

Project: Second Sun

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# Executive Summary

Project Second Sun is our proposal for a new, permanent population centre in space, dedicated towards business deals and shipping.

# Business, Costing and Schedule

## Award Date to IOC Subcontractors

* Beam builders
  + Construct the general structure of the Axle
* Orbitlink Communication
  + Allows for faster internet access to other stations and Earth
* Bucky Breakthrough
  + Windows made of silicon bucky structure
* Hard Roll
  + Will be in use before other construction related subcontractors as they produce useful materials from moon mined rock
* Lossless Airlocks
  + airlocks
* 3D Logistics
  + 3D printed tools and materials

### IOC Date

## Pre IOC Costing and Scheduling

## Post IOC Costing and Scheduling

## Risk Analysis/Matrix

### Structural Hazards/ Dangers

|  |  |  |  |
| --- | --- | --- | --- |
| Risk | Likelihood | Severity | Mitigation |
| Self automated machines compromised with malicious intent | Very Low | Catastrophic | Drones come equipped with top tier anti-malware systems. |
| Supply Ship Lost | Low | Low | There will be enough supplies stockpiled on the station to survive 2 supply runs. Rationing may be needed. |
| Elevator Failure | Low | Medium | A rescue ship will be able to clamp to the ship in space and cut a hole to extract passengers. In case of elevator failure during ring descent, mechanical brakes will clamp and passengers can disembark. |
| Local electrical failure | Medium | High | All electric systems will have redundancy and atmosphere controls can be operated manually  All electrical systems will have redundancy units in case a few fail, which can be repaired at a later date. Atmosphere controls will be operated manually if it fails. |
| Total electrical failure | Low | Catastrophic | Backup generators and solar panels will minimise the chances of total power failure. Emergency alarms warning the staff and civilians will run on seperate circuits, from there a response can be made to resolve the problem. |
| Total communication failure | Very Low | Catastrophic | Communications will have multiple redundant systems in case of failure. There is also the option to have Earth to focus a powerful antennae at us so that we are still able to communicate with Earth. |
| Sewage and waterway failure/ blockage | Medium | Medium | Sewer systems will be equipped to alert Maintenance of a potential blockage and from there action can be taken to clear the blockage.  Active regulation on what will be allowed to be disposed in toilets to limit the chance of blockage. |
| Large breach (1 m^2 plus) | Low | Catastrophic | Rooms and corridor compartments will have airlock bulkheads to automatically close in case of breach. Detectors alongside the bulkheads will be able to determine a drop in pressure and attempt closure of the breach. Security Center will be notified of the breach and from there suitable action to repair the breach can be taken. |
| Small breach (1m^2 less) | Low | High | Rooms and corridor compartments will have airlock bulkheads to automatically close in case of breach. Detectors alongside the bulkheads will be able to determine a drop in pressure and cause the closure of the breach. Security Center will be notified of the breach and from there suitable action to repair the breach can be taken. |

### Human Factor Hazards/ Dangers

|  |  |  |  |
| --- | --- | --- | --- |
| Risk | Likelihood | Severity | Mitigation |
| Individual stranded during EVA | Very Low | Low (high in terms of PR) | Another individual will be sent to retrieve them if within range. Recreational related EVAs will have supervisor/s nearby.  If out of range of this, a tug can be sent to retrieve them to bring them within range of an airlock or a retrieving individual. |
| Food Shortage | Low | High | Communication would request an increase in food from Earth to the station and begin rationing food. Food injections will also be accompanied by materials to restart food production if it was caused by crop failure. |
| Food source based disease | Low | High | Seeds and fertilizer will be checked as it enters the station for potential dangers, in the case of blight the hydroponic systems will be flushed out and replaced. Food reserves will exist on the station allowing the station to survive long enough until an injection from Earth or another settlement. |
| Lethal disease | Low | High | Individuals of the station must be up to date with vaccinations (unless valid reason is presented) and mandatory checkups. Incoming cargo and passengers will be screened for pathogens and passengers will have their medical history analysed and approved or declined before arrival at the station determining whether they will be allowed into the station. |
| Rioting | Very Low | Catastrophic | Riots will be easily contained within rings due to the difficult nature of transfering from ring to Axle and the natural bottlenecks created by the elevators necessary to travel within rings. In dire cases suppressant gases can be selectively distributed through the atmosphere regulation systems within a ring. |
| Non-lethal disease | Medium | Medium | Atmosphere controls will limit the spread of any pathogen. Ring to ring quarantines can be enforced before a suitable medical response can be made by staff. |
| Terrorism | Low | Catastrophic | Customs and excise will control all immigration to the station functioning similarly to airport security. |
| Civil unrest | Medium | Medium | Civil unrest will be easily contained within rings due to the difficult nature of transfering from ring to Axle and the natural bottlenecks created by the elevators necessary to travel within rings. In dire cases suppressant gases can be selectively distributed through the atmosphere regulation systems within a ring. |
| Key card lost | Low | Low | Keycards can be deactivated from CDM HQ. |

