5.1 Image 3.5.1	16
Minimum Requirement: Drawing of space elevator cab design	Image 3.5.2 Image 4.5.1	17,28
4.0 Assure natural sunlight and views of earth and moon available to residents	Image 4.2.1	20
4.1 Provide services for residents (housing, good food, education, entertainment, etc.)	Section 4.1.1	18
4.1 Make chart consisting of variety and quantity of consumables and other supplies, estimate annual replenishment of clothing and paper and describe source	Section 4.1.2 Chart 4.1.1	20
4.1 Describe open areas with open space and consideration of psychological factors (long lines of sight)	Section 4.1.3 Image 4.1.1	18,20
4.1 Describe means of distribution consumables	Section 4.1.2	20
Minimum Requirement: Maps and illustrations depicting community designs and amenities	Image 4.1.1	18
4.2 4 designs of typical residential homes, show room sizes	Image 4.2.2 Image 4.2.4 Image 4.2.6 Image 4.2.8	21,22
4.2 Offer residents differentiated neighborhoods for preferences of architectural designs and lifestyle (keep in mind demographics)	Section 4.2.2	22
4.2 Estimate numbers and types of furniture for residential and office areas	Chart 4.2.2	23
Minimum Requirement External drawing and interior floor plan of at least four home designs, the area (preferably in square feet) for each residence design, and the number required for each design	Section 4.2.1 Chart 4.2.1	22,23
4.3 Describe systems, devices, and vehicles intended for use by humans outside artificial gravity volumes, must emphasize safety	Section 4.3.2 Image 4.3.1 Image 4.3.2	24
4.3 Provide means of safe access to any location in parts of the settlement with low gravity environments, inside the hull, or exterior surfaces	Section 4.3.2 Image 4.3.1	24

4.3 Define requirements for spacesuit designs for work outside pressurized volumes. Show spacesuit donning/doffing procedures. Show airlock designs for exiting/entering the settlement from unpressurized volumes	Image 4.3.4 Image 4.3.2 Section 4.3.5	24,25
Minimum Requirement Drawings showing examples of handrails, tethers, cages and/or other systems enabling safe human access to any location on or in low-g settlement areas	Image 4.3.1	24
4.4 Must describe attributes of favorable first impression upon arrival	Image 4.4.2 Section 4.4.1	26
4.4 Show passenger arrival and departure facilities for both the space elevator and ships	Image 4.4.1 Section 4.4.1	26
4.4 Show locations and designs of hotels or other visitor accommodations	Section 4.4.2 Image 4.4.3 Image 4.4.4	26,27
4.4 Describe security measures to unobtrusively monitor visitors and ensure their activities do not interfere with lives of permanent residents	Section 4.4.3	27
Minimum Requirement Floor plans of arrival/ departure areas and public areas of hotels (lobby, restaurants, and shops)	Image 4.4.1 Image 4.4.4	26,27
4.5 Show design of space elevator cab accommodations for passengers, including size, configuration and amenities.	Image 4.5.1 Section 4.5	28
Minimum Requirement Show seating, privacy, and entertainment for space elevator passengers	Section 4.5 Image 4.5.1	28
5.0 Describe computing systems, robots and other computing information devices to operate the settlement	Section 5.3 Section 5.2.4	30,31
5.0 Define physical locations of computer robots and support systems for critical functions	Section 5.2.4	31
5.1 Describe use of automation for construction	Section 5.1.1 Image 5.1.1	28
5.1 Automation for transportation and delivery of materials	Section 5.1.2 Image 5.1.3	28
5.1 Assembly of the settlement and interior finishing	Section 5.1.3 Image 5.1.4	29
5.1 Show robot designs, indicating dimensions and function.	Image 5.1.1 Image 5.1.2	28

