Aynah

Space settlement

Sayre School
Lexington KY, USA

Northdonning Heedwell

AYNAH

EXECUTIVE SUMMARY 1

1.0 Executive Summary

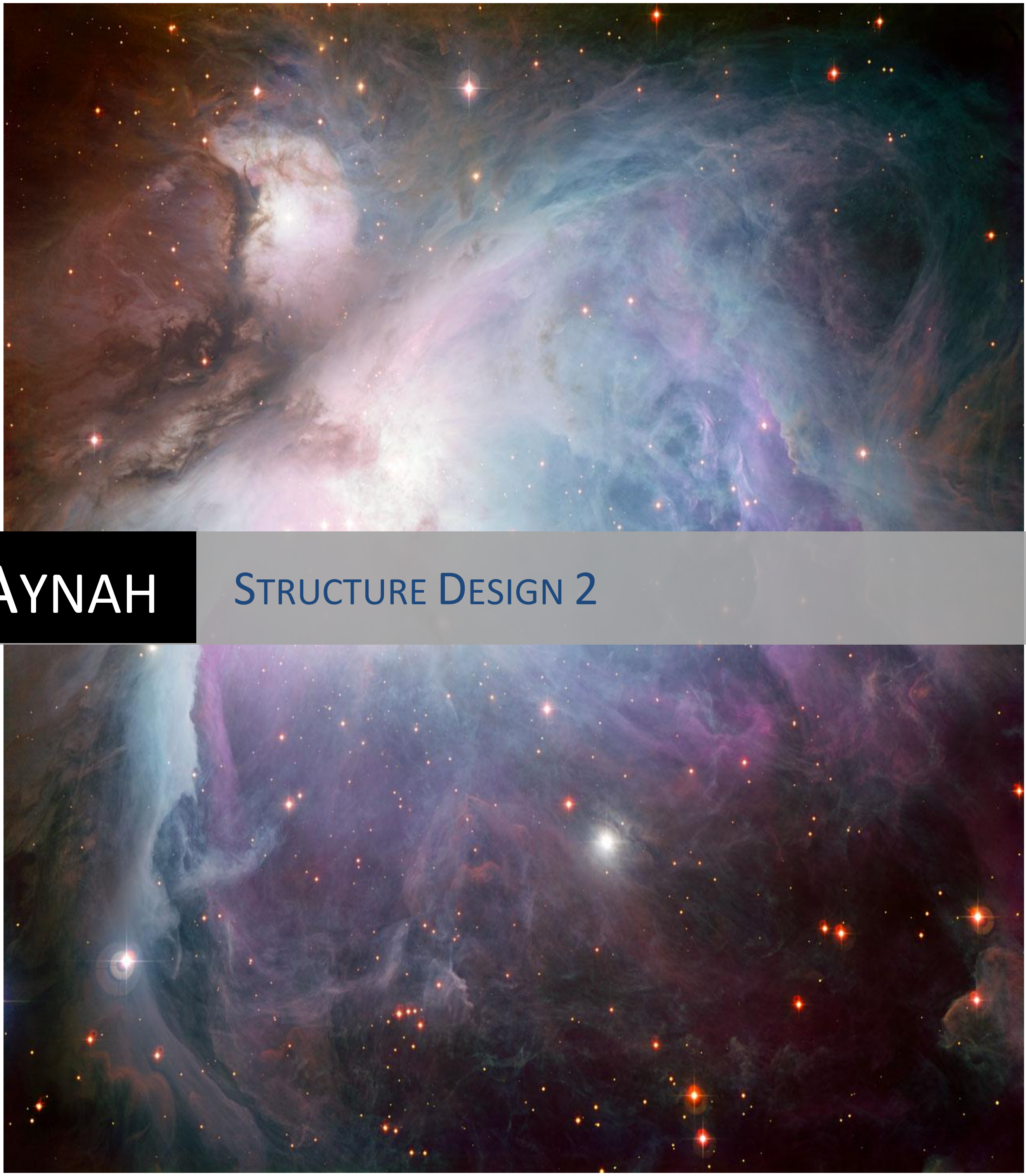
Northdonning Heedwell is proud to present *Aynah* to the Foundation Society; a innovatively designed space settlement that focuses on balancing economic endeavors with a comfortable social atmosphere despite the environment provided by the area in and around Mercury. *Aynah* combines creativity, innovation, functionality, and balance to place the Foundation Society at the forefront of space based industry.

Not only will *Aynah* make the Foundation Society the dominant supplier of reardonium, we at Northdonning Heedwell have set a plan to replace several of our parts over the years with reardonium once they have given away to wear and tear so that *Aynah* is as self-sufficient as possible in conjunction to taking advantage of this miraculous new found metal.

Our vision for this first settlement in orbit around mercury starts with a grand structural design in which every feature has been thought out to maximize the potential of the mining process as well as host 14,000 people and 200 non-permanent residents comfortably. In addition to the projected economic prosperity that *Anyah* will experience, *Aynah* provide its residents with beautiful living areas, and the latest technology to enhance their experience. They will be provided with Earth-like features in conjunction with the awe inspiring elements of space. All amenities and goods have been thought out to increase livability including a vast array of food provided via hydroponics and in vitro.

Northdonning Heedwell is confident in the success of this mission and is certain that they will not only meet, but surpass the expectations of the Foundation Society. It would be our honour to once again work with the Foundation Society in their endeavors. We hope that our collaboration continues with the establishment of *Aynah* and in future business in the space industry.