# Structural Design

## Exterior Design

Columbiat will consist of four thin discs rotating around a central axle 100 meters in diameter and 2000 meters in length. Each disc shall extend 800 meters from the surface of the axle, giving a total radius of 900 meters, and they will be 400 meters thick. These rings will, together, have a ground area of 44 km^2, enough to comfortably fit the 88,000 people in an Australian suburban style density.

Exterior Design Materials

Put materials here

## Interior Design

Each rings surface shall be divided into public and private spaces, with large parks and shopping districts for private economic ventures. Each ring will have a single train line running along the centre of the ring with eight stations along its length, each one positioned 706.858 meters apart. This means the longest distance need

Interior Design Materials

Put materials here

## Construction Sequence

The construction sequence will be ordered as follows:

1. The construction of the Axle which will serve as the IOC, able to support 20,000 occupants as well as serve as a port for ships intending to dock
2. The construction of the 0.75g ring.
3. The construction of the 0.6g ring.
4. The construction of the 0.5g ring.
5. The construction of the 0.38g ring.
6. The ‘spinning up’ of the rings.
7. The mass movement of the citizens into the station.

# Operations and Infrastructure

## Location and Material Sources

## Related image

Image Source: <http://alfin2100.blogspot.com/2011/02/creating-staging-base-at-l1-for.html>.

Columbiat will be located in high Earth orbit approximately 384000km above Earth based around the Earth-Luna L5 lagrange point, the height of which is comparable to the height of the Moon’s orbit. We will not have to fear our orbit colliding with the Moon or being affected by the bodies in part by our orbit matching the Moon’s. This orbit allows us to take advantage of potential material sources from Luna due to our fairly similar orbit as well as pre-existing satellite infrastructure for communication purposes.

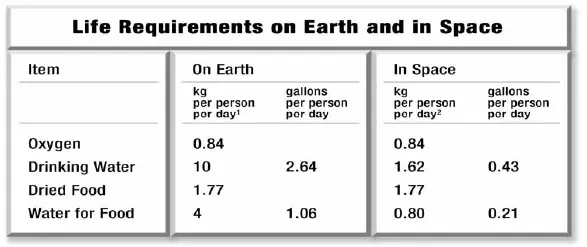
From *Alexandriat* we will source materials and goods produced from lunar materials and the mining of asteroids, which will be applied for automated construction, repairs, transportation and other similar operations. We will source the rest of the materials from Earth, which will be transported in CASSSAC containers, then assembled at site.

## Atmosphere Control, Refrigeration and Preservation

Objects and foodstuffs that require unique storage conditions will be designated dedicated storage locations around the station. Within the Axle near docks to receive food from imports and the ring floors near the facilities of food production and allowing easy access by consumers and food producers for necessary functions. Food and other similar perishable items will be frozen or refrigerated depending on when it will be used, and will be stored in the station axis near the residential sections.

The atmosphere within the station will be modelled to closely mimic Earth conditions with regulated temperature, humidity, pressure and gravity.

* Temperature: 22 degrees Celsius is the standard, although there will be room for individual adjustment in homes.
* Pressure: 101.3kPa, near Earth sea level pressure but with room for minor adjustments.
* Atmosphere: 80% nitrogen, 20% Oxygen with trace amounts of Carbon Dioxide from human respiration which will be constantly filtered out.



