ARESAM

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1.0 Executive Summary

In the new era of space exploration, the focus is shifting towards the new frontier of the red planet, Mars, and the ingenious possibilities that lie beneath the rocky surface. Northdonning Heedwell unveils its newest interplanetary innovation, Aresam. This sanctuary reflects not only the lights of space but also the ideas of the future. With its exclusive view of the Martian surface, and an experience that leaves the inhabitants astounded by the unparalleled beauty of the station. The inhabitants, having such an access to a multitude of exotic forms as well as proverbial forms of entertainment and recreation, will be able to enjoy the settlement and the industry that prospers within the safe walls of Aresam, and will help serve the station as it plays a crucial role in the mining of the red planet and the colonization of the new frontier.

Aresam's basic yet conventional ring design allows for an effective and inexpensive solution. It will consist of two rings, with one zero-g ring in the middle, which will allow residents to safely travel from one ring to another. During the assembly of the rings solar sails will be used to quickly transport materials to mars in less than a month. The construction would start with a center sphere and then the spokes are added with the outer ring assembled twice around it. After construction, to keep a daily commute on Aresam similar to earth, a monorail-like system will allow transportation between the rings.

The operations and infrastructure of Aresam are characteristic of a fully self-sufficient community. Aresam's innovative internal communication system will allow personal-to-personal connection through their Personal Assistant Mechanism (PAMs). To help residents cope with their lives in space, a day/night cycle will be controlled by an automated system, shifting the light to not only simulate different times of day but also the climates.

Aresam's housing will be adaptable to every resident. They will have the option of four types of housing, each having removable walls that allow each resident to add a "personal" touch to their home's décor. The houses will be placed in sub environments that consist of an urban, suburban, and rural area to allow people to feel more at home. Aresam will run on a 24.7-hour day cycle to mimic the Martian day, and night will consist of 8 hours. Aresam will have both gravitational and zero-g recreational facilities to ensure that the inhabitants of the station to maintain a fit physique.

The mining of the Martian surface will be done by the CONS-type C robot with its unique design to allow mining to be an uncomplicated task. Aresam's communication system will function by PAMs and will allow residents to communicate with each other. Aresam will use floating servers as its network system.

Northdonning Heedwell's efficiency is evident in a construction schedule for Aresam that has the settlement finished in a little over 4 years. Theoretically Aresam should start to make a profit in no more than 6 years after its completion. The design for Aresam is cost-efficient and conventional and allows the foundation society to quickly make and maintain a profit for years to come.

Northdonning Heedwell is honored to present the foundation society our proposal for the design of Aresam. It undoubtedly is the most efficient and capable for the Foundation society's wants and needs.

Structural Design

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Head of Structural

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Structural/Costs

2.0 Structural

2.0.1 Safe and Pleasant

Homes and businesses similar to earth structures and gravity similar to that of Earth's along with a 24.7 -hour day/night cycle will make living in Aresam pleasant. Security personnel and secure servers will make Aresam safe.

2.0.2 20,000 Full-Time Residents and Increasing Transient Population

There will be ample housing and resources for the residents and visitors. Expansion capabilities are outlined in 2.4. A large and efficient docking area will make for easy transportation to and from the station and also to and from Mars.

2.1 Exterior Design

2.1.1 Dimensions

Main ring (m)	Open Center (m)	Layer 1	Layer 2	Layer 3	Docking Ring
Radius= 460 (663)	203	154 (509)	153 (356)	153 (203)	460
Diameter=1326	406	1018	712	406	1326
Height=300	300	300	300	300	150
Area(m^2)=1.25x10^6	1.3x10^5	9.6x10^5	6.75x10^5	3.83x10^5	3.39x10^5
Volume(m^3)=4.1x10^8	4x10^7	2.4x10^8	1.2x10^8	3.9x10^7	1.67x10^8

Center Cylinder (m)	Spokes (8)	
Radius(m)= 50	5	
Diameter(m)= 100	10	
Height(m)= 100	Length(m)= 103	
Area(m^2)= 7.9x10^3	79	
Volume(m^3)= 7.9x10^5	8.1x10^3	
Totals	Area	Volume
Main Rings	1.25x10^6	4.1x10^8
Spokes	632	6.5x10^4
Docking	1.25x10^6	3.13x10^7
Cylinder	7.9x10^3	8.1x10^3
Total total	2.58x10^6	4.41x10^8

2.1.2 Construction Materials

The station will be built almost entirely from materials from the two moons and Mars itself. See 3.1 for a list of all available resources. These will be used to make steel, carbon based products such as carbon fiber, and various plastics. This covers nearly all construction requirements. The majority of the station will be built from iron compounds, such as the base structure and the hull. See 2.1.6 for more materials.