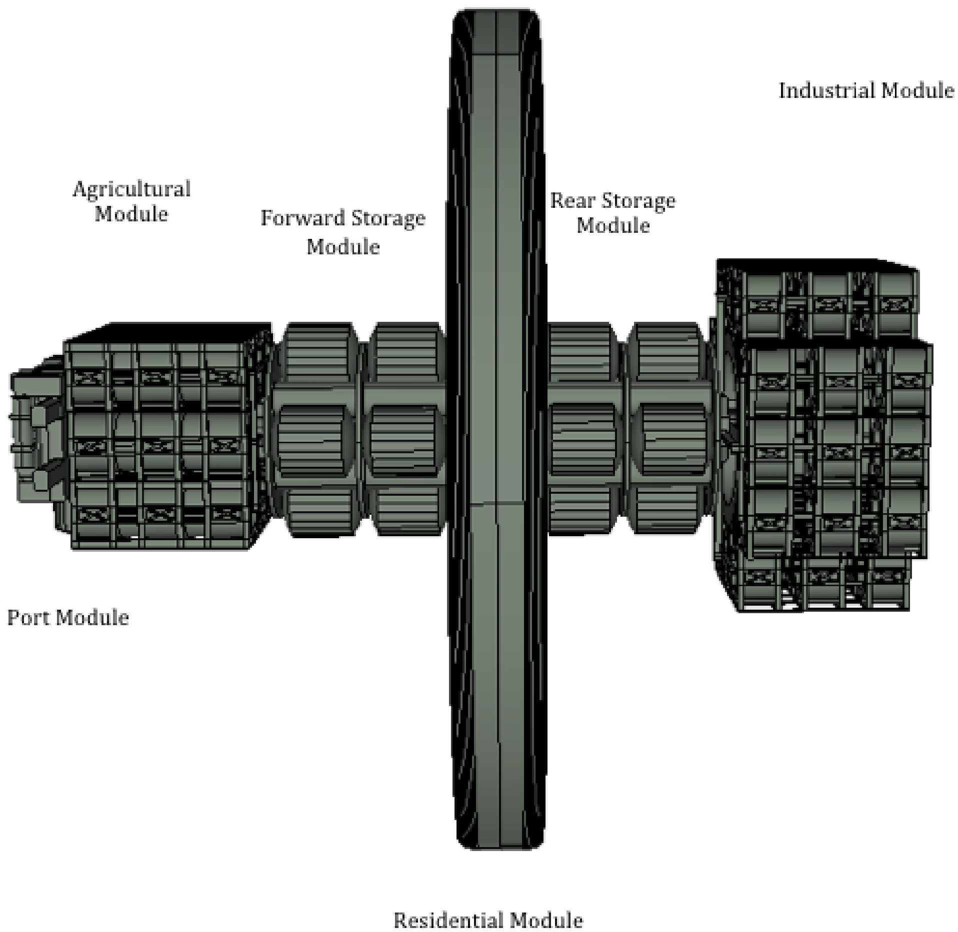
Northdonning Heedwell

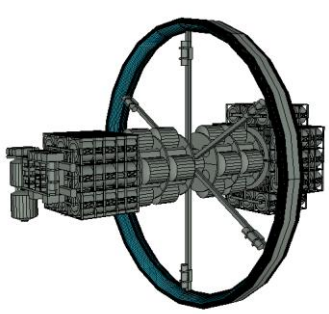


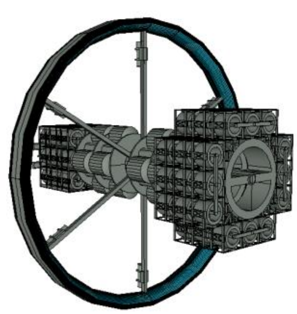
AYNAH

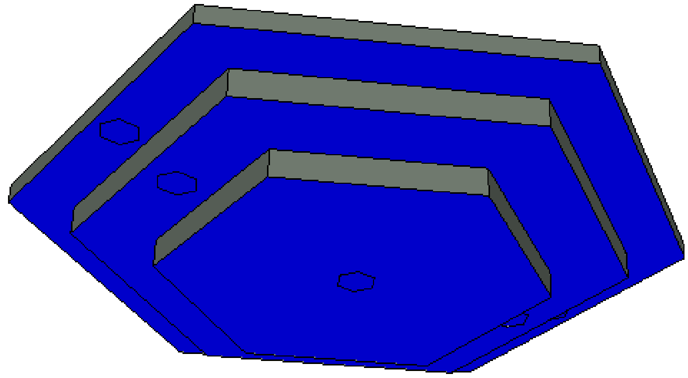
STRUCTURE DESIGN 2

2.1 Exterior design



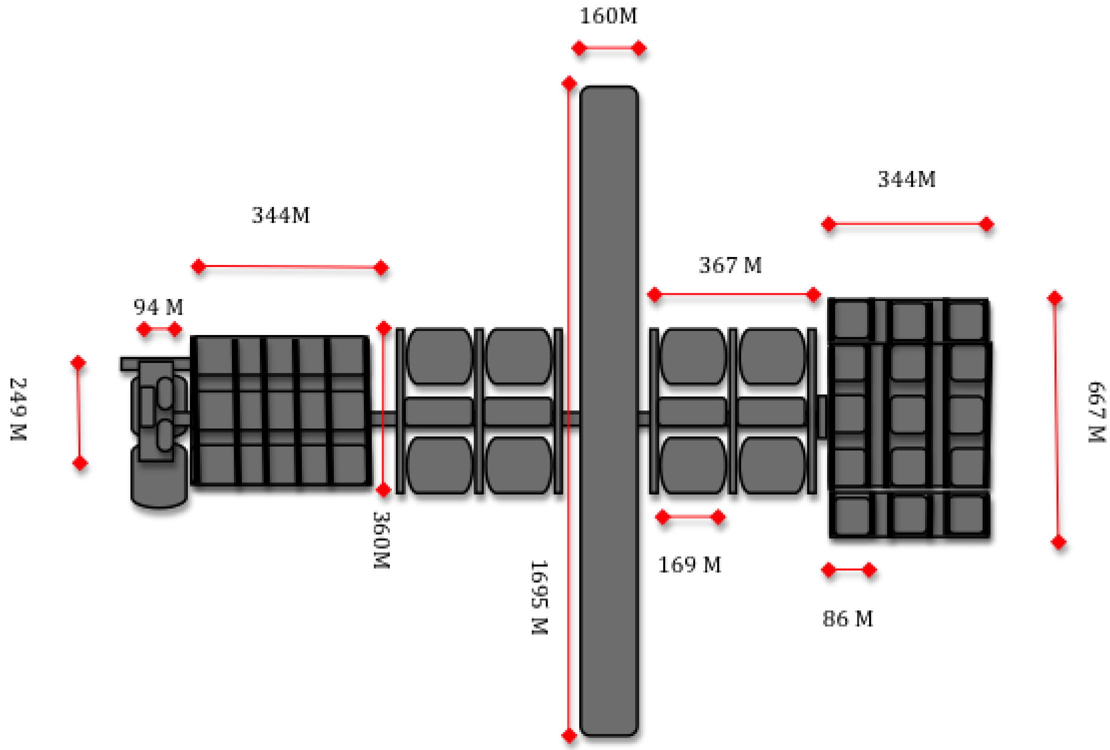


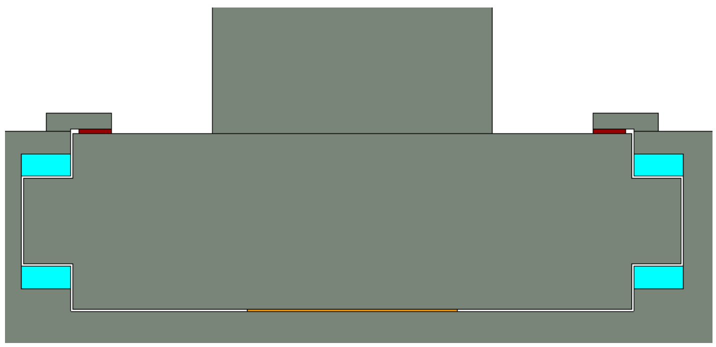




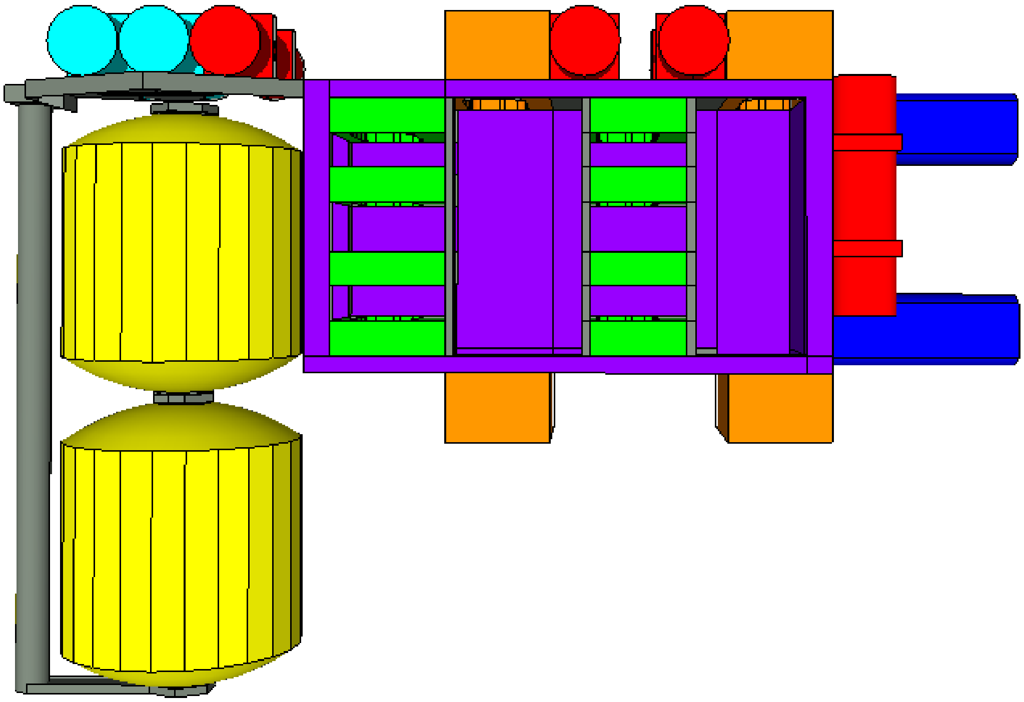
Anyah will consist of six independent modules interfaced with a central transportation axis. The axis will be aligned parallel to the surface of mercury. Between the Anyah and the sun there shall be a solar array with a surface area of twelve square miles. This array will serve the dual purpose of providing power to Anyah via wireless microwave transfer, and acting as a shade to shield Anyah from the heat and radiation of the sun. The hull of the settlement will be constructed using a reardonium girder superstructure covered on the interior and exterior by reardonium plates. The space between the plates will be filled with Areogel to provide insulation.

Unit Name	Number of Units	Volume (Per Unit)	Total Volume	Surface Area (Per Unit)
Habitation Ring	1	31,604,768 Meter^3	31,604,768 Meter^3	1,371,968 Meters^2
Command and Control Center	1	2,742,560 Meter^3	2,742,560 Meter^3	105,474 Meters^2
Fluid Storage Tank (Transportation Struts)	6	173,880 Meter^3	1,043,280 Meter^3	19,982 Meters^2
Agriculture Unit	6	1,569,672 Meter^3	94,180,32 Meter^3	139,654 Meters^2
Fluid Storage Tank (Port Module)	2	173,880 Meter^3	347,760 Meter^3	19,982 Meters^2
Small Reardonium Part Manufacturing Areas	36	405,920 Meter^3	146,131,120 Meter^3	47,298 Meters^2
Large Reardonium Parts Manufacturing Area	2	8,555,928 Meter^3	17,111,856 Meter^3	15,127,338 Meters^2
Fluid Storage Tank (Storage Unit)	16	643,045 Meter^3	10,288,720 Meter^3	36,998 Meters^2
Inflatable Storage Unit	16	1,903,794 Meter^3	30,460,704 Meter^3	87,159 Meters^2
Temporary Storage Unit	2	1,903,794 Meter^3	3,807,588 Meter^3	87,159 Meters^2
Fuel Storage Tanks	4	173,880 Meter^3	695,520 Meter^3	19,982 Meters^2
Cargo Processing Areas	1	1,097,460 Meter^3	1,097,460 Meter^3	113,242 Meters^2
Shuttle Terminal	8	61,120 Meter^3	488,960 Meter^3	14432.176 Meters^2
Central Axis	1	7,477,512 Meter^3	7,477,512 Meter^3	581,672 Meters^2



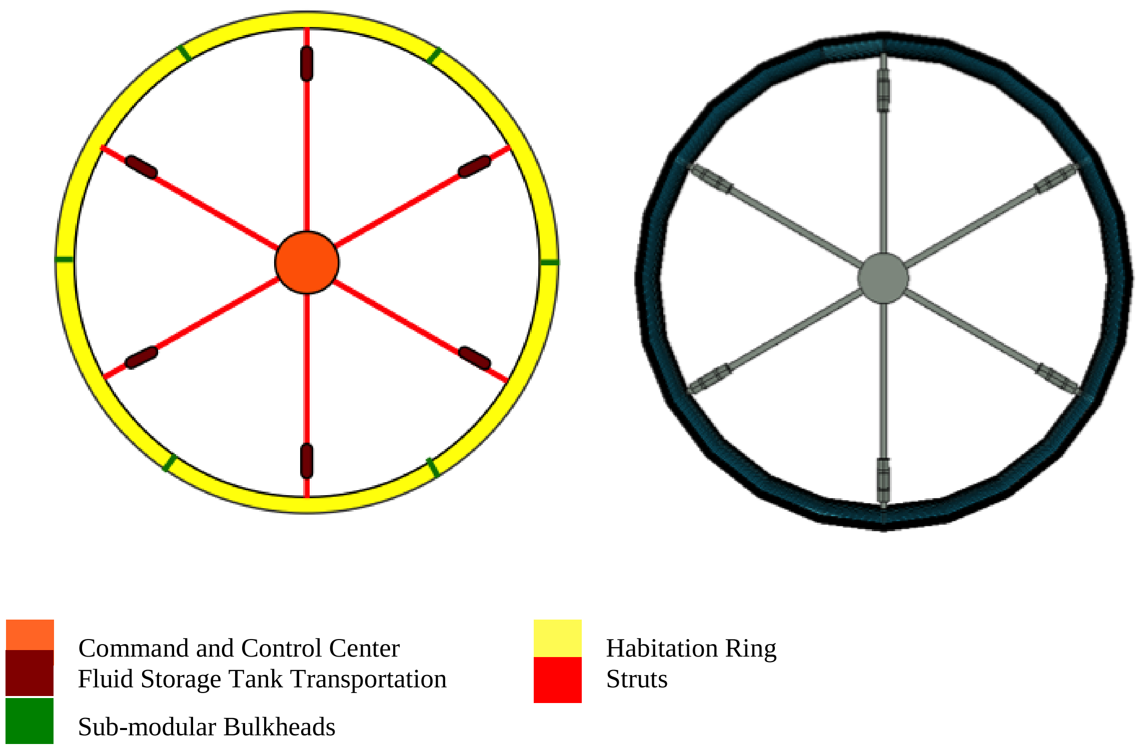


Rotating components will interface with the settlement via a mechanism such as the one shown below the blue areas are the electromagnets that suspend the rotating components to reduce extraneous friction. The red area will seal the interface from the vacuum of space. The brown Area represents the connection between the Non rotating and rotating components. To offload people, products, Ect. A platform will accelerate up to the speed of the Rotating component. While the platform and the rotating component are traveling at the same speed goods will be passed over. The platform will then slow down until it is not moving and goods can be moved to the non-rotating area.



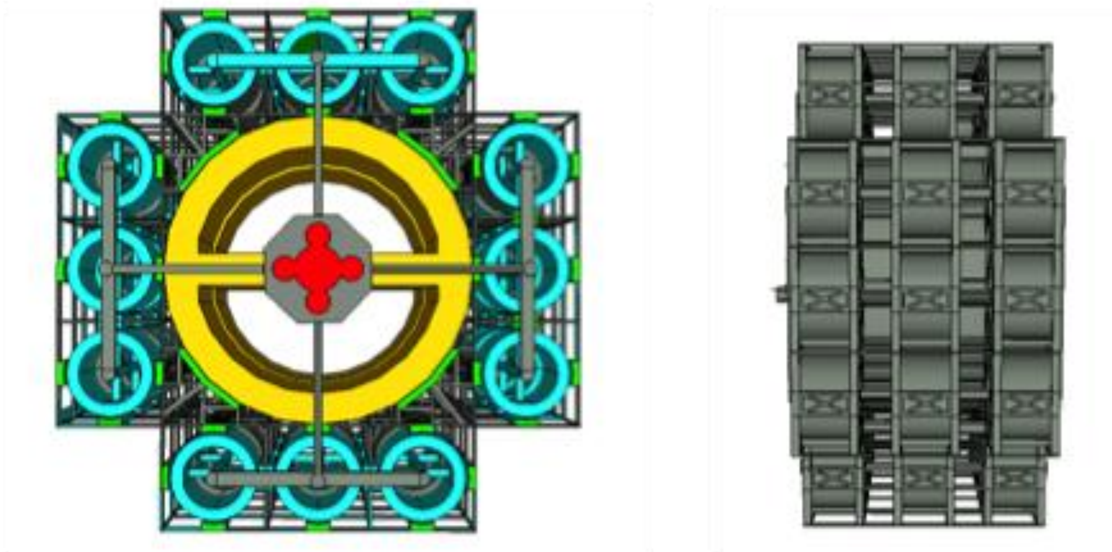
The port module is Aynah’s lifeline to Mercury, Earth, and the rest of the solar system. This module will allow for all of the function necessary to act as a port of entry for both the settlement and the surface of the planet. The cargo processing areas of the module will be the heart of the operation. Outgoing and incoming cargo will be received in the Shuttle Terminals; these facilities can also double as a shuttle maintenance area. The two inflatable storage units to the left of the central structure will be used for warehousing purposes. Because reardonium is a metal that is a commodity with extreme value (Company) has designed an interface for larger Crafts, located to the right of the main body of the module. To refuel Fusion Powered craft four fuel storage tanks are located at various areas on the module, the fuel is distributed via the Shuttle terminals and the Large Craft Interfaces. To prevent the entry of Dust and grit from the planets surface all shuttles will enter the port via the Particulate Removal Entrances. These entrances use Specialized Nano-Bots to remove particulates from the surface of the Shuttles.

Residential Module



The fourteen thousand occupants of Aynah will live, play and to a certain degree work in the Residential Module.The Module will consist of an outer habitation ring connected to a command and control center via six transportation struts. These struts attach the habitation ring to the Command and Control Center as well as provide a transit route from the ring to the central axis. Attached to each transpiration strut near the Habitation ring is a Fluid Storage Tank. These tanks will serve as a supplemental water reserve. The Habitation ring is internally split into six sub-Modules. These sub-Modules can function with complete independence. In the Unlikely event of a depressurization in a Sub-module, the two modules next to the module in question will seal their entrances to said module to prevent total depressurization. The command and control center will contain all network functions.

Industrial Module



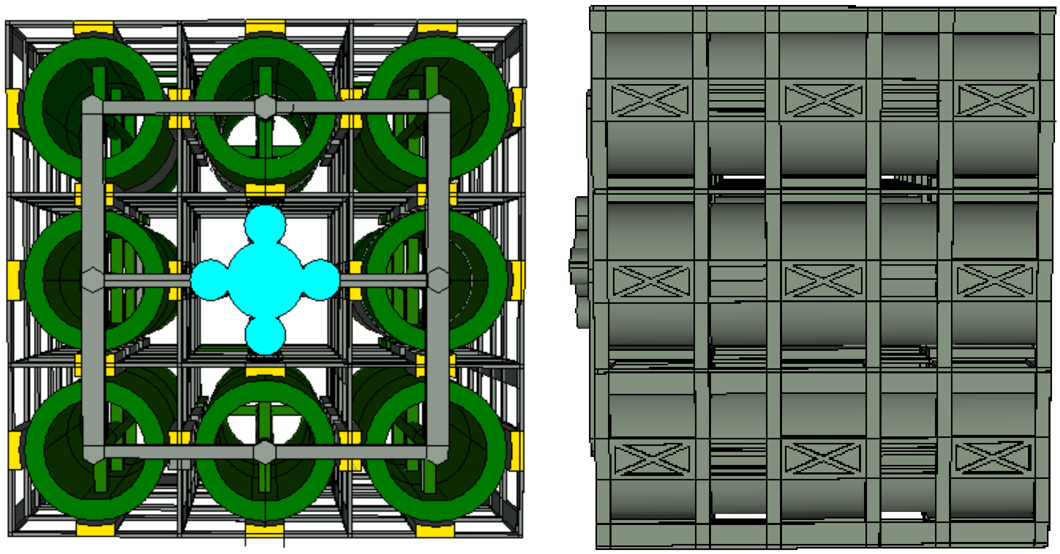
Central Axis
Small
Electromagnets

Large Reardonium Parts
Reardonium Part

Manufacturing Area
Manufacturing Areas

The Industrial Module will facilitate the mass production of reardonium Metal. Reardonium components that are bigger than 40 by 20 feet and up to 100 by 40 feet will be manufactured in the reardonium Parts manufacturing Area. This area is separated in to two independent manufacturing areas by a space of 40 meters. Each of these areas can spin at independent rotation speeds and pressures. Components smaller than 40 by 20 will be manufactured in the Small Reardonium Part Manufacturing Areas. Each row of these areas is separated into three separate units by a space of 43 meters. Each individual unit can operate at independent rotation speeds and pressures. The electromagnets will be used to initiate rotation in the manufacturing areas.