## Food Production and Sourcing

Our main food sources will include:

* Tomatoes (17.69 calories per 100g. Nutrients: vitamin C,K, A and potassium)
* Potatoes (77 calories per 100g. Nutrients: vitamin C and B6)
* Beans, pinto (347 calories. Nutrients: iron, magnesium, vitamin B6, thiamin, potassium)
* Cabbage (25 calories. Nutrients: vitamin K, C and B6)
* Fish, trout (141 calories. Nutrients: omega 3 fatty acids, vitamin D, vitamin B3, vitamin B1 and potassium)
* Wheat (327 calories. Nutrients: dietary fiber, manganese, phosphorus and niacin)
* similar starches

Food will be produced using aquaponic systems due to their high yield and nutritional value and variety, and will be genetically modified to maximize yield and nutritional density of the crop. As the average person requires 2000 calories a day. To support 88,000 people on the station we will need to produce 176 million calories worth of food per day. There will be a surplus stockpile of food in case of resupplies not occurring or blights/diseases affecting food production.

Fish will share the aquaponics water tank systems in which they are stored and raised, each tank having the approximate volume of 44 cubic metres. Excrement produced by the fish will be used to nutritionally enrich the aquaponics system. The primary species of fish cultivated will be trout, estimated to weigh 1 kg each when mature. The fish excrement will fertilise the plants and the plant detritus will provide a food source for the fish. This system will need to be occasionally supplemented by fish food and fertilizer as the system is not completely self sufficient. Due to the threat of air pockets forming in water due to low gravity, the aquaponics system will be located in the ring with the most gravity to lower the chance of air-pockets forming in the water and causing our fish to suffocate.

Food production can be moderately automated with software monitoring water temperature, pressure, pH and humidity and from which make suitable responses to resolve it. Other actions automation can make is dispensing fish food and harvesting crops. Some amount of human intervention will be required to monitor the state of the crops and fish and respond if they become affected by blight or disease.

As we can’t produce all food types we will have to import other food types from Earth or some other facility. Injections would occur monthly as opposed to water occurring twice a year due to the perishable nature of food. Food produced on the station will be able to sustain colonists but injections will increase food variety satisfying the demands of those who request it.

## Water Production and Management

As there is not any nearby body of water that can be easily exploited, the station will be mostly self sufficient with its water supply by recycling and minimising the amount used and wasted by individuals or cargo leaving the station carrying moisture with them or water escaping into space when airlocks are operated. Water saving measures will be implemented such as efficient showers and efficiently grown food, averaging an individual’s daily water use to 200L. This will mean that 17.6 million liters of water will flow through the population every day. In case of an emergency, individual water usage can be reduced to half that, by significantly shortening showers.

Due to the extremely efficient nature of the water recycling systems, only 1 week of water will be stored on the station at any one time. Small top-up shipments of water will arrive at the station twice a year.

## Electricity Production and Storage

Electricity will be produced by solar panels lining flush with the exterior of the rings. 1 x 2 foot (0.304 x 0.6096 meters) solar panels will be produced by *Zap! Industries* in which we will require … producing … to sustain the station requiring … .The problem of efficiency in which not all the solar panels are in constant use will be dealt with by satellites in high Earth orbit equipped with mirrors produced by *Mirror Image* to redirect light towards the station solar panels so that they are constantly producing electricity. The satellites will be able to determine the location of the Sun and the station and determine the angle in which it must be at to reflect the light towards the station. Each mirror will be several hundred metres across, and will focus light inward slightly onto available panels.

## Internal and External Communication systems

The primary method of communication will be by radio transmitters and receivers through the use of PDAs and smartwatches, due to our relatively close proximity to Earth and its existing infrastructure. A combination of existing satellite infrastructure orbiting Earth will be used for non-essential communication, with critical administrative communication given priority or beamed direct. The satellite system as a whole will be able to support everyone though the majority of the traffic will be for non-essential communication.

## Waste Management

Most of the produced human waste will be composted and recycled into fertilizer to assist the growth of plants and by extension the fish which feed off the plants. This system will not be fully sufficient and will require monthly injections along with food to supplement our own produced supply of fertilizer.