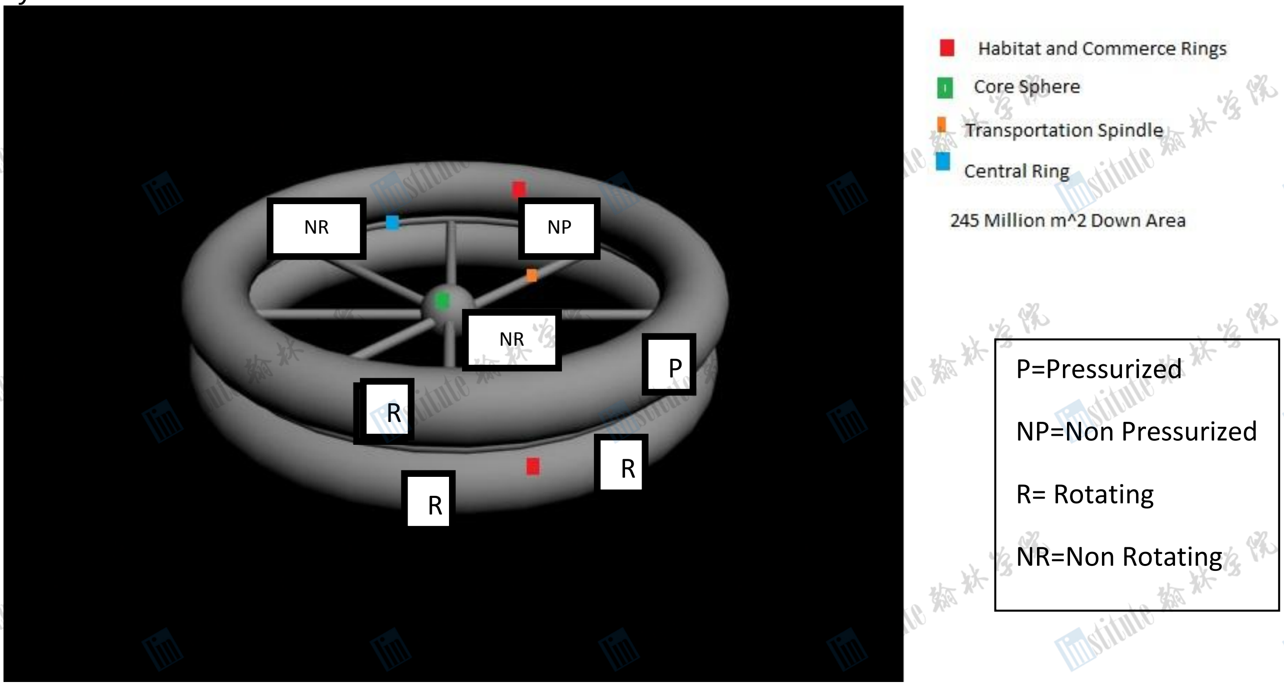
2.1.3 Artificial Gravity and Rotation Rate

	Layer 1	Layer 2	Layer 3
Gravity Magnitude (g)	1	.53	.31
Rotation Rate (rpm)	1.16	1.16	1.16

To have 1g at Layer 1 the rotation rate must be 1.16rpm. Therefore the rate at Layer 2 and Layer 3 will be the same. The station must rotate at this speed to make 1g of gravity at the Residential Layer (Layer 1).

2.1.4 Rotating Interfaces

For initial rotation see 2.3.2. The center docking area will not rotate and the two main rings will rotate in opposite directions. Therefore rotational momentum will not be lost because the two separate rings will be pushing in opposite directions on the stationary docking ring. This also allows the docking ring to stay stationary. The spokes are also stationary along with the center cylinder.