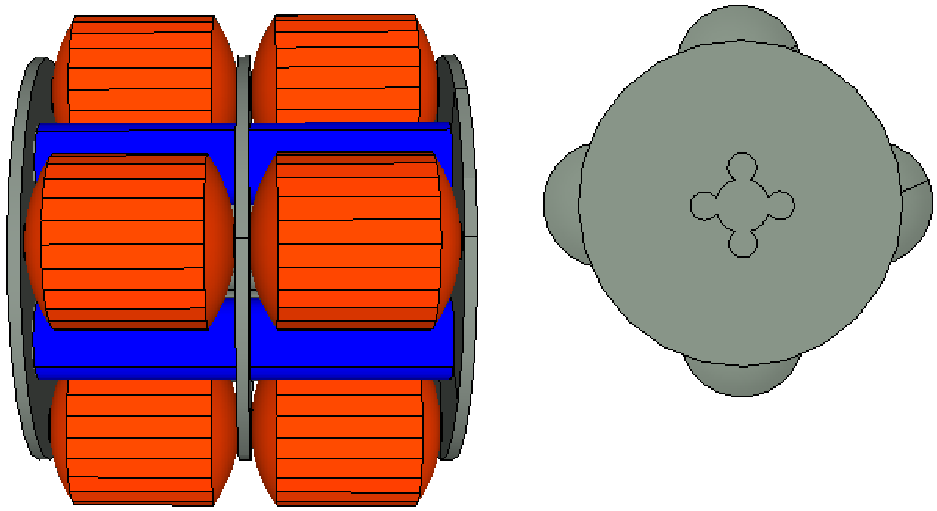
Agriculture Module



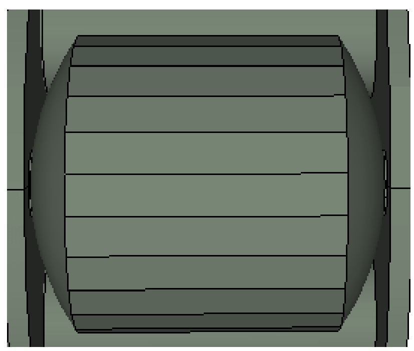
Agriculture Units Central Axis Electromagnets

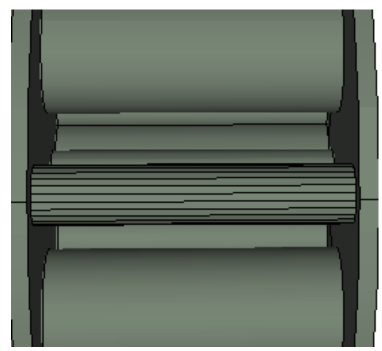
The Agriculture Module will provide the sustenance that is the lifeblood of any settlement. In this module all important stem cell meat and Aeroponics functions shall take place

Storage Module



Inflatable Storage Units Fluid   Storage Tanks





The storage module is used for storage. The placement of the storage module next to the residential ring is to facilitate logical goods movement. An item rarely goes strait off the supply ship to the consumer; it must first go into storage. A key technology of the Storage module was originally pioneered in the early part of the century. The inflatable storage units are based on the *Transhab* design proposed for the International Space Station and its descendants *Genesis I* and *II*. When in use a unit is filled with a gaseous solution comparable to earth atmosphere. The pressure of the gas will give the unit its rigidness. When the unit is not in use the gas is drained and placed in the Fluid storage tank. This design allows the storage sections to have atmosphere with out the waste of keeping them pressurized and running life support at all times. Further more in the event of a large lose of atmosphere; gasses from the storage module can be used instead. The units will be made of two layers of carbonanotubles woven with reardonium. The intermediary area will be filled with Areogel for insulation.

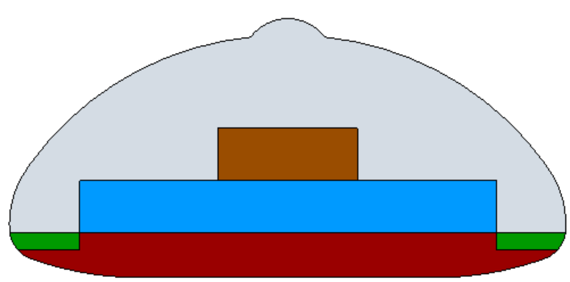
Rotating Component	Pressurized components
Residential Module • Habitation Ring* • Transportation Struts* • Fluid Storage Tanks* Industrial Module • reardonium Parts Manufacturing Area • Small reardonium Part Manufacturing Areas Agriculture Module • Agriculture Units	Port Module • Shuttle Terminal • Cargo Processing • Temporary Storage • Large craft Interfaces Residential Module • Command and Control Center • Habitation ring • Transportation struts Industrial Module • reardonium Parts Manufacturing Area • Small reardonium Part Manufacturing Areas Agriculture Module • Agriculture Units Storage Module • Inflatable Storage Units

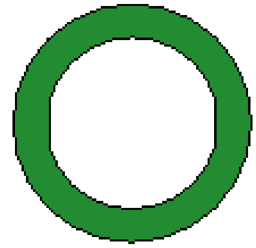
* Habitation ring, Fluid Storage Tanks and Transportation Struts are attached and rotate at the same rate, like a single components

Rotational Velocities		
Module	Velocity	Rational
Residential Module	1 RPM	This velocity provides a one G earth like environment for the occupants of the residential module. This level of gravity is need for childhood development.
Agriculture Module	0.26 RPM	This velocity will provide a gravity of 0.4 G. This gravity is optimal for the growth of plant life
Industrial Module	Variable	No velocity is set for the industrial module. Each of the Units of the Industrial modules can rotate at a different speed. This allows for a unique and variable gravitational condition to manufacture reardonium in.

2.2 Residential module

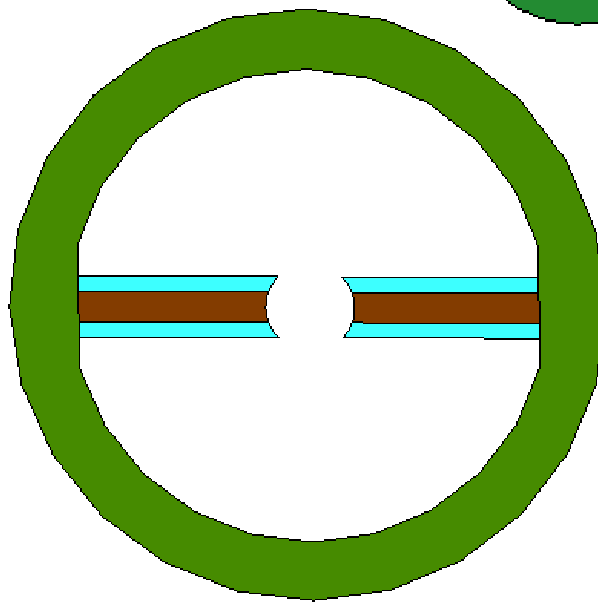
Operational Area- This area is dedicated to water treatment, waste management, atmospheric control, transportation and various other operational uses.
Green Space- These areas are dedicate parks, were Aynah residents reinvigorate themselves.





First tier- (Residential Area) Aynah Residents will live in this area enjoying a dynamic and pleasant environment.

Second Tier-(Commercial Area) this area is where all of the commercial functions including Schools hospitals and



Large scale Shopping facilities.
Small reardonium Part Manufacturing Areas
Gas Storage Areas- These areas are used to store atmosphere used to increase and decrease pressure for manufacturing purposes.

Reardonium Manufacturing Areas- This area is used for the refining and manufacturing of reardonium parts.

Large reardonium Parts Manufacturing Area

Reardonium Manufacturing Area- This area is used for the refining and manufacturing of large reardonium parts.

Gas Storage Areas- These areas are used to store atmosphere used to increase and decrease pressure for manufacturing purposes.

Agrarian Units

Agriculture Area- This area is used for Aeroponic production of Plants and the growth of in vitro meat.

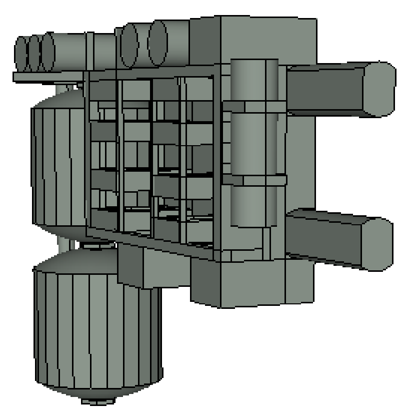
2.3 Settlement Assembly

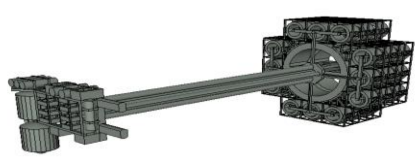
Stage 0: Building materials for the port module are transported to Mercury orbit, along with two OCVs (Orbital construction vehicles) and a communication satellite (Diameter: 16.8 meters) (Height: 34 meters)

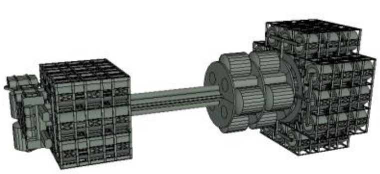
Stage 1: The port Module is constructed from initial materials and reardonium manufactured on the surface. The Temporary Storage areas in the port module will be taken from the storage components of the OCVs. In addition to the port module being constructed on square mile of solar panels to facilitate power generation and preliminary radiation shielding. At this point the OCV's will connect to the port module Via the Large Craft Interfaces. With the port module online reardonium from the surface and materials from other parts of the solar system can be received more efficiently. Command and control functions are carried out from the OCVs.

Stage 2: The central transportation axis and three square miles of solar panels is constructed.

Stage 3: The Industrial Module and two square miles of solar panels is constructed. At this point the area of the solar array is nine square miles. With the appropriate power provided the industrial section would come online. Industrial facilities on station are now able to produce components with dimensions up to 100 by 40.

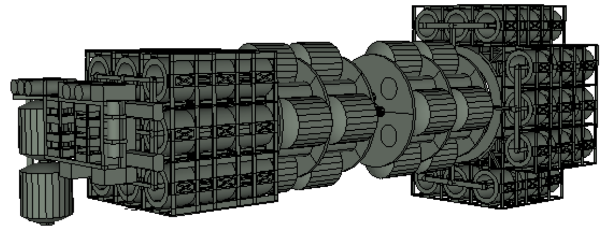




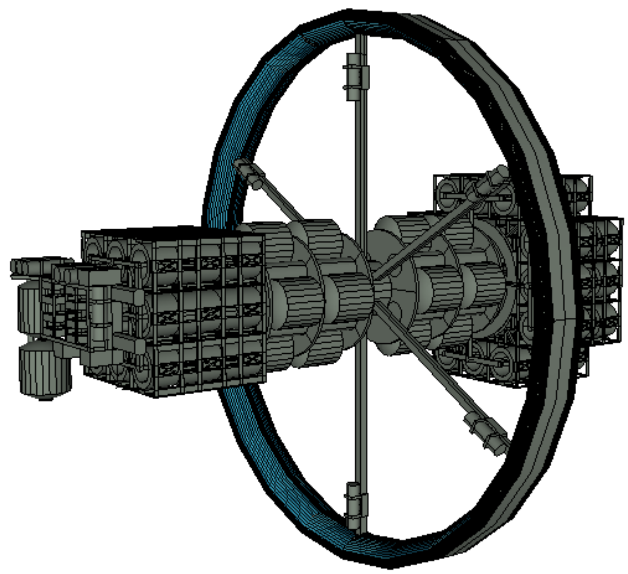


Stage 4: The agriculture module and the rear storage module are constructed along with two square miles of solar panels. The agriculture Module will come online and food will began to be stock piled in the Rear Storage Module

Stage 5: The Forward Storage Module is constructed along with two square miles of Solar Panels. This number brings the Solar Array to its full area of twelve square miles.



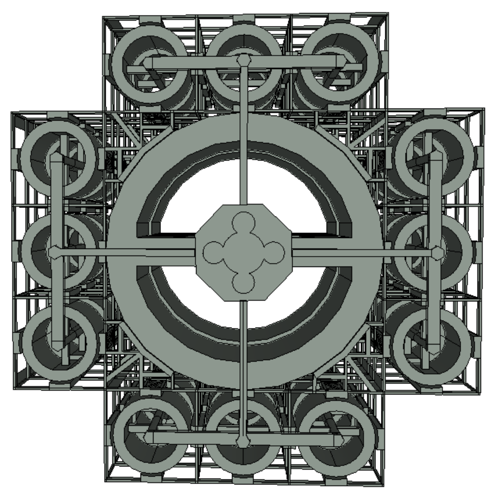
Step 6: The residential ring is constructed and brought online. Command and Control Functions are transferred to the Command and Control Center in the middle of the Residential ring. At this point the entire colony will go online.



Rotation will be initiated by two methods on Aynah, Ion drives and electromagnetic proportion. The First method, Ion Drives, is employed only on the residential ring. Two ion drives will be placed across from each other on the ring. The direction of thrust on each will be opposite of its counter part. When both engines fire simultaneous, Rotation is induced. The electromagnets are employed in the Industrial and Agriculture Modules. This method operates on the same principals as a Maglev. This method is used instead of Ion drives because it allows a variability of rotation Speed. By changing speed artificial gravity is altered, meeting requirements for variable reardonium manufacturing environments.

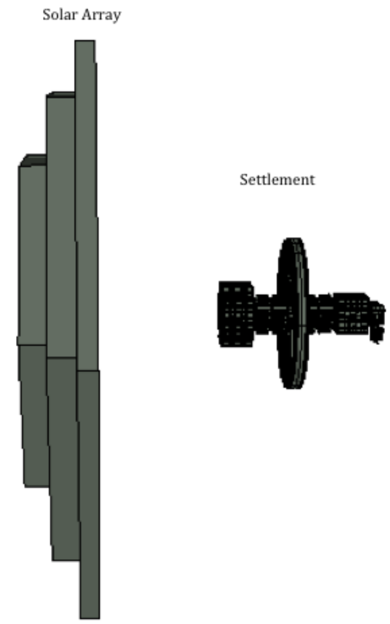
2.4 Manufacturing Areas

A variety of gravitational and atmospheric conditions will be provided in Aynah's industrial faculties. To create a variety of gravitational conditions Electromagnets are employed to cause the rotation of the industrial sections. Electromagnets allow speed variation and by effect gravitational variation. To allow a Varity of pressures tanks of atmosphere and compressor pumps will allow pressure to be increased and decreased at will.



2.5 Radiation Protection

To prevent harmful solar radiation from reaching the settlement, all residential areas will be covered with a 0.5M thick water shield. To combat Ionization from comic and solar radiation the water will de-ionize in deionization centers. Any energy gained from the process will be returned to the station.



Northdonning Heedwell

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OPERATIONS AND INFRASTRUCTURE 3

3 Operations and Infrastructure

Aynah will be designed such that the operations, basic infrastructure, and machine design will be both efficient and reliable. Construction materials and techniques will be innovative in addition to daily operations. Subsystems necessary for human life, mining, and station operation will be sustainable and cost-effective.