Industrial or heavy waste produced on *Columbiat* will be minimal, due to the mostly business-focused nature of the station. Waste in which we cannot recycle or repurpose will be transported back to Earth on the same transport ships delivering injections to be disposed of at proper facilities.

## Key Management and Administrative Bodies

The station will require several administrative and monitoring bodies in which to manage station ongoings. These bodies include the Authority of Station Security (ASS), Communication and Data Monitoring (CDM), Immigration, Commerce and Finance Sector (ICFS) ,Central Administration, or Central for short and the Department of Public Relations (DPR).

### Authority of Station Security (ASS)

ASS is responsible for maintaining security and stability across the station as well as regulating traffic in and out of the station. ASS is an authority presence across the station able to quell civil unrest and riots through the use of issued tasers, protective clothing and batons holding down natural choke points such as the elevator access points to prevent riots from spreading. ASS also deals with criminal cases and civil disputes brought forward to them by civilians and dealt with based on Australian law. Headquarters for ASS will be located in the Axle in a compound known as the Bridge, with regional branches within each ring and divisions within each branch community. Working closely with CDM, ASS will use CDM security systems to monitor individuals who are considered high risk to station safety. ASS will securely keep a record of biometrics, key cards and passwords of all individuals in the eventuality that it is required to access critical information. Access to ASS buildings will be restricted, requiring a combination of biometrics and conventional keycards or passwords.

### Communication and Data Monitoring (CDM)

CDM will be the primary point in which all electronic communication from, to and around the station, including drone feeds, personal communications and broadcasts, will be monitored and a record of activity will be kept. In association with ASS, CDM staff will monitor electronic traffic and flag content which may suggest suspicious or criminal behaviour for ASS staff to review and determine any action to be taken. CDM HQ will be located in the Axle as it does not require gravity and it enables it to be located near ASS which it works closely with. Due to the personal and compromising nature of the data that will be regularly passing through the CDM, access will extremely restricted with the staff manning it tightly controlled under a non-disclosure agreement.

### Immigration, Commerce and Financial Sector (ICFS)

ICFS is responsible for several functions relating to the managing of the station’s finances, immigration and trade. ICFS is responsible for issuing station standard PDAs, smart watches and laptops from which can be used as a credit card which the user will pair with their bank. ICFS will manage the initial selling of land both commercial and residential as well as managing taxes so that the station is able to afford maintain itself, as well as using extras to reinvest into the station under the authority of Central.

ICFS will regulate the movement of passenger and cargo in and out of the station through customs offices located at each dock exit. Potential visitors to the station will need to go through two stages determining whether they are eligible to enter the station. The first will be before they have begun travelling to the station in which they are required to inform the ICFS the intent of the journey, evidence they can financially support the trip and their criminal history. If they are approved in this stage they will be allowed to begin travelling towards the station. Upon arrival their possessions will be searched for contraband items such as weapons, illegal substances and similar items. If the offense is serious they will be deported and fined. If the offense is minor they will be issued a warning or a fine and the item will be impounded. The ICFS will record imports and exports from the station and determine whether ships will be allowed to dock at their port, the cost of refuelling and the tax for using the port. Where and when a ship will be allowed to dock in a specific dock will bet determined and scheduled by a permanent, dedicated Traffic Control to streamline processes and to reduce the chance of blockage within the Axle.

### Central Administration (Central)

Central will deliberate on how money may be invested into the station to improve the facilities as well as resolving issues of major importance to the station such as major damage to the station or civil unrest. Central will be located 0.75G ring and will be composed of a council of individuals hired by the Foundation Society to manage the station on their behalf which will involve setting, revoking and modifying ring policy to adjust to changing situations within the station’s lifespan.

### Department of Public Relations (DPR)

The DPR will be responsible for organising station activities, news and advertising the station to prospective tourists and business on other stations and planets. The DPR will organise station recreational activities for residents and tourists (detailed further in Human Factors - Tourism and Recreation), scheduling activities, hiring supervisors and distributing prizes. THe DPR will also handle the distribution of station relevant news to residents and tourists via the internet to their PDA.

### Maintenance Division (MD)

The MD is responsible for all station maintenance, monitoring maintenance drones feeds and Axle internal traffic responding appropriately in response to an incident either dispatching engineers or maintenance drones. Works closely with CDM to monitor maintenance drone feeds and Axle internal camera network.