2.1.5 Radiation/Debris Protection

Panels made of titanium will cover the entire station. The protection is made of layers of titanium, water, concrete, and aluminum. See table. These materials will provide protection from radiation and debris ranging from dust to small asteroids.

Titanium	Water	Aluminum	Concrete
1m	.1m	.5m	2m

2.1.6 Isolation of Separate Areas

Each layer has four airlock doors that can close in case of emergency. That is 24 airlock doors that can isolate 24 separate volumes. Each door in the residential areas is 154m tall by 1m thick. In the remaining areas the doors are 153m tall by 1m thick. The doors will be on the tram tracks between the residential homes. During regular times the doors will stay collapsed along the walls of the station. If an emergency occurs and the volume needs to be closed the trams will be alerted and the doors will unfold and close.

2.1.7 Pressurized/Non-Pressurized Sections

Every place inhabited by humans will have pressure. The docking area is the only area lacking pressure. Therefore the rings, spokes, and cylinder will be pressurized.

2.1.8 Functions of Each Volume

There are two of each kind of pressurized volumes in the station. Layer 1 is Residential, including parks, recreation, and minor business. This layer has four airlock doors that can close in case of an emergency. The doors are 154m in height, and 1m thick. Layer 2 is Commercial, Business, and Industrial. It also has four airlock doors along with layer 3. Layer 3 is Agricultural. There are two of each layer because there are two identical rings. The center docking ring is used to house ships mostly for repairs, temporarily house materials either incoming to the station or preparing for departure, and temporarily dock ships. The eight spokes are used for transporting materials and persons from one side of the station to another and from one side of the dock to the other. The central cylinder is the exchange place for the incoming/outgoing materials/persons from the cylinders.

2.2 Interior Design: A conveyor like mechanism transports people and goods on the sides of the cylinder for transport from the main rings to the docking rings.

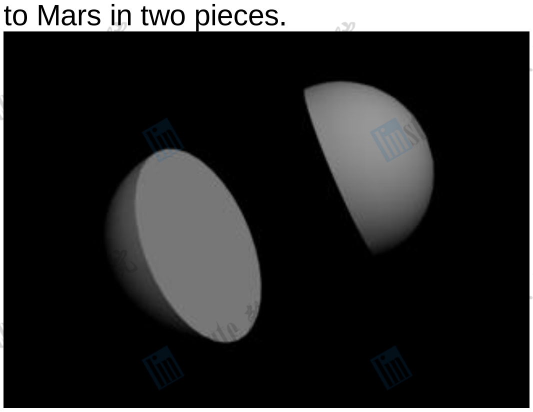
2.2.1 Percent Allocations and Dimensions of Down Surfaces

Residential	29.29%
Industrial/Commercial	20.50%
Agricultural	11.68%
Transportation	.26%
Docking	38.15%

2.2.2 Orientation of Surfaces
“Down” is away from the center of the station. The direction of gravity is the same for both rings. In the spokes and central cylinder there is no need for orientation because there is zero gravity. For docking “down” is perpendicular to the “down” of the main rings.
2.2.3 Vertical Clearance

Docking	25 meters
Spokes	10 meters
Main Rings	20 meters

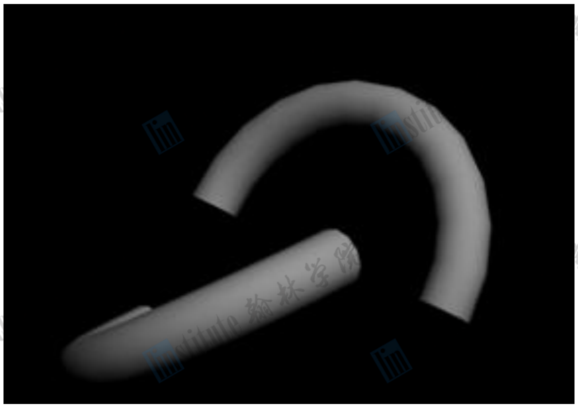
2.2.4 Overall Map of Layout with Usages
See 4.1 for additional details and image of the internal layout of the station.
2.3 Construction Process
2.3.1 Assembly Process
The assembly process for ARESAM is as follows. The first step in construction will be that of the core sphere of the station. This will be done in Earth orbit and the product will be sent to Mars in two pieces.