3.1 Location and Materials Sources

3.1.1 Location

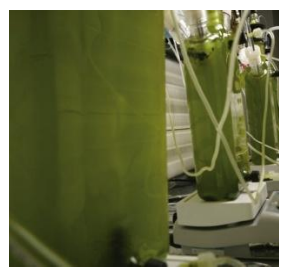
The station will be in a polar orbit around Mercury with an altitude of about 10 kilometers above the highest point on Mercury. The altitude was selected based on the equivalent altitude of satellites in low-earth orbit adjusted for the mass of mercury. The altitude of low-earth orbit is generally considered between 160 and 200 km, and the mass of Mercury is about 0.055 Earths.

3.1.2 Materials

Most construction equipment for Aynah will come from a previously built underground base on Mercury, especially reardonium metal, agricultural seeds, and stem cells for artificially grown meat, which will already be being used and produced. Once facilities on the space station exist for refining and shaping reardonium and producing in-vitro meat production, shipments from the underground Mercury base will cease. All other materials will be sent from Earth, including carbon nanotubes, non-reardonium electronics to be used in the station and on solar panels, non-structural building materials, such as aero gel for insulation, air, and water.

Item	Initial Necessary Quantity	Use	Place of origin
Reardonium	2,250,000 cubic meters	Structure	Underground Mercury Base
Steel	750,000 cubic meters	Structure	Earth
Agricultural seeds	14,280,000 seeds	Food production	Earth and Mercury base
Stem Cells	2,100,000 cells	Food production	Earth and Mercury base
Aero gel	150 cubic meters	Insulation	Earth
Water	800,000,000 L	Food production, radiation shielding, and residential uses	Earth
Nitrogen Gas	36,000,000,000 L	Atmosphere	Earth
Oxygen Gas	9,000,000,000 L	Atmosphere	Earth

Necessary Materials



Algae Vents

3.2 Community Infrastructure

3.2.1 Atmosphere

The composition of air will be similar to Earth, with about 80% nitrogen and 20% oxygen. Carbon dioxide will be converted back to oxygen quickly to prevent an uncomfortable buildup, similar to Earth. Air will be regulated in the system in a two-part process. Firstly, CO_2 will be converted to oxygen through genetically engineered algae separated from the rest of the station with semi-permeable membrar will allow air to pass through while keeping the algae and water inside. After the air is made breathable for humans, it will be purified of pollution and airborne disease.

3.2.2 Food Production

Food production will be divided into two sections: aeroponic agriculture and growing cultured meat. Both agriculture and meat production will happen at 0.25 G's to allow for quicker growth.

3.2.2.1 Agriculture

Fruits and vegetables will be grown through aeroponics. This means that roots will absorb water through the air. The agricultural section will be kept humid so root uptake will be equivalent to soil-based agriculture. 3.7 mL per cubic meter of water per day will be added continuously. Excess water will be trained. Temperatures will be optimized for each individual plant. Assuming current trends in agricultural efficiency, 2500 square meters will be needed per person. Ideally, 35 million cubic meters will be needed for total agriculture. 90 million cubic meters have been set aside for agriculture, allowing for machinery necessary for lighting, humidifying, and harvesting. 333,000 liters of water will be used per day in agriculture.

3.2.2.2 Cultured meat

Meat will be grown in vitro, allowing for healthier and more efficient growth. Stem cells will grow in a nutrient rich solution, allowing for rapid growth. The meat will be artificially exercised to grow desirable parts of the animal being grown. This method will also be healthier by having less fat and no disease. Per person, 200 mL of water will be used per person per day, producing 100 kg of meat per year per person. Accounting for the 14,800 people who will be living in or visiting the station, approximately 3,000L of water will be necessary for meat production. Growth will result from artificial exercises of the meat. Because of the versatility of the process, a wide variety of meat and fish can be grown.

Food Type	Method of growth	Amount
Fruits	Aeroponic	42,000 servings per day
Vegetables	Aeroponic	56,000 servings per day
Grains	Aeroponic	119,000 servings per day
Meats	In-vitro	350,00 servings per day
Dairy Products	In-vitro	350,00 servings per day

Table of Food Distribution

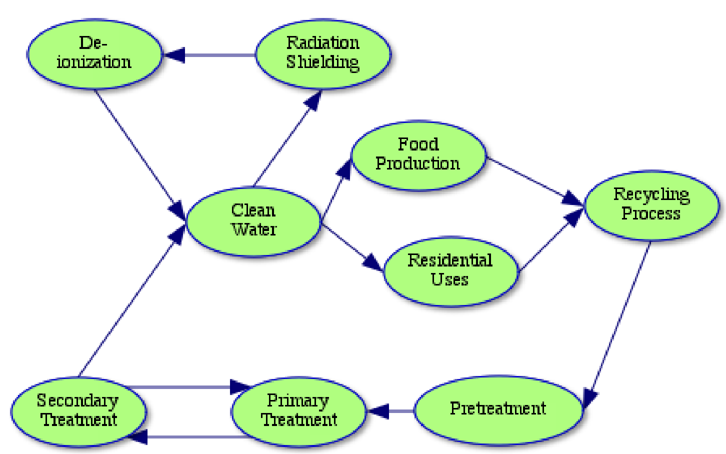
3.2.3 Energy Production

All energy for Aynah will come from nearby solar panels. There will be 86 separate solar panels, each having an area of 0.23 square kilometers per solar panel. Each panel will transport energy to the station through microwaves. Approximately 9.43 square kilometers will be devoted for non-industrial uses on the station, out of a total of 19.8 square kilometers. This will produce approximately 9 gigawatt hours of energy per day, before being transported. An average person uses approximately 10 kilowatt hours of energy per day, totaling 140 megawatts, leaving ample energy that can be lost through inefficiency in the microwave transport and intra-station power distribution systems.

3.2.4 Water Management

Water will have three primary uses on Aynah: shielding residential areas from solar radiation, food production, and residential uses such as drinking and showering. In total, 789,854,500 L of water will be needed. This will require about 5000 cubic meters of storage space, in addition to the space needed for shielding. The water shield protecting against solar radiation will consist of a 0.5-meter shield on the exterior of the station. Deionization systems will exist at the same places as wastewater treatment facilities. Shielding will require 784,845,000 L of water. 336,000 L of water will be used in producing food, including both growing aeroponic agriculture and cultured meat. Residential uses of water are expected to use 4,637,500 liters of water, or about 1,325 liters of water per household, the US average. Both clean water and wastewater will be transported through traditional plumbing systems. On-station water will be recycled completely so water imports will not be necessary.

3.2.5: Waste Management Filtering wastewater to drinking water consists of four separate stages, each with its own set of sub – treatments. Each stage filters out bacteria, grit, and waste from the flowing fluid, as well as chemically, biologically and physically alters the fluid as to return it to thoroughly purified drinking water. Pre-treatment removes materials that can be collected with ease from the raw waste prior to main treatment to avoid clogging and permanent damage to the pipes and plumbing in the filtration system, and to allow for more efficient filtering of smaller contaminants. During this process the sewage passes through several bar screens in order to filter out large solids, which will be transported to a separate waste container. This will be

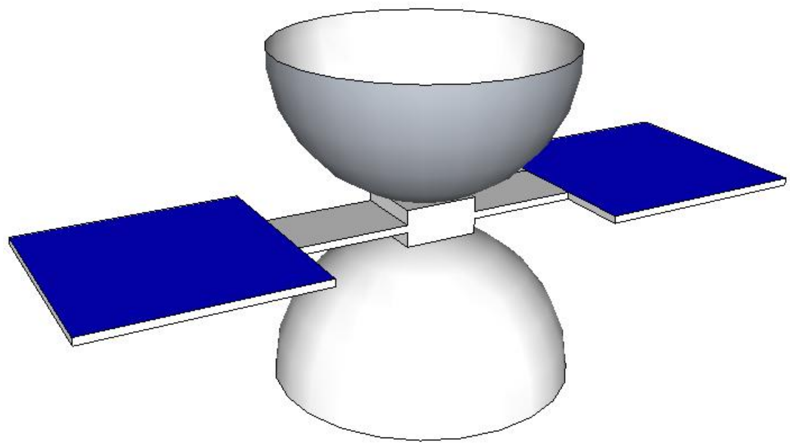


On-Station Water Cycle

done using automated machines to clean the screens of the waste. Varying sizes of mesh can be used to filter out as much solid waste as possible. Primary treatment then begins by allowing the sewage to sit in a quiescent basin so that the heavier solids will settle at the bottom while the lighter fluids may float to the surface. Fat and grease will be removed by passing the sewage through small tanks where skimmers collect fat that has surfaced or air blowers at the base of the tank to recover the fat as froth that will be useful for cultured meat production. This is followed by a secondary treatment stage that removes dissolved and suspended biological matter. This requires the aid of indigenous water-borne microorganisms composed of bacteria and protozoa spawned in a managed habitat and removed before water can be used. This will be added through a system of trickling filters, bio towers, and rotating biological contractors. Treatment works more efficiently with an equalized flow rate. To meet an efficient condition there will be multiple equalization basins for temporary storage of incoming sewage during any needed maintenance of other treatment machinery. These basins may also be used as a means of diluting and distributing discharges of toxic waste that might inhibit secondary treatment.

3.2.6 Communication Systems

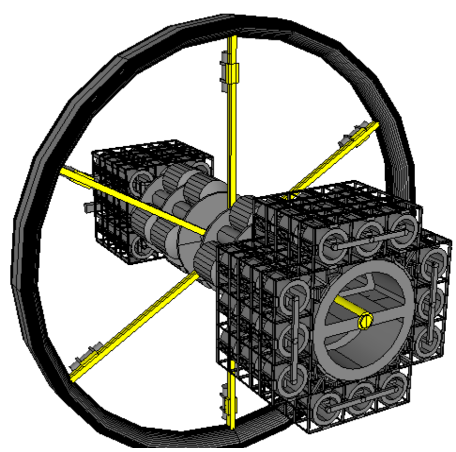
Communication in the station will be accomplished though a public hi-speed Internet system. Citizens can access the Internet at speeds up to 1 gigabit per second. A central hub will control the Internet on the station, and provide many online services. The system will branch out using fiber optics throughout the station to prevent bottlenecks and allow for greater efficiency. Communication with earth will be done with microwaves, with relay satellites to get the microwaves around the sun when Mercury is on the other side of Earth. Although Internet communication with Earth would be possible, many services would exist on the station to allow for easier communications. Each dish will be a reardonium semicircle with a radius of 20 meters. Although Internet communication with Earth would be possible, many services would exist on the station to allow for easier communications.



Communication Satellite

3.2.7 Transportation Systems

Although the station is designed so that people will not have to travel far in the station, maglev trains will exist so that people and supplies can be transferred quickly and efficiently from various sections of the station. There will be stations in each of the six main residential areas, in addition to branching out to the industrial, storage, and agricultural sections of the station



Maglev Trains

3.2.8 Day and Night Cycles

Day and night cycles will be timed so that there will be a 16 "day" and an 8 hour "night". Structurally, there are six main residential areas. These areas will be timed so that each area is four hours behind the last one. As one station goes into the night cycle, another will come out and a third area, physically between the two, will have another four hours of night. While during the night period, lights in public places will be dimmed but not turned off. Private areas will not be subject to the day night cycle, allowing residents to choose when to have their lights on or off.

3.2.9 Storage Facilities

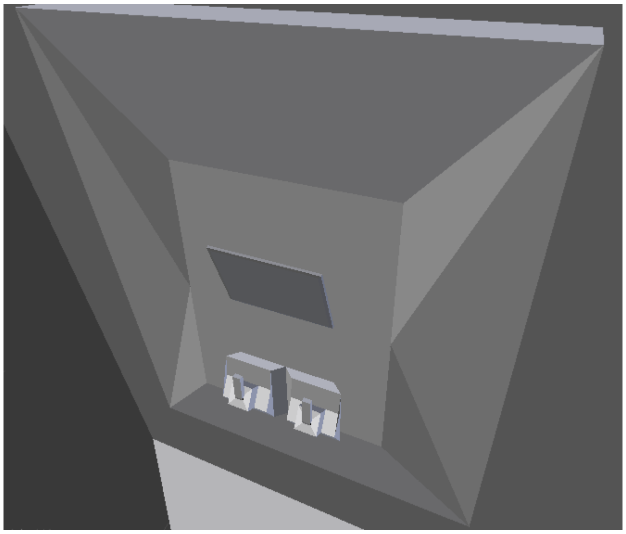
Storage facilities will exist so that both temperature and humidity can be controlled in similar ways as in agricultural production. Because of this storage system, that allows reardonium-weaved metal to expand or contract based on storage needs, a great amount of flexibility will be allowed for stockpiles. There will be 16 units of 1,903,794 cubic meters, totaling 30,460,704 square meters of potential storage space. The station is largely self-sufficient, so little storage space will be required for interruptions from Earth bound imports.

Item or need	Quantity
Oxygen	9,000,000,000 L
Total Air	45,000,000,000 L
Food	37840 Kg per day
Power	19 gigawatt hours per day
Water	800,000,000 L
Communication	3 satellites, 14,000 gbps internet access
Maglev Stations	8 stations

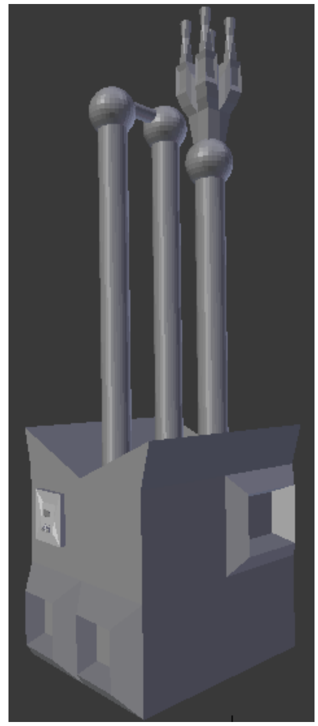
Total Necessities

3.3 Machinery

Large-scale machinery will be necessary to construct the major parts for the station. Reardonium parts will be able to be assembled in space, with large sheets being welded together to create the basic internal and external structure of the station. The process will be automatic for most general construction purposes, however humans can take control of the machinery for tasks that a computer program cannot handle. Electro-magnetic claws will be used to move and place the reardonium plates.