# Human Factors

## Settlement and Community Plan

The location of residential sectors, some commercial sectors and community services will be grouped into communities dispersed across the floor of the rings at the desired gravity level in order to foster a sense of community and belonging within their community. Ideally the individual lives within a community which will also have their place of employment as to minimise traffic. A train network will loop around the individual ring allowing for easy transportation across the ring with four multi car elevator shafts transporting from the ring floor to the Axle. Due to the radius of rings being 800 meters, we will be able to meet the height clearance of 2500 feet (762 meters)

## Settlement Housing

City-core communities will centralise around the elevator shafts while villages and rural communities extend out from there. The main characteristics differentiating the three will be:

* Theme, decoration
  + Theme of the city-core communities will be New-York city life.
  + Theme of villages will be more suburban living.
  + Theme of rural homes will be farms although food production from it will not be a primary source.
* Structure heights
  + City-core apartment complex and offices will be multiple stories although five stories will be the max as any higher then there will be a serious difference in gravity felt.
  + Villages will have suburban like homes 1-2 stories high with commercial buildings 2-3.
  + Rural communities will have homes a single story tall and commercial buildings up to two stories.
* Commercial zoning
  + Businesses which require constant transportation of the elevator such as trading will have priority of commercial space in city-core with business priority radiating out from there.
* Room interiors will be similar across all community types with the exterior different to suit the theme of the community.

Family Rooms

**43% of the population are married couples and children**. This is a total of 37,840 people.

We have **2640 children**. As we don't know how many of the couples have children and how many they each have, we will assume the "worst case scenario" where each couple with children only has one child and the rest don't have children.

Therefore we create **2640 "family" houses** which will be designed for a family of 2 parents and 3 children by default. There will be one large bedroom for the couple and three smaller kids' bedrooms. **To accommodate some larger families, a few of the family apartments will have bunk beds in the kids' rooms rather than single beds** (although the size and design of the house will remain the same).

Each family apartment has dimensions 13m x 19m = 247m^2

Several of these apartments might be in one level of the large skyscraper building; if so then the living room/balcony/kitchen side will be facing the outside with lots of windows, and the bathroom/entrance side will be the one facing the inside of the building (where there will be a central corridor between the apartments).

7m 
Balcony/lndoor 
Viewing Area 
(mostly glass walls) 
Double 
Bedroom 
5m 
7m 
Living 
Room 
4m 
Entrance 
E 
5m 
Kitchen 
Dining 
Area 
Hallways 
3 
Door 
Double aed 
Single Bed 
& rge Cm c h 
Armchair 
Television 
Table 
Refrigerator 
Stove Top 
Sinks 
Dishwasher 
Was hing 
Tumble Dryer 
Shower 
3m 
Single 
Bedrooms 
3m 
Hallways 
3m 
Bathroom 
1.5m 
Toilet 
Laundry' Room 
4m 
3m 
3m 

## Exterior Infrastructure

During IOC, the Axle will have been constructed allowing individuals to temporarily reside there without the need of extra inhabitable volumes. Temporary residences and commercial offices will be constructed until at least the first ring has been constructed in which the people will be relocated. While within the gravity less Axle the people will have to go through a constant daily exercise regime to minimize the weakening of bones and muscles.

Spacesuits will be procured from the subcontractor *Extreme Survival Technologies*, at IOC the station will require 20,000 increasing as more rings are constructed until the last ring is constructed bringing the total to 88,000. This is so that in the event of an emergency and evacuation is required all individuals will have a spacesuit. With the spacesuits distributed evenly across the station rings and Axle, they will be equipped with RCS thrusters for maneuvering in space as well as a beacon for rescue. Maintenance work will be prioritised over civilian recreational pursuits involving the space suits with civilians required to book their use ahead of time so that they can be grouped with others and be monitored by a supervisor.

Airlocks will be located:

* Interior of Axle (present in IOC)
  + Entrances and exits for incoming passengers and cargo.
  + If an incident occurs within the Axle maintenance crew can leave these airlocks to resolve the issue.
* Exterior of Axle between where the rings are expected to be present in IOC
  + Primarily maintenance
  + Can be used for recreational purposes in which individuals can go on spacewalks.
* Multiple surfaces of the rings
  + Mainly used for maintenance affairs.