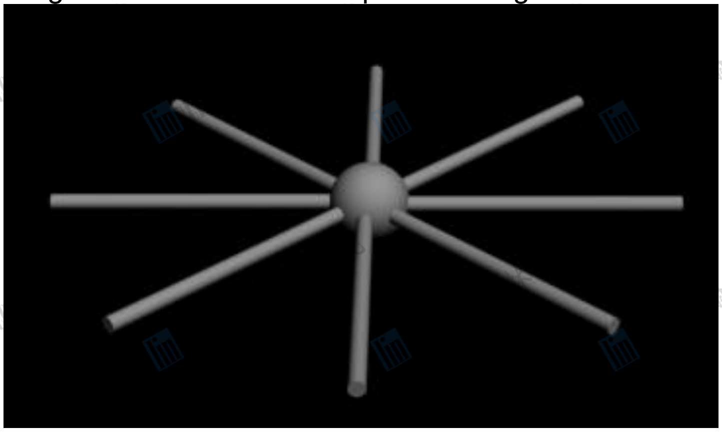
The second stage will be construction on the eight “spokes” that go out from the core sphere and intersect with the middle ring. These will be shipped into Mars orbit, from Earth’s surface, all together.

The third stage will be the construction of the middle ring. This component will be created, initially as four parts, and then shipped to Mars from Earth orbit, for assembly.

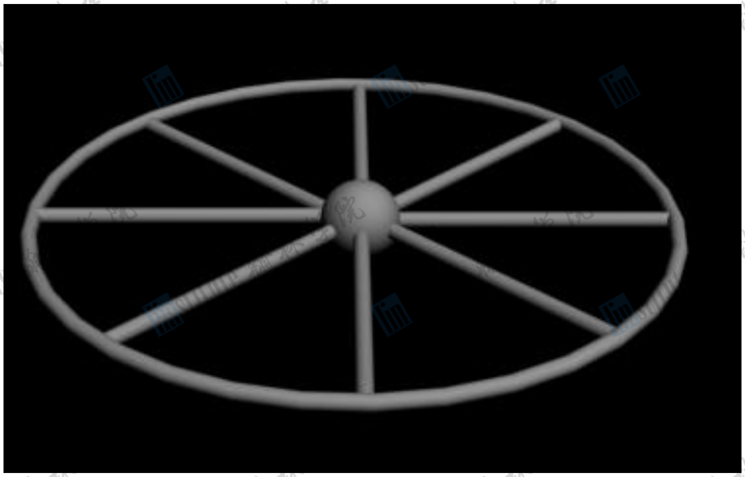
The fourth stage of construction will consist of the building of the upper and lower habitat rings. These will be built as two pieces each and then assembled in Mars orbit, having been shipped from Earth orbit.



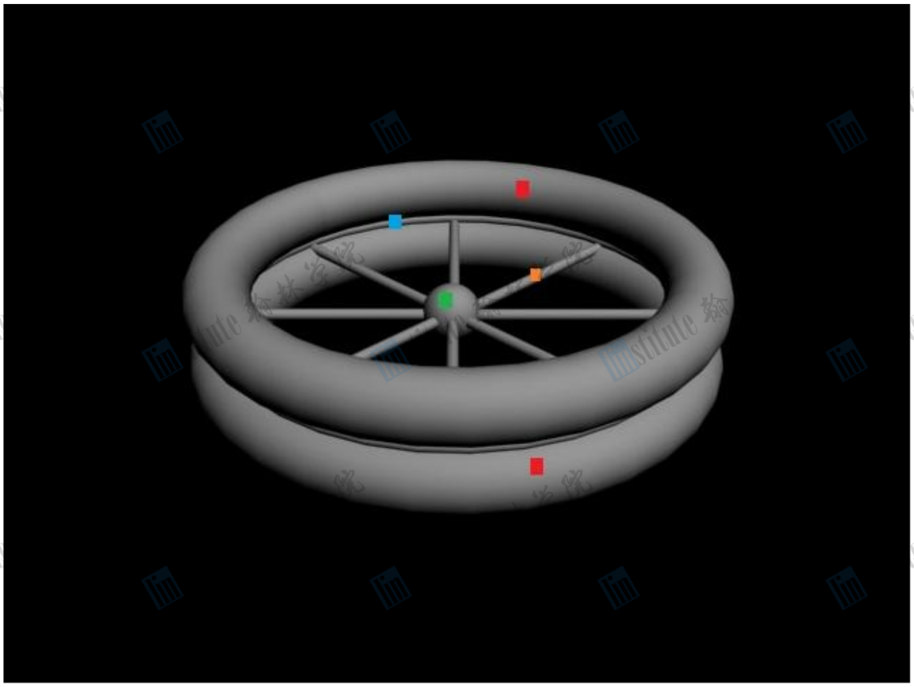
The last three stages will be done in Mars orbit at the site that ARESAM is to occupy. Stage five consists of the “spokes” being united with the central core.