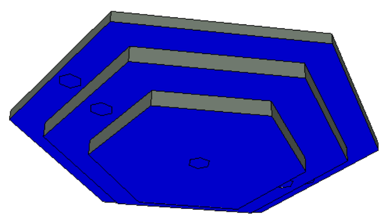
Control Panel



Assembly Machine

3.4 Reardonium Energy Production

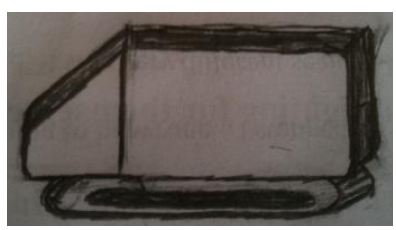
Foundation Society metallurgists have anticipated that approximately 10.36 square kilometers of solar panels will be necessary for producing all necessary reardonium. These solar panels will be provided in the same array of solar panels described section 3.2.3, which has a total of about 19.8 square kilometers. Specifically which panels are being used is not an issue, and the uses can be changed with ease because of the flexible microwave transfer system. The solar panels dedicated for reardonium production will produce approximately 9.8 gigawatt hours of energy per day, and will be used along the refining and production of reardonium ore and equivalent.



Solar Panel

3.5 Reardonium Production Transportation

Unrefined reardonium ore will be transferred on Mercury's surface using large, ground based units. Although slower, they are much more efficient, this is important because they are much farther from the rest of the station. The transporters will carry 25 metric tons, or 3.5 cubic meters. On Mercury, this will weigh the equivalent of 1.05 metric tons Mercury



Reardonium Transportation Robot

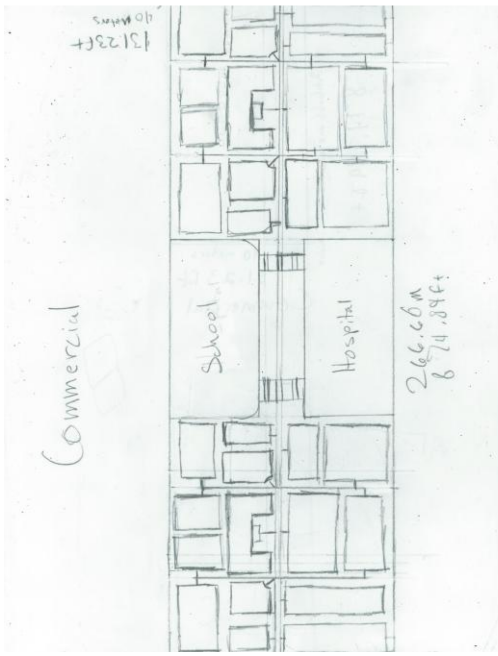
Northdonning Heedwell

Aynah

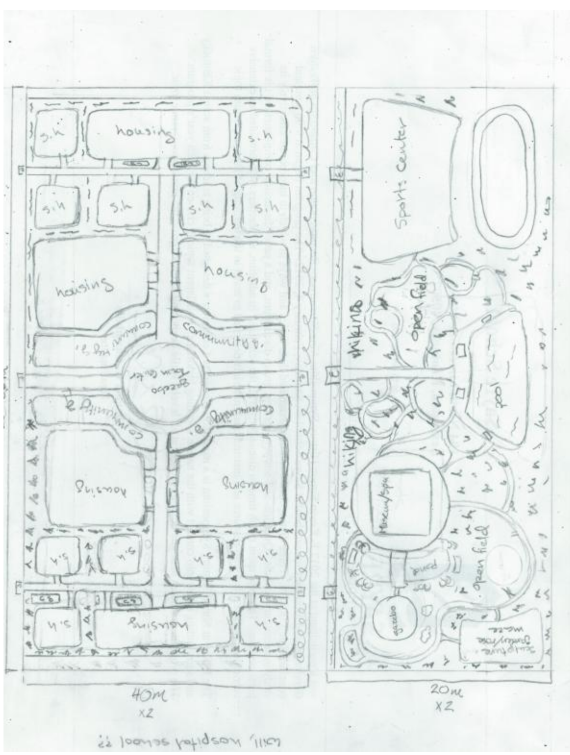
Human Factors 4

4.1 Community Design

Communities will be divided into six sections of the torus structure, each of which will be 266.66 meters in length and 160 meters in width, with about 10% of land space allocated to roads and pathways. Each section will have three tiers that will be assigned different main purposes, and each tier will be each tier 15 meters high so as to allow for buildings to be as tall at four stories.



The first tier will contain the Commercial District, which will consist of all the facilities found in most modern cities. In the center of each of these Commercial Districts there will be a Hospital, designed to accommodate any and all residents of its section, and a school, which will cater to the learning requirements of it's section from first grade through the equivalent of a college mastery. The Commercial District will also have shopping and entertainment, much like a modern day mall, and some job opportunities for residents. This will include, but is not limited to, opportunities such as movie theaters, restaurants, hotels, shopping areas, and other such commodities. The second tier will contain the Residential Section, in which will be located six main housing apartment blocks and 12 subsequent specialized housing blocks. (see section 4.2). These areas will be spacious and open, with some trees planted in order to give residents privacy and simulate a more calming and earthlike environment. Each of the main housing buildings will also have the space and opportunity to plant community gardens. Other food sources, such as meat, vegetables, grains, ect. will be manufactured inside separate modules so as to increase production in every way possible (see section 4.1.1). All other manufacturing and industrial jobs will be located inside the tier structure so as to maximize living space for residents, and can be accessed via elevators by residents. There will also be a maglev train that will run though out the torus, making each different section accessible to all people should they have the need. The final tier will hold the recreational component of each section, complete with, but not limited to, small parks, a swimming pool, a museum/spa, sports center, and trails for walking and hiking. Under its surface will be all the requirements for the everyday life of residents that are usually not seen, such as water, recycling, food distribution, and other such necessities.



4.1.1 Consumables

On Aynah residents will have the option of growing their own personal gardens that will provide them with an alternative method of acquiring food as opposed to getting it in the market, while at the same time making the station more earthlike. In addition this will allow for more oxygen to be produced inside the station and allow residents to save money at the grocery store. Residents will also have the option of purchasing food in the Entertainment section among a variety of shops. Vegetation will be grown via aeroponics utilizing an automated system to optimize growth rate. The station will use In Vitro meat and fish to save space and cut costs from raising animals. This will at the same time allow for higher control and production. Anything that can't be produced on the station (such as dairy products, condiments, etc.) will be shipped in and sold in the market. The station will produce a wide variety of dietary options to accommodate religious diets, vegetarians, diabetics, and other dietary restrictions.

Once produced or shipped the food will be stored in storage facilities outside of the habitat capsule. When it is needed it will be transported to the appropriate habitation capsule using a Maglev train. All vegetation and meat will be produced at start up from seeds and stem cells so that it will be ready for consumption and purchase when residents arrive.

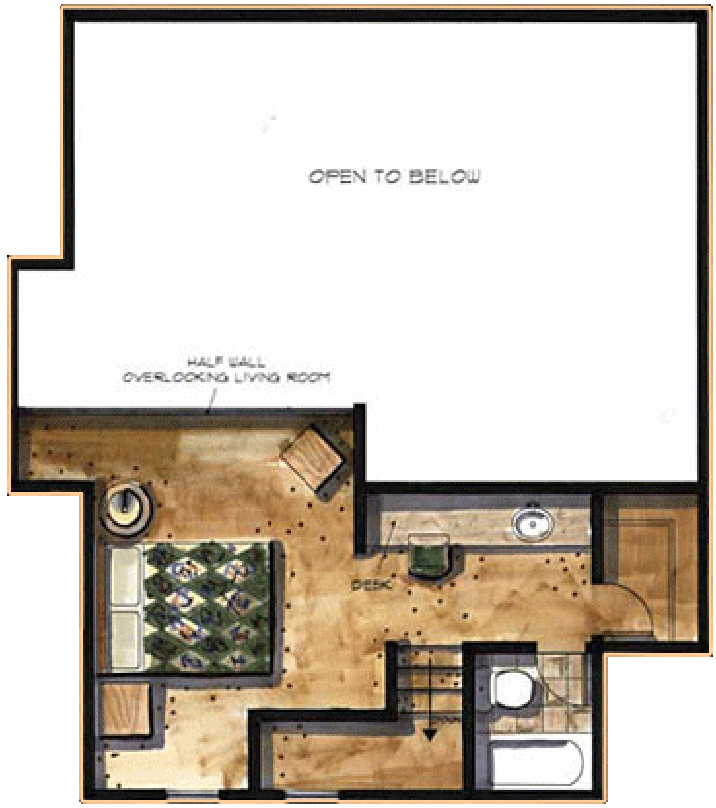
4.2 Residential Design

In each separate section of the torus design there will be two residential areas, each which will span 40 meters and be 266.66 meters in length, and will be connected by maglev-train and paths that pass through the commercial district. Each residential section will subsequently be divided into two mirroring parts, each with three main housing buildings and six smaller sub-housing buildings, and in the center of the section there will be a large gazebo structure in which two meetings, festivals, and celebrations can be held. Of the six main housing buildings, all will be t minimum four stories tall, but vary slightly in width and length so as us utilize the most pf the space available. The first four located closes to the gazebo will be 60 feet in length and 118 feet in with, and the two closest to the section walls will be 61 feet in length and 115.5 feet in width, allowing all residents ample room to live. The six main housing buildings will also have their own community gardens located outside for growing beneficial fruits and vegetables, which will be tended to and can be consumed by residents. In the main residential buildings there will be two choices of luxury apartments designed to fit the needs of all peoples, from single person residences to family units. The basis of the two main designs is an extended model of loft housing, so as to maximize use of given space and increase the perceived area of living by exposing the most amount of space through an open floor plan. The six smaller housing buildings will be a regulated 30 feet width and 110 feet length. In each of these buildings, six on each side, there will be two choices of housing for larger families or people with specialized needs. The floor plans for these two housing choices will be mirrors of the two floor plans above in shape, but will be completely open. Residents will be able to access programs so that they may design their houses to fit their own specialized needs before they arrive. However, to prevent people from taking advantage of this system, those who choose to live in these houses will need to be approved before the construction begins. Once they have been approved and have designed their floor plan, construction robots using lightweight panels, which will later be reinforced to ensure safety, will construct it quietly and efficiently.

Before people arrive at the space station they will be able to order furniture, which will range from various metals to wood in construction, all of which will be manufactured and made on the station, so as to be cost and time efficient. Residents will also be able to personalize their homes by selecting online their own wallpaper and household decorations. Residents may also purchase necessities such as cloths and cooking implements in their commercial districts, and if they may update their houses by donating their old decorations/furniture, which will be recycled and made into new pieces, and to buy new items.

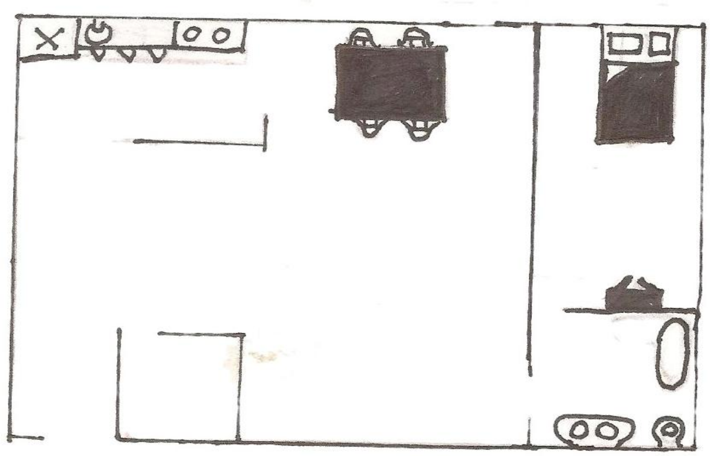
Standardized Housing 1

Standardized Housing 2



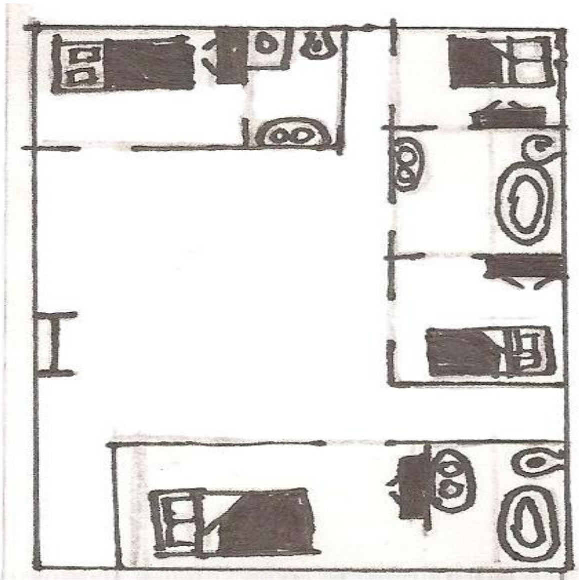
The six smaller housing buildings will be a regulated 30 feet width and 110 feet length. In each of these buildings, six on each side, there will be two choices of housing for larger families or people with specialized needs. The floor plans for these two housing choices will be completely open. Residents will be able to access programs so that they may design their houses to fit their own specialized needs before they arrive. However, to prevent people from taking advantage of this system, those who choose to live in these houses will need to be approved before the construction begins. Once they have been approved and have designed their floor plan, construction robots using lightweight panels, which will later be reinforced to ensure safety, will construct it quietly and efficiently.