## Tourism and Recreation

### Accommodation

Hotel types and locations will vary depending on price and length of stay. Short-term and budget hotels will be primarily located within the Axle, those staying for long periods of time required to participate in an exercise regime. Long-term and high-end hotels will generally be spread out amongst the rings being more comfortable and not requiring to regularly exercise comparatively as much to those staying in the Axle.

The price of renting a PDA and/or a smartwatch for the tourist will be included in the initial cost, having all normal functionalities such as a credit card but also can show the directions to their hotel and other places through inputting the station address. Another option is to hire a private escort to direct them to their accommodation.

### Unobtrusive Monitoring Methods

Methods in which we will unobtrusively monitor tourists through camera monitoring, data monitoring, supervisors/ tour guides on authorised activities and security screening through customs. CDM will monitor tourists through existing camera infrastructure and monitor internet usage and electronic communications for suspicious activity. When participating in station activities, tourists will be under the supervision of supervisors who will be able to intervene in the event of an incident. Upon arriving at the station the tourists will have to submit security screening through customs arranged by the ICFS in order to prevent contraband and potentially dangerous individuals within the station. Contraband will be disposed of and dangerous individuals deported. More comprehensive detail into general security located in Automation of Operations and Security.

### Recreational Activities

Along with acting and exploring the station freely, recreational activities will be arranged by the station to entertain both residents and tourists.

EVA activities would involve going outside the station through an exterior airlock in the Axle will be on offer requiring a booking ahead of time to schedule an instructor to provide guidance and supervise. These spacesuits would be tethered to the station for safety purposes.

Tourists will be offered a complimentary group station tours upon arriving at the station and passed through immiration, while their luggage is being offloaded from the ship and transported to their accommodation, in which they will get to see the sights around the station and learn about and appreciate the architectural and scientific feats and challenges involved in building such a structure.

Inter-ring and inter-community competitions will run in which to foster team spirit and competitive natures. These competitions will be based around events such as … Inter-ring and inter-community leaderboards will be setup with those winning events rising on the leaderboard and earning a cash prize varying with the event and it’s overall significance.

A recreation and exercise facility will be present in each community with residents and long-term tourists required to regularly use the for a set amount of time each session as to maintain bone and muscle integrity.

The internet available on the station will be used for entertainment, productivity and information distribution on the station. Through the internet residents and tourists will be able to consumer content (movies, games, TV shows) and be able to conduct productivity tasks as well as the internet being the place in which the station will distribute resident relevant news accessible from their PDA.

# Automation

## Automation of Construction

## Automation of Operations and Security

### Station and Individual Security Methods

Multiple security methods will be employed to protect the individual and the station, these include:

* Extensive station wide camera system
  + cameras will be located throughout the station to monitor the population through the CDM
  + Cameras will be high resolution allowing easy identification of faces by the system
* Biometrics
  + biometrics will be the most common lock within the station as it is generally faster and more convenient, consuming less resources
  + each individual’s biometric readings will be stored in a database located in the ASS
* Conventional key cards and passwords for high security areas
  + Such keys and locks will be reserved for high risk, high security areas
  + In such high risk areas a combination of both biometrics and conventional keys will be needed
* Credit card
  + Issued incorporated and paired with personal bank account upon arrival by ICFS into the PDA or smartwatch
  + Replacements for lost electronic devices will be issued by ICFS, the individual required to pay a flat fee to cover the cost of production
  + This will be used to pay throughout the station, connected to the individual’s bank account
  + Payments over $1000 must be approved with a biometric reading to limit major fraud