Stage six consists of the middle ring being united with the “spokes” by being put together around them.



Stage seven consists of the upper and lower habitat rings being attached to the structure via the middle ring.



The final stage consists of the construction and placement of buildings, electrical equipment, and the docking mechanisms. (See cover).

2.3.2 Implementation of Artificial Gravity

Artificial gravity shall be applied once the main rings have been completed. This shall be accomplished by means of an electromagnetic track (one on top of and one on the bottom of the middle ring). Each habitat ring shall have a series of magnets running directly above (or below as the case may be) the track, of opposite polarity.

When gravity is to be applied, power is given to one of the electromagnets on each side of the middle ring, so that each habitat ring is pulled in opposite directions on the track causing a specific amount of centripetal force and thus artificial gravity, to be applied on the sides of the habitat rings while keeping the central core at zero g.

2.4 Design Features Enabling Expansion

2.4.1 Expansion capabilities

The stations expansion capabilities are as follows. When additional space is needed, additional compartments are constructed and laid on top of, or below as the case may be, the original ring in a manner similar to that of the Nautilus shell. This could theoretically go on as long as materials are supplied to the station. For illustration in figure 4.4.4.

2.4.2 Interfaces

As the compartments constructed will be attached directly to the interior of the station, the only interface needed would be the ceiling, or rather wall, considering the orientation of the station, which would be opened, using hydraulic valves, once all electrical, water, etc. connections have been made and the module made completely secure for habitation, from the vacuum of space. The water, used in said section would be evacuated and moved to the water radiation protection area in the new module.