Specialized Housing 1

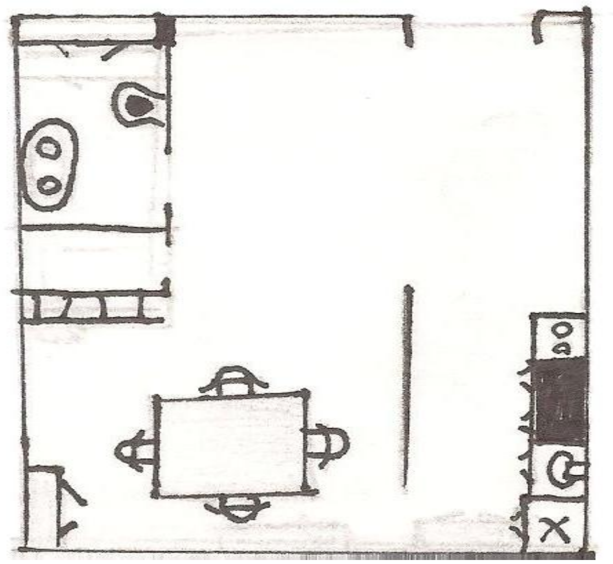


Specialized Housing 2

Floor 2

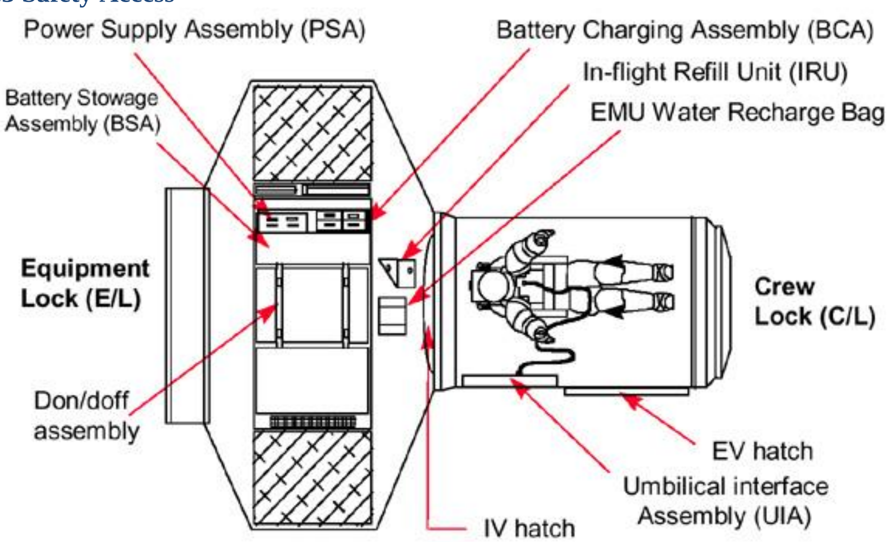


Floor 1

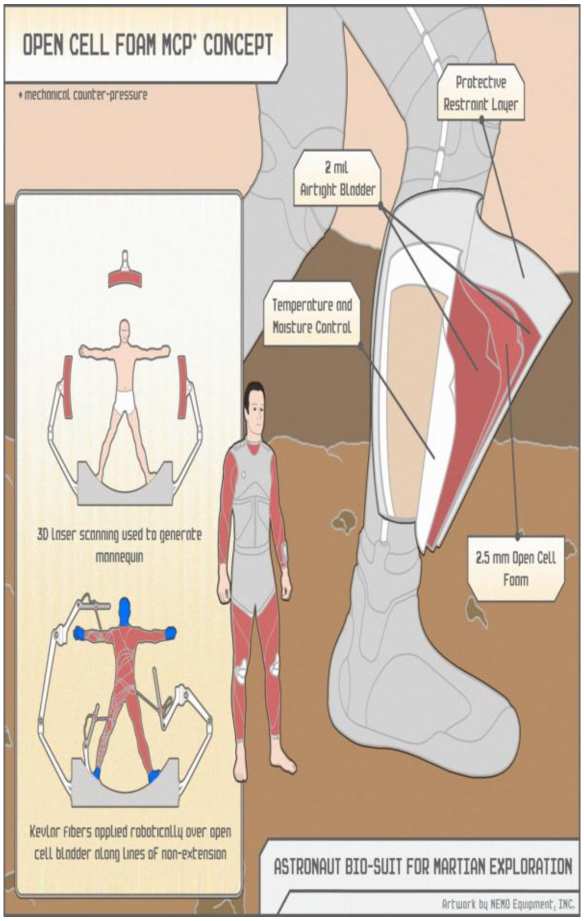


Before people arrive at the space station they will be able to order furniture, which will range from various metals to wood in construction, all of which will be manufactured and made on the station, so as to be cost and time efficient. Residents will also be able to personalize their homes by selecting online their own wallpaper and household decorations. Residents may also purchase necessities such as cloths and cooking implements in their commercial districts, and if they may update their houses by donating their old decorations/furniture, which will be recycled and made into new pieces, and to buy new items.

4.3 Safety Access



In order to exit the space station, individuals will go into the air lock, which will have two doors. The first door will lead from the station to the airlock and the second one will lead from the airlock to space. Safety systems will be installed to make sure that both doors can never be open at the same time. Individuals will need to go through facial recognition and retina scans in order to gain access into the airlock, so as to make sure that only authorized personal can get in. Once inside the airlock the door will close for safety and then they will be able to put on a space suit stored safely inside. Then a tether will be attached to the suit to secure the person to the inside of the airlock. Once the suit and tether are safely attached the room will depressurize to conserve oxygen. Then the second door will be opened and the person will be free to go outside the airlock while tethered using handrails. Once outside the airlock a second, longer, tether will be attached to the person, giving them free access to move outside. Once this second tether is secured the first one will be removed and recoiled by machines inside the airlock. Then the airlock will close. Once outside and tethered the person can use handrails to travel around the station. The tethers will be long enough to reach the next closest airlocks so that the person can re-tether there to go back inside or travel further.



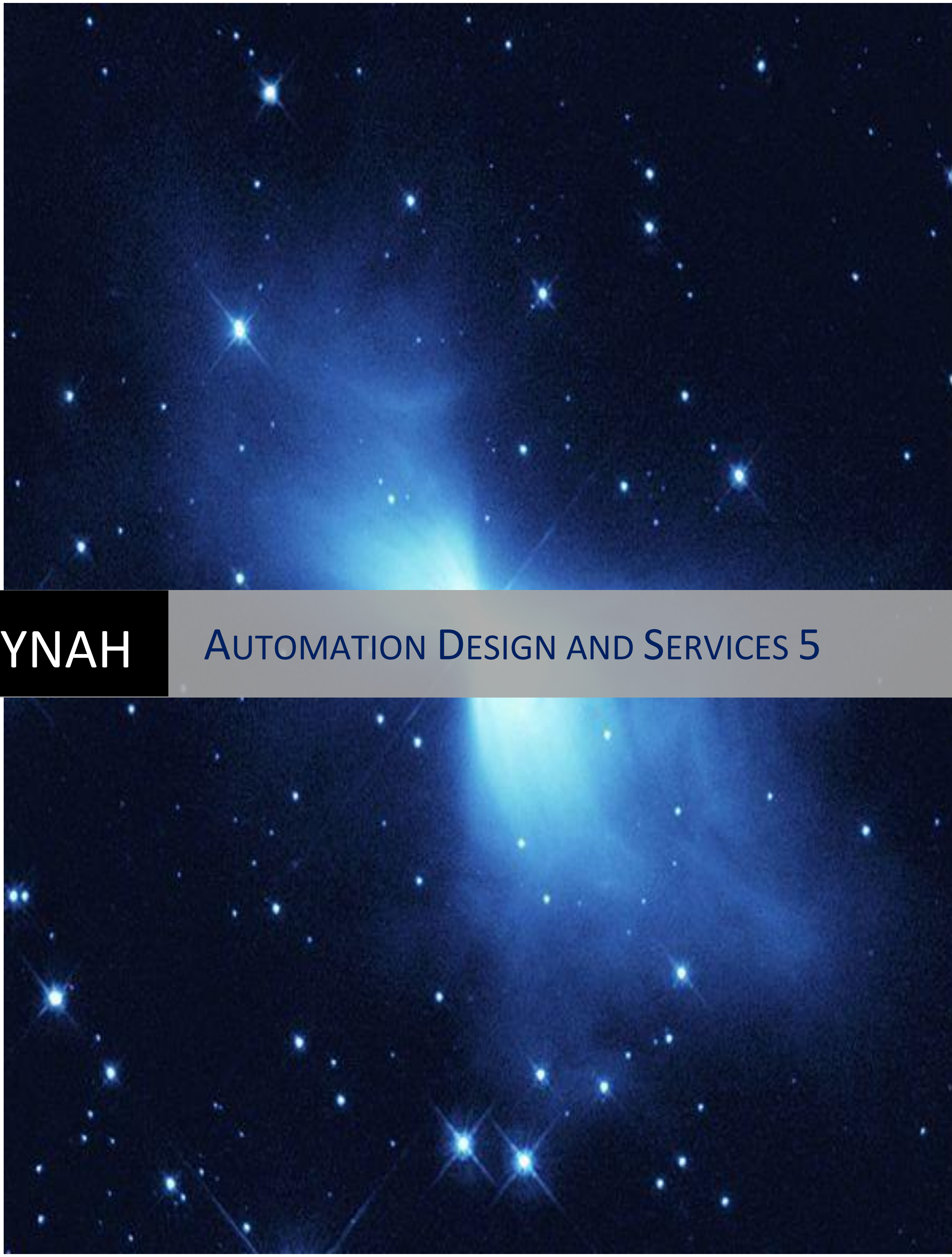
Spacesuits will be made of a mix of Kevlar and Reardonioum weavings. Because Reardonioumis radiation proof this will protect people traveling outside of the station and therefore the radiation shields. These will allow for smaller and less bulky space suits than is traditional. Underneath the layer of reardonium and Kevlar weaving will be an air system that will be able to constantly maintain the natural pressurization that human bodies are used to on earth. Under that layer will be a temperature regulation system that will be able to regulate body temperature. On the back of the suit will be a pack which will be were the astronaut can be tethered to the station and which will also contain the systems needed for life support and all other necessary functions for surviving in space. All vehicles, surface rovers, etc. will also have reardonium shields to make sure they are as light as possible while making sure they are still safe.

4.4 Gravity

For convenience and safety, all areas with human habitation will be in 1 g gravity.

4.5 Human Monitoring Vehicles

The surface vehicles will be heavy so that way they can traverse the crater filled mercury terrain, and at the same time reduce turbulence for people inside the rover. It will have all terrain tires so that way it can deal with the unstable terrain, and at the same time maintain a relatively constant velocity. It will have thick Reardonium shields to protect the interior environment. The typical vehicle will be about the size of the RV, and inhabitants of Aynah. The interior environment will be controlled, and like an RV will have everything the inhabitants need to go on multi-earth day expeditions without ever leaving the RV. Necessary robotic limbs will be added to the vehicle so that way mining can be done without humans ever leaving the interior capsule.



AYNAH

AUTOMATION DESIGN AND SERVICES 5

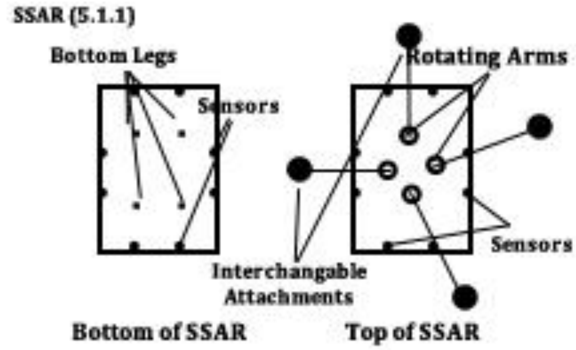
5 Automation design and services

Aynah will have access to state of the art automated systems utilizing the latest advancements in the field of technology. A myriad of automated systems and devises will be used to enhance livability for the inhabitants, provide efficiency in the numerous daily tasks to keep the settlement running smoothly, and provide safety for the structure and population.

5.1 Automation for Construction & Transportation

5.1.1 Construction

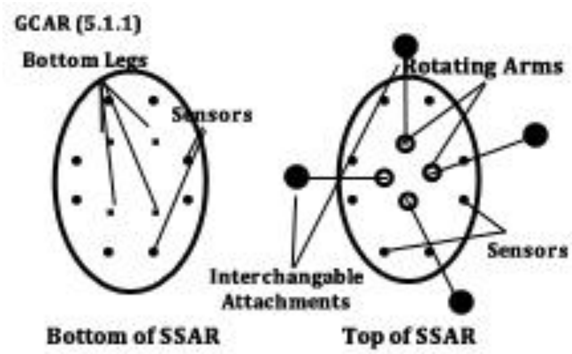
The construction process of *Aynah* will begin with a specialized Construction and Assembly Ship (CAAS). This ship contains all of the construction robots, the modules for the settlement, as well as smaller vessels to transport specific groups of robots and modules to specific locations. This ship will navigate using a three-dimensional sensory system and several layers of pre-provided astronomical data, which will be centralized in a Settlement Construction & Assembly Layout Blueprint (SCALB). After the main modules of the settlement have been transported from Earth and assembled in orbit around Mercury, robots will be released to complete construction. The different robots involved in construction and assembly are as follows:



Scaffolding and Skeletal Arrangement Robot (SSAR)

The SSAR is designed to specifically setup the underlying scaffolding network for the other robots, and for laying out the underlying framework of the settlement. The robot will have a main chassis in the shape of a slim rectangular prism. This will allow the robot to fit into smaller areas in the scaffolding. Extending from the main chassis of the robot will be four arms designed to let it climb on the scaffolding for ease of mobility. The other side of the chassis will have four arms placed in a diamond pattern. These arms will have claws, drills, jacks and numerous other attachments allowing specific steps to be performed simultaneously. The robot will be able to automatically change the attachments as needed. It will also be preprogrammed by the SCALB on appropriate time and usage of attachments. Sensors located throughout the robot will ping statusupdates to the CAAS. All functions of the robot will be powered by a large capacity Li-on battery.