### Virtual and Physical Robot Applications

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of System** | **Accessible by** | **Location** | **Security Protocol** |
| Station facilities Maintenance areas | Designated robots  Maintenance staff | Throughout the station | Biometrics, maintenance staff are given access to the areas consistent with their work hours. |
| Elevator cargo and commercial shaft | Cargo transportation vessels | Across all rings | Biometrics and conventional key cards/passwords, permission and access needs to be granted in advance. |
| Main elevator transport shafts | All people | Located within the rings as transportation from ring to Axle | No security |
| Agricultural sectors (aquaponics) | Those whose occupation relates to the production and transportation of food materials  Food production drones | Located throughout the station | Biometrics, staff are given access to the areas consistent with their work hours |
| Living Quarters | Individuals can access their own quarters  Those wanting to enter another’s quarters needs to have the tenant present | Located throughout the station | Biometric lock on the doors to the living quarters    "Panic Button" that someone inside can press if there is someone outside their door that is distressing them    Security Cameras - aimed at the door to monitor the flow in and out of the residence |
| Food Consumption Facilities | Anyone can access customer designated facility    Only staff can access staff areas    Partially manned by software based robots which dispense food and accept orders |  | Robots will be identified with an EMMI number detailing their type (maintenance, food production)  Biometrics, staff are given access to the areas consistent with their work hours  Consumers will not be impeded by locks, they will be able to purchase through the use of a credit card incorporated into their station issued device |
| Retail | Anyone can access customer designated facilities  Partially manned by software based robots which handle transactions and dispense products  Manned by humans when necessary in stores selling high value products or in clothing stores | Located throughout the station | Biometrics, staff are given access to the areas consistent with their work hours  Products dispensed in a style similar to a vending machine. Clothing and high value stores will be an exception, being a more conventional store front manned by people |
| Commercial Facilities and offices | Each job category will have their own separate designated facilities | Located throughout the station | Biometrics, staff are given access to the areas consistent with their work hours  Conventional locks can be issued upon request if need is valid |
| High risk Administrative Bodies (administration, security, communications) | Authorized Officials | Localized in the central axle  Major branches in each ring depending on body | Combination of conventional key and biometrics (the number varying depending on how high risk the location is)  Extensive camera system |

## Automation to Benefit Liveability

### Population Monitoring

Depression and other mental illnesses will be an expected problem within our human population caused by work, relationship struggles and/or a combination of other problems. To assist with identifying these mental illnesses an AI pre-installed onto colonist's issued PDA (explained further below). This will track the vitals, online activity and wellbeing of the individual in order to determine the likelihood of the person being affected by illnesses. If the individual is considered to have a high chance of being ill affected it will be reported to the individual's local medical centre to be reviewed and dealt with.

### Communications

A PDA will be issued to all inhabitants onboard the station, providing access to the internet, games and work related applications. The form factor and shape will be similar to that of a large ruggedized phone, airtight and radiation-proofed in case they are brought outside.

The PDA will act as a platform to which station-wide news is distributed and work related applications and functions are conducted. It will also act as a source of recreation and connection for the individual to the outside world thanks to its internet access capabilities. Work related and other sensitive data will be stored on the PDA secured behind a second password. ASS will be able to fully access any PDA in emergency circumstances. Other options include smartwatch and laptop providing varying degrees of convenience and productivity capability.

As *Columbiat* will be relatively close to Earth, internet access and support will be quick and consistent as electromagnetic waves will be able to reach to and from the station within a second. Internet bandwidth can be expected to reach speeds up to 300 Mbs thanks to existing infrastructure on and around Earth and our communications network which will be based around the existing ISS infrastructure although on a much larger scale to accommodate the larger station.

The Communication and Monitoring Centre (CDM) will be a central point through which all communications will flow and can be monitored from, including drone feeds, personal communications and broadcasts. There will be several small, omnidirectional antenna for receiving drone feeds with larger dishes for Earth and Moon communication. All antennas will have equal copies for redundancy and will be sunk into recesses to reduce the chances of damage by impacts. These antennas will be placed in various optimal locations along the non-spinning axis of the station. Access to the CDM will be highly restricted to limit misuse due to the amount of personal and sensitive data that passes through it.

# Business Development

## Transport Interchange

## Commercial and Financial Centre

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# Glossary

Axle: The central section of the station.

Axle interior: The pressurised space contained in the ‘walls’ of the axle.

Axle exterior: The unpressurised space contained by the walls of the axle, and outside it.

Ring: The ring of the station

Ring Surface: The down surface of each ring,

# Summary

Project Second Sun is our proposal to

We look forward to your response,

Zachary Thexeira

Chief Executive Officer

Aperture Spaced