Minimum Requirement: images of robots with dimensions clears showing functions, and chart or table describing automated construction and assembly devices--both for exterior and interior applications (e.g., homes)--and the purpose(s) of each.	Image 5.1.2 Image 5.1.3 Chart 5.2.1	29,30
5.2 Automation for settlement maintenance, repair, and safety functions, ie back up systems and contingency plans	Section 5.2.1 Section 5.2.2	29,30
5.2 Robots that do emergency repairs must survive solar flares and the harsh environment	Section 5.2.3	30
5.2 Means for authorized personnel to access critical data, command automation systems. Security systems so only authorized personnel can access critical data for authorized purposes	Section 5.2.4 Chart 5.2.2	30,31
5.2 Number and types of personal communication and data devices. Includes computers, servers, software, network devices, and robots	Chart 5.2.1	30
Minimum Requirement chart or table listing anticipated automation requirements for operation of the settlement, and identifying particular systems / devices to meet each automation need.	Chart 5.2.1 Image 5.3.1	30,31
5.3 Automation to enhance livability and productivity in work environments, and convenience to residences	Section 5.3.1 Section 5.3.2 Image 5.3.1	31,32
5.3 Automation to perform maintenance and routine tasks.	Section 5.3.3 Image 5.3.2	31,32
5.3 Privacy of personal data, and controlling systems in private spaces	Section 5.3.4 Chart 5.3.1	32
5.3 Access to community computing and robot resources	Section 5.3.5 Chart 5.3.1	32,33
5.3 Types and capacities of data storage, collection, and distribution, and user access to computer networks	Section 5.3.5 Chart 5.3.1	32,33
Minimum Requirements drawings of automation systems that people will encounter in Columbiat, and diagram(s) of network(s) and bandwidth requirements to enable computer / device connectivity.	Section 5.3.5 Image 5.3.2 Image 5.3.1 Chart 5.3.1	30,31, 32,33
5.4 Automated cargo handling systems for ships that will completely unload and load	Section 5.4.1 Image 5.4.1	33
5.4 Automated warehousing for temporary storage of goods and bulk materials and inventory management and tracking packaging.	Section 5.4.3 Image 5.4.1	33
5.4 Anything moving in our area must have the ability to transfer between vehicles at Columbiat	Section 5.4.2 Image 5.4.3	34

Minimum Requirements: Illustration, chart, or matrix showing inventory management system; and illustration of automated unloading/loading system(s).	Image 5.4.2 Image 5.4.1	33,34
5.5 Transport to and from repair and overhaul facilities	Section 5.4.2 Image 5.4.3	34,35
5.5 Allocated space for robot repair and cleaning facilities	Section 5.5.1 Image 5.5.1 Image 5.5.2	35
5.5 Dust mitigation and containment systems	Section 5.5.2 Image 5.5.2	35
5.5 Robot repair and overhaul systems	Section 5.5.3 Image 5.4.3	35
Minimum Requirements drawing(s) of robot repair facilities, including illustration(s) of measures implemented in order to prevent spread of dust contamination brought by visiting ships.	Image 5.5.1 Image 5.5.2	35
6.0 Include a schedule for completion and occupation of Aynah, and costs for design through construction phases of the schedule	Chart 6.1 Chart 6.2	36,37
6.1 Schedule must show tasks from start (5/8/2077) to customer control point	Section 6.1 Chart 6.1	36
6.1 Show dates of when people can move in and when settlement will have full population	Chart 6.1	36
6.1 Durations and completion dates of major designs, construction, and occupation tasks	Chart 6.1	36
Minimum Requirement: 6.1 durations and completion dates of major design, construction, and occupation tasks depicted in a list, chart, or drawing	Chart 6.1	36
6.2 Cost per phase of Columbiat construction	Chat 6.2	37
6.2 Estimate numbers of employees for each stage of construction	Chart 6.2	37
Minimum Requirement: 6.2 chart(s) or table(s) listing separate costs associated with different phases of construction, and clearly showing total costs that will be billed to the Foundation Society	Chart 6.2	37
7.1 Resorts, restaurants, theaters, and amusements	Section 7.1.3 Section 4.1.2	20,38
7.1 Temporarily house 5000 visitors in transit	Section 7.1.4	38
7.2 Office facilities: four 150-person offices, eight 100-person offices, fifteen 30-person offices, and thirty 5-person offices.	Section 7.2.1	38

7.2 Facilities for offices of three banks	Section 7.2.1 Section 7.2.2	38
7.2 New Foundation Society headquarters, 300 person staff	Image 7.2.1 Section 7.2.3	39
7.2 Computing centers enabling secure networked internal communications and interconnectivity	Section 7.2.4	39
7.3 Construction control center with views	Section 7.3.1	39
7.3 Robot crawlers and cameras for monitoring of ribbon integrity	Section 7.3.2	40
7.3 Facilities for and deployment of maintenance and repair systems	Section 7.3.3	40
7.3 Monitoring of passenger experience and safety in elevator cabs	Section 7.3.4	40

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