The General Construction and Assembly Robot (GCAR) will be in charge of assembling the main interior and exterior components of the larger modules for *Aynah*. The robot will be designed to have an elliptical body with four segmented legs protruding from the lower half of the chassis. These four legs will be the primary form of movement for the robot. The chassis, on its upper side, will have four arms extending out. These arms will be designed to almost 'drape' over the robot. This configuration will allow the robot to operate in a 360º radius. These arms will have jacks, claws, drills and numerous other attachments allowing specific steps to be performed simultaneously. The robot will be able to automatically change the attachments as needed. It will also be preprogrammed by the SCALB on appropriate time and usage of attachments. This robot, much like the SSAR, will have sensors located throughout its body, which will continuously ping status updates to the CAAS concerning construction progress. This robot will have all its functions powered by a large capacity Li-on battery.



General Construction and Assembly Robot (GCAR)

5.1.2 Transportation

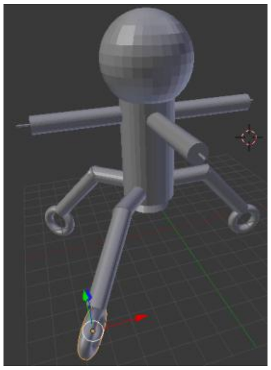
Cargo and Human Transport Ship

The Cargo & Human Transport Ship (CHT) will transport all the settlement modules, components, and robots to Mercury. The ship will be 2640 ft. (804 m) in length, and 1320 ft. (402 m) tall. The ship will also contain within it the CAAS (see 5.1.1). The ship will depart from Earth and arrive at Mercury in approximately one year. The Unloading of all the modules and other components required for construction is estimated to take one week to unload. Once unloaded of all its cargo, the ship would return to Earth, and bring back the initial settlers of *Aynah*. *Aynah* will be fully assembled and ready for occupation upon the arrival of the settlers. The robots in (5.1.1) will complete all stages of assembly and construction.

5.2 Facility Automation

5.2.1 Maintenance

The automated maintenance and repair robot (AMRR) is designed for a variety of tasks to increase efficiency and variety in the tasks it can perform. The 1.2192 meters tall cylindrical body with a diameter of 0.3048 meters is designed to act as a temporary holding place for trash and other things picked up by the vacuum attachment at the bottom. Waste will then be transported to a designated area in the settlement for disposal. The spherical feature at the top of the AMRR will be used to transport and distribute nanobots through the holes in the arms of the AMRR. Utilizing recent advancements in the field of claytronics, these nanobots are capable of attaching to one another to form the ultimate multi-tool. These modular reconfigurable robots are made possible by software that controls electromagnetic attraction and repulsion between the nanobots to create one working system from many of them. Other uses for these nanobots can be seen in their role of detecting and repairing small cracks in the station. Once distributed by the AMRR, nanobots will be able to disperse and repair what is needed.

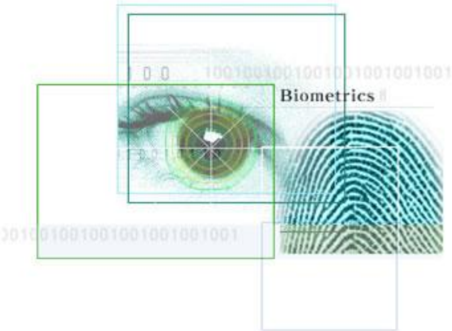


Automated Maintenance Robot (AMRR)

The same method will be applied to the repair of external malfunctions. For protection from the extreme solar environment and solar flare activity, nanobots will be manufactured using Reardonium. In this way, they will be able to find and perform external repairs safely.

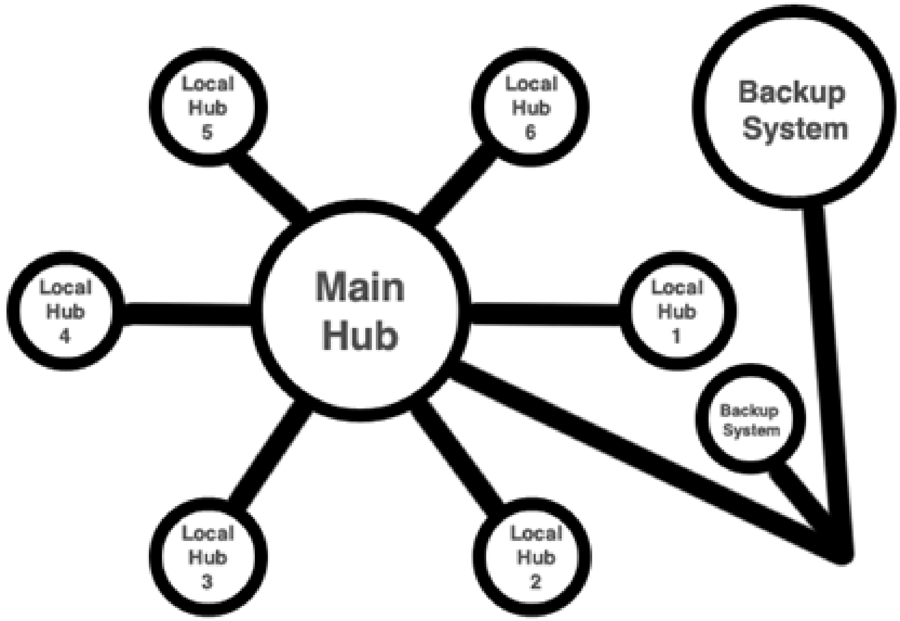
5.2.2 Security

Security on Anyah will be of upmost concern. Every measure will be taken to provide safety to the residents while not invading their privacy or taking away from their quality of life. Biometrics will be used as a method of protecting access to areas as well as systems to which many residents will not legally have access to. Via this method we will be able to detect finger prints, use facial recognition, and use other futures to prevent illegal access. In addition, security cameras will be placed in all secure locations to monitor behavior of those who have clearance to be in those areas and further reassure the first system was not breeched.



5.2.3 Backup Systems and Contingency Plans

Aynah has full backups of its entire network structure, and also has reserve power sources for the settlement. The network backup is split into two different sections, a backup of personal data from the residents and workers of the settlements. The other part of the backup is of the system that runs the settlement. These two backups will be disconnected from the network and backed up daily.



Network and backup system

5.3 Habitability and Community Automations

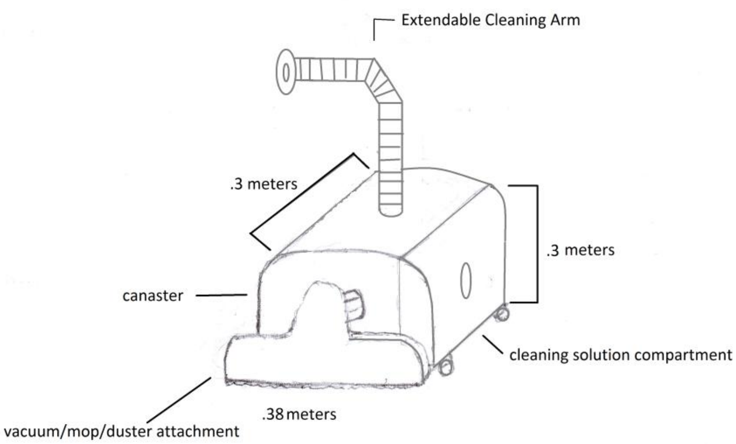
5.3.1 Personal Electronic Devises

To enhance livability on Aynah, residents will be equipped with a wearable gestural interface capable of performing all of the tasks of a laptop, cell phone, and watch. Residents can use these systems for work, games, music, education, and other practical or entertainment uses.

Wearable Gestural Interface

5.3.2 Janitorial Robotics

Residents will also have access to janitorial robot capable of performing various tasks around the household including vacuuming and cleaning various objects and spaces. These Automated Home Maintenance Robots (AHMRs) will be assigned to each community housing unit and can be requested by the inhabitants to facilitate clean and comfortable living. The robot will host two storage tanks: one for waste and one to hold a multipurpose cleaner. Both sections will have a gauge to tell the robot to go to designated areas for disposing picked up debris and refill on the multipurpose solution that will be provided. In addition to the main cleaning attachment at the front of the AHMR (capable of mopping, dusting, and vacuuming) there will be an extendable arm with a cleaning attachment for higher surfaces and small objects.



AHMR

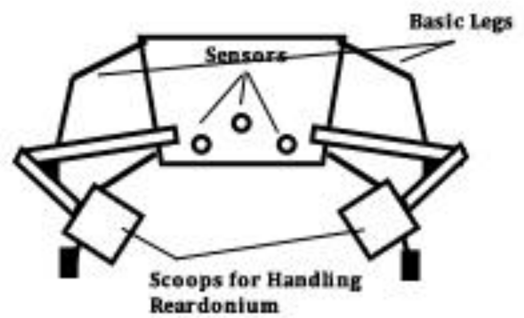
5.3.3 Networking and security

For safety, all robot activity will be monitored and recorded in a control room. In addition AMRRs will not be given the ability to run in the presence of humans. For the convenience of the inhabitants, Aynah will provide its residents full high-speed Internet access, with speeds of up to 1 gigabit per second in each household. For added security, computers will be equipped with an operating system resembling the modern day UNIX OS in conjunction with all required passwords consisting of numbers, letters, and punctuation. The Network will be controlled from a central hub in the settlement, and will branch out to the different sectors of the settlement, ensuring a reliable connection (see diagram above). Aynah will communicate with Earth via X-Ray satellite using it to send and receive data with earth. There will also be a separate, highly secured network accessible only to any government organizations on the settlement. The overall bandwidth of the settlement will be 500 gigabits per second for the convenience of the inhabitants.

5.4 Reardonium Manufacturing and Handling

5.4.1 Reardonium Processing Robot

The Reardonium Processing Robot (RPR) This robot will have main chassis in the shape of a rectangular prism, and will have four wheeled for basic movement. The robot will also have to forward facing arms equipped scoops to pickup loads of the cured Reardonium. Once the Reardonium is mined, the robot will place it in a cargo bay located on the back of the robot.



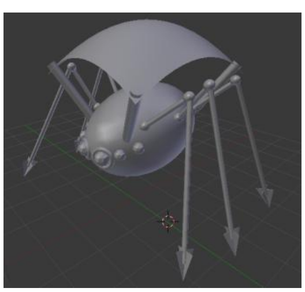
Reardonium Processing Robot

5.4.2 Curing & Manufacturing of Reardonium

The Reardonium, once transported to *Aynah*, RPRs will transport small loads of Reardonium, using the scoops and cargo bays mentioned in 5.4.1, to maglev trains on the settlement for long-term transportation. These same RPRs will transport the Reardonium between different points of curing and manufacturing.

5.5 surface robots

5.5.2 Arachnid-Type Scavenging Robots (ATSRs)



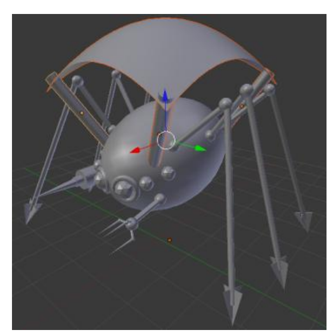
Arachnid-Type Scavenging Robot

For finding reardonium on Mercury, small (approximately one cubit centimeter) robots will be used. These robots will be able to crawl into the ground using the pointed tips on their legs to dig and search for reardonium.

Utilizing this design from natural sources, ATSRs ATMRs will be sturdy, lithe, and versatile. They will be equipped a solar shield which they can curl their legs under when a sensor they will be outfitted with detects increased radiation.

5.5.2 Shipping and Unloading Reardonium Parts

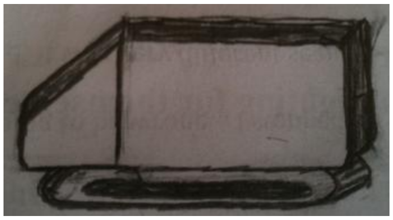
On Aynah, it will be necessary to have robots for shipping reardonium parts to and from Mercury. Several automated system have been designed to facilitate the ease and efficiency in these processes. Mining robots will be equipped with mandibles where they will be able to scoop up amounts of reardonium and bring it to the surface or curing. For convenience and cost effectiveness, these Arachnid-Type Mining Robots (ATMRs) will also be able to use their front arms for grasping and turning over reardonium during the curing process. ATMRs will also be able to load cured reardonium on and off the CHTs as well as Automated Land Cargo Transport Vehicles (ALCTVs) so they can be transported to Aynah for processing.



Arachnid-Type Mining Robots

5.5.3 Automated Land Cargo Transport vehicle (ALCTs)

ALCTVs will work by detecting a signal from ATMRs. When the ATMRs are curing enough materials to fill the ALCTV, they will send a signal to the vehicle and it will locate their position. It will be equipped with a sensor to tell it when it is full, at which point, the ALCTV will go back to the port where CHTs are waiting to transport the goods back to Aynah. The first generation of ALCTVs will have a lead coating to protect them from radiation and in extreme heat; they will have ability to travel back to the port for cover. The next generation will utilize Reardonium in its design for further protection from solar activity. Other aspects of the ALCTVs include a tread system instead of wheels for navigation on rough terrain. The Automated Land Cargo Transport Vehicles will also be responsible for transporting ATMRs and ATSRs.



Automated Land Cargo Transport Vehicle

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AYNAH

SCHEDULE AND COST 6

6.1 Schedule

	2077		2078		2079		2080		2081		2082		2083
Event	*May-*	*Nov-*	*May-*	*Nov-*	*May-*	*Nov-*	*May-*	*Nov-*	*May-*	*Nov-*	*May-*	*Nov-*	*May-*
Contract Awarded	8-May												
Research/ Development	2yrs	>	>	>	/								
Construct initial robots: mining , construction, and farming					2yrs	>	>	>	/				
Prepare Seeds and Meat Invitro													
Prepare/ Harvest Water								6months	/				
Prepare materials needed besides Reardon Metal						1.5 yrs	>	>	/				
Send Robots to Mercury									3months (may-aug)				
Initial Mining									3yrs	>	>	>	>
Envoy to Mercury										3months (nov-feb)			
Construction of Factories											2yrs	>	>
Refining of First Resources												1.5 yrs	>
Manufacturing of Reardon Metal													1yr
Construction of Aynah													1yr
Construction of Agriculture Center													1yr
Build more Bots													
Build more Factories													
Interior of Agriculture													
Interior of Aynah													
Pressure and Gravity													
Agricultrue Activated													
Send # of workers needed to start operations													
Deatiled Instilation													
Tweaking													
Infastructure Comeplete													
Rest of Population arrives													
Make yourself at Home													
Party													
Settlement Operations													

6.1 Schedule

		2084		2085		2086		2087				
Event	*Nov-*	*May-*	*Nov-*	*May-*	*Nov-*	*May-*	*Nov-*	*May*	*Future*	...	...	...
Contract Awarded												
Research/ Development												
Construct initial robots: mining , construction, and farming												
Prepare Seeds and Meat Invitro												
Prepare/ Harvest Water												
Prepare materials needed besides Reardon Metal												
Send Robots to Mercury												
Initial Mining	>	/ future										
Envoy to Mercury												
Construction of Factories	>	/ to future										
Refining of First Resources	>	/ to future										
Manufacturing of Reardon Metal	>	/ to future										
Construction of Aynah		/										
Construction of Agriculture Center		/										
Build more Bots		1yr		/								
Build more Factories		1yr		/								
Interior of Agriculture		1yr		/								
Interior of Aynah		1yr		/								
Pressure and Gravity				.5yrs	/							
Agricultrue Activated				.5yrs	/							
Send # of workers needed to start operations					3months(nov -feb)							
Deatiled Instilation					1 yr		/					
Tweaking					1yr		/					
Infastructure Comeplete							now					
Rest of Population arrives							3 months					
Make yourself at Home							feburary					
Party							feburary					
Settlement Operations							feburary	>	future			

Raw Materials	Material	Cost per unit	Column1	units needed	Total Cost (millions)
	Reardonium	0	per qubic meters	2,250,00	0
	Aerogel	$300	per pound	60,000	18
	Carbon nanotubes	$100,000	per Square Meter	1,394,544	139454.4
	Steel	$150	per Qubic Meter	750,000	112.5
	Water	0	Per Liter	800,000,000	16
Total					139600.9

Salaries

	Job Type	Job	Annual Salary	Man-years	Total (Millions)
	Engineers	Design	80,000	1,000	80
		Automation	95,000	200	19
		Rockets/ Transportation	85,000	500	42.5
		Operations	75,000	325	24.375
		Agriculture	75,000	400	30
		Biological	70,000	300	21
		Electrical	90,000	250	22.5
	Researchers	Societal	60,000	100	6
		General	70,000	20	1.4
		Medical	90,000	150	13.5
	Management	General Management	125,000	320	40
		Engineering Management	120,000	100	12
		Public Relations	120,000	100	12
	Misc.	Facilities Upkeep	30,000	100	3
		Communications	60,000	50	3
		Astronauts	170,000	600	102
Total				4515	432.275

Transit Costs

	Location	Transit Type	Price		Amount	Total Cost (Millions)
	Earth Orbit to Mercury	Initial Envoy: Personnel	200,000	per person	350	70
		Initial Envoy: Equitment	3,000	per kg	17,500,000	52,500
	Earth Orbit to Mercury	Final Population	200,000	per person	14,000	2,800
Total						55,370

Equipment Costs

	Category	Type	Price (Millions)
	Robotic	Electronics	35
		Motors	45
		Misc. Parts	150
	Agriculture	Minerals	10
		Aeroponics	120
		Misc.	45
	Instruments	Communications	110
		Computers	560
		Radar	20
		Scientific	1,500
	Other	Ion Thrusters	18,000
Total			20595

Total Cost

	Area	Cost (Millions)
	Raw Materials	139600.9
	Salary	432.275
	Transit	55370
	Equipment	20595
Total		215998.175

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BUSINESS DEVELOPMENT 7

7 Business Development

In order for Aynah to be successful it is absolutely essential that businesses develop with the settlement. In particular, Aynah will have to able to mine Reardonium in a profitable fashion. In order to do so, from the very inception of Aynah, we will be planning to have the facilities to promote businesses as they develop. This includes both the anticipated mining facilities and any other unanticipated economic activity that develops to support Aynah and related mining operations.

7.1 Infrastructure for refining and manufacturing Reardonium Parts

The Raw materials will be brought onto the station in the port module. They will then be prepared for transportation via the maglev through the center of the settlement in 80 by 40 Feet containers. The containers will be specifically designed to be air tight so that no reardonium or other materials such as dirt, grit, etc. will pollute non-industrial areas.

Once the Reardonium containers arrive in the industrial module they will be taken to airtight processing centers where they will be processed. All manufacturing operations will take place in the industrial module.

7.2 Receiving and Shipping Reardonium Parts

Once the product is ready for shipment off the settlement, they will be transported back to the port. From there they will be processed for shipping to their respective destinations. There will be a port authority that will be responsible for making sure that all of the incoming reardonium is up to quality and that all outgoing products meet colonization society standards.

They will all be shipped out in solid reardonium containers.

There will also be a shipping center on Aynah that will sort all parts into appropriate containers on appropriate shuttles for shipping. The colonization will hire people to do this, and will develop revenue from this venture by adding a charge to the finished project to raise revenue from the markets where the final project is sold.

All products will be shipped to markets in solid reardonium containers. Once they have been shipped there the containers will then be shipped out. The freighters would then use the liberated room to ship all materials that Anyah cannot provide for themselves. The colonization will then sell all of these other products for a small but sustainable profit back to the settlers of Aynah.

Shipping Containers such as these will be made from reardonium

7. 3 Port of Entry for Mercury

The colonists will operate a fleet of shuttles that will transport reardonium to and from the society. This fleet will be mostly light crafts that will have a crew of two or three with the rest of the space devoted to being able to carry cargo.

There will be a larger interplanetary fleet that will include large, or “tankers” that will carry large containers of finished product back to markets off the settlement. These vessels will be large and will have adjustable, multipurpose cargo spaces so they will have the ability to carry a variety of products back to Aynah when they are returning from the various markets.

7.4 Refueling Station for Future Expeditions

In addition to Aynah serving as a port for shipping all of Aynah's reardonium products to markets, it will also serve as the primary port for all expeditions inside of Mercury's orbit, and closer to the sun. Since these will also require extensive shielding, and reardonium is the "Miracle Metal" capable of producing the necessary shielding for space vehicles as they get closer to the sun, Aynah will also serve as a hub where ships can come to get outfitted with reardonium shields for future missions. Since it will be relatively cost-effective to outfit all of these ships with the reardonium shielding on Aynah instead of shipping it back to earth, the colonization society will be able to develop a low-overhead, high profit reardonium shielding outfit industry that is a win for consumers in that they will be able to get the shielding at a lower cost then further away from the mines, and a win for Aynah because it will develop an outfitting business that will be profitable over the long term, and will develop a bunch of support industries for outfitting expeditions in addition to reardonium shielding.

All expeditions beyond Mercury will be outfitted on Aynah.

7.5 Robotics Industry Development

Due to the harsh conditions of Mercury, a lot of the surface mining operations will need to be carried out by robots. Because over time we will transition to solely reardonium shielded robots it will be cost-efficient to create them on Aynah. The mining bots will be made on Aynah. Because robots that are able to withstand incredibly harsh conditions have applications outside of space exploration (i.e. fire rescue on earth), we can create reardonium shielded robots to ship back as a finished product. It will be more cost-effective to create them en-masse with the mining robots, and then ship them, so we will be able to build them at a lower-overhead then elsewhere, and provide them at a reasonable cost to consumers while still making a profit.

7.6 Services Industry

In order to support the 14,000 people that compose the permanent population and the 200 person guest population, it will be necessary to have a full-range of services for the people of Aynah, such as hospitals, luxury goods, entertainment, etc. These can be sold to the settlers for a profit, and will result in the development of a services industry.

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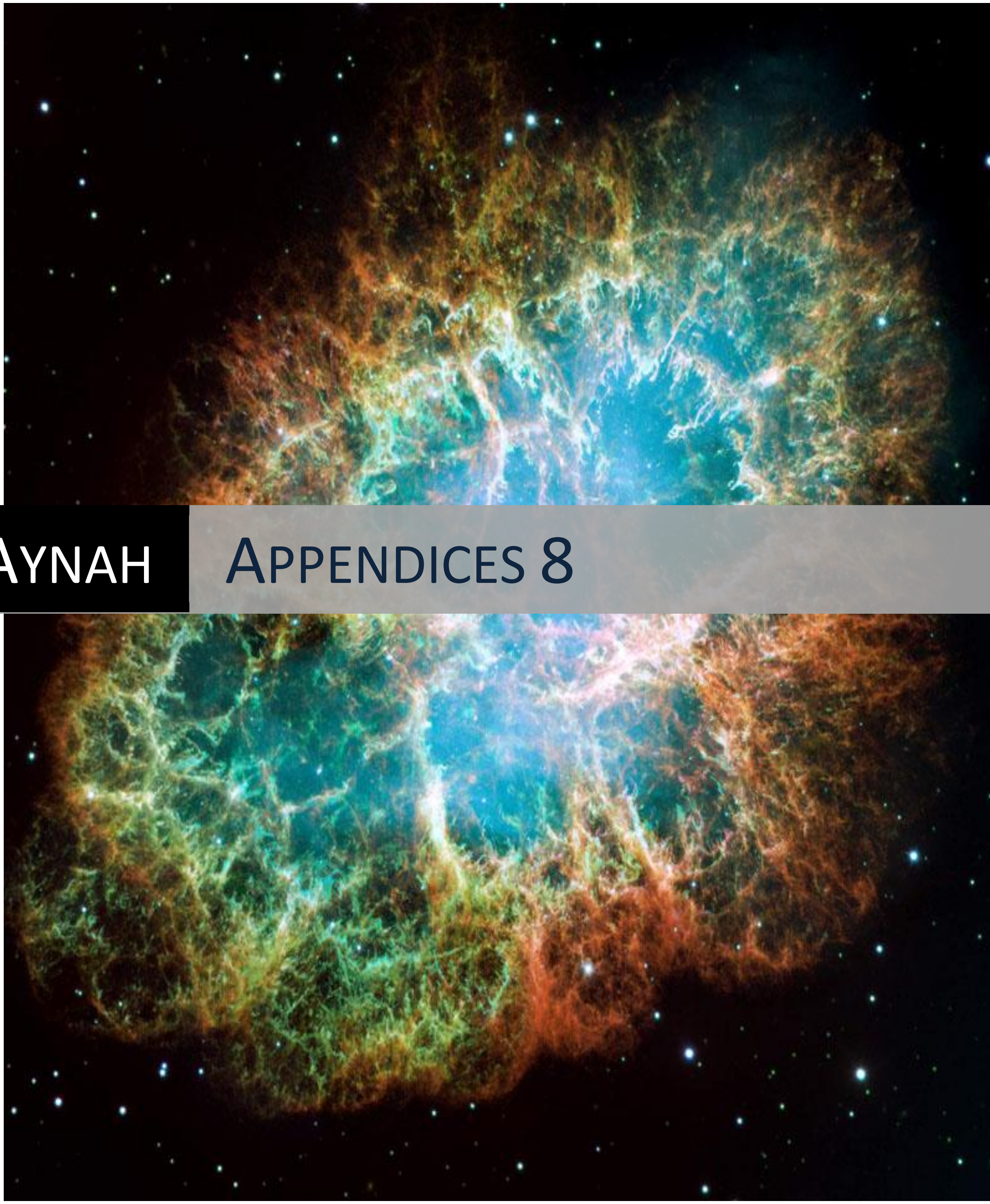
AYNAH APPENDICES 8



Appendix A: Operational Scenario

At 6:00 am, the day begins for the Smith family with the going off of their individual alarm clocks. Mrs. Smith grumbles as she get out of bed, and makes her way to the shower, already preprogrammed with her ideal water temperature, while Mr. Smith makes his way down to the breakfast table. After ordering a wholesome, hot breakfast for him and his family, Mr. Smith sits down with his wearable gestural interface device (WGIT) and begins to read the newspaper.

Once the family is done with their breakfast, they place the dishes into the sink for the Automated Home Maintenance robots to take care of later. Mrs. Smith, a teacher, walks with her children, Kenny and Martha, down the spacious, flower-lined path of their apartment building to the Maglev trains that will take them to the first tier. After a quick 1 minute ride with some of the other children, they arrive in the Commercial district, and board a motorized vehicle that transports them in 3 minutes to their school. Kenny, who is 10, follows his mother to the kindergarten section of the school, where she and other teachers will take care of him for the day. Martha, who is 18, walks with friends to the high school section of their school and greats her teachers. She will learn for the day before checking out what courses might be available in the college section of the school next year.

Meanwhile, Mr. Smith heads to his office to being his tasks for the day, which are overseeing the production of wooden tables to be sold in the Commercial District. Happily for him, this is a task he can do from his home office, and so he settles down for a comfortable day of work designing the newest model for his home collection.

Unbeknownst to Mr. Smith, some children were playing outside and managed to crack his downstairs window. Fortunately, this is detected by his home sensor system and he is alerted by a message from his WGIT. Wasting no time, he orders an AMR to be sent, which arrives in less the 5 minutes and spreads claytronic nanobots to quickly and efficiently seal the crack. Afterwards, the cleaning robots come to take care of the everyday mess in the house, and the AMRs scan and make sure there are no other damages.

Soon lunchtime arrives and Mr. Smith orders a meal with his wife. His children receive their meals from a menu design specifically to cater to the needs of children in their specific age group. Once the day is done, Mrs. Smith sends Kenny and Martha home with a school provided chaperone so she can go shopping without the kids.

Meanwhile, the children have arrived and greeted their father. Mr. Smith orders Kenny’s favorite meal as he got and A on today’s math test, and promises he will show him how to use an old fashioned TI-nspire cx calculator. After Mrs. Smith gets home, the family sits down to their dinner and watches Aynah’s most popular television show, *Big Bang Theory.* Later, after the children have finished their homework, the family moves to the living room and Kenny and Mr. Smith sit down to their nightly ritual of chess. After an hour or so of fun, the children head of to bed, and Mr. and Mrs. Smith settle down with a cup of tea.

Appendix B: Bibliography

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Appendix C: Compliance Matrix