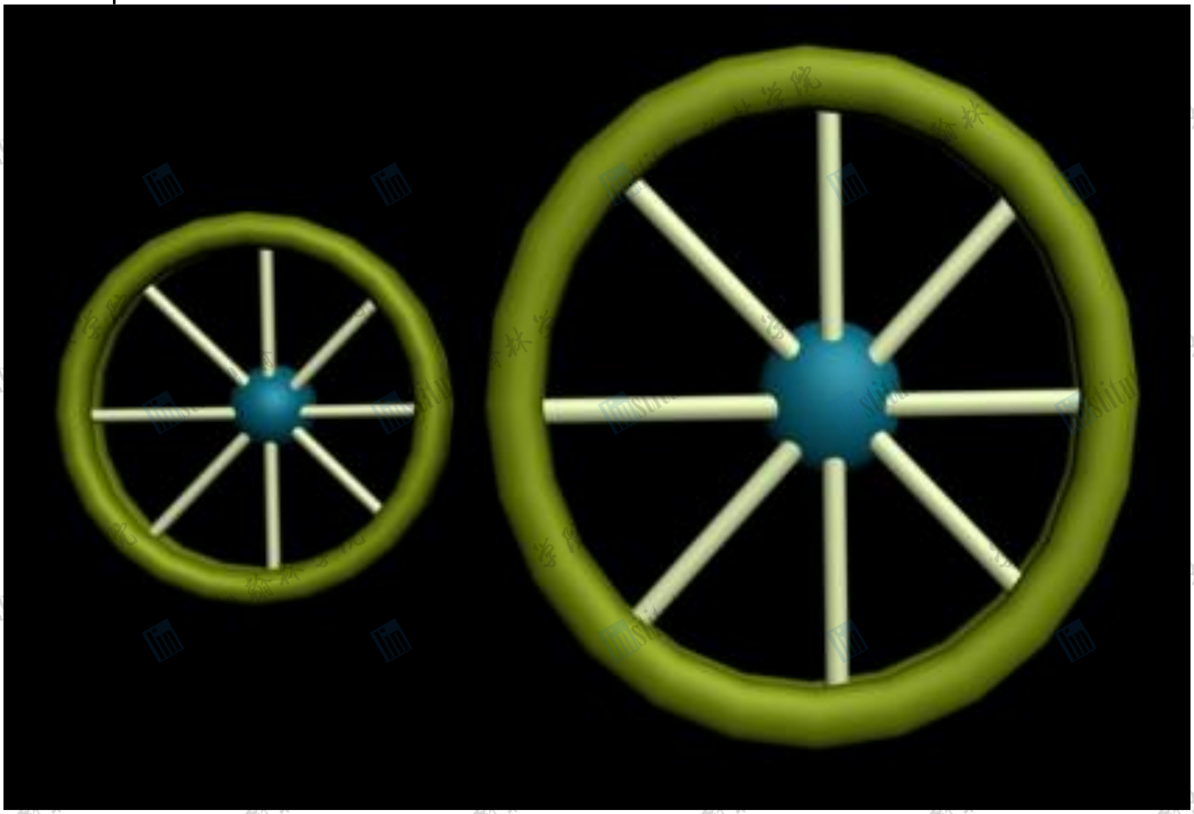
2.4.3 Port Modifications

The middle ring functions as the docking area. Metal doors, which can be modified to accommodate larger ships, will be opened using hydraulic valves, and allow the vessel inside the docking area.

There will be a standard airlock in the middle of each dock, equipped with a small cushion that will negate the impact of a docking vessel and, if necessary is able to be inflated with any necessary gas, liquid, or foam, to accommodate smaller airlocks for a tighter fit. The umbilical ports also have this feature.

To actually attach the ship to the station, the docks are equipped with extendable and retractable, neodymium, magnetic pads to latch on to the vessel and hold it in place as long as necessary. In addition, those same pads are run along small tracks so that they can adjust to accommodate any size vessel.

2.4.4 Expansion model for future



2.5 Prefabricated Structure

Includes: four bedrooms, two full bathrooms (i.e. sink, shower, space toilet), pull-out ceiling storage, pull-out cabinets around the inside circumference, excluding the suit area, and a kitchen area. The structure has two layers, one for living described above and one for storage, pipes, and power. There will be a small "robot" to retrieve items for the inhabitants upon a computer inputted request. The computer will also monitor the supplies, life support systems, and the state of the structure. It will have battery power for a few days until alternate energy forms are erected such as small wind turbines. To protect the structure from high wind damage a wind barrier will be set up around it and connected so that it will be able to rotate to face the winds. To rotate the supports will have small wheels set into grooves around the circumference of the structure. To protect from dust an "umbrella" will be erected and connected to the wind barrier.

To enter or exit the habitat, persons must don a space suit by opening a hatch in the side wall and also opening the suit hatch. After climbing into the suit both hatches will close and the airlock will open. This will keep all dust out of the structure.

In the initial configuration the structure will be half its size built inside a modified cargo container of dimensions 4mx4mx9m. After reaching the surface researchers, with the aid of the "robot", will remove the structure from the cargo container. By pressing a button the structure will "grow" into its final spherical shape. To remove trapped dust a strong magnet will run over the interior. To set up the wind barrier the cargo container must be disassembled and snapped back together to create four 11m long sections. These sections can then be set up around the structure and attached with supports. Then the station must be pumped with air stored in the bottom storage space. After that the people can attach their suits and enter the station to pull out the counters and beds, etc.

Dimensions	Length	Height	Volume	Surface Area
Wind Barrier	11m	2m		88m^2
Structure	Diameter=9m	3m	382m^3	255m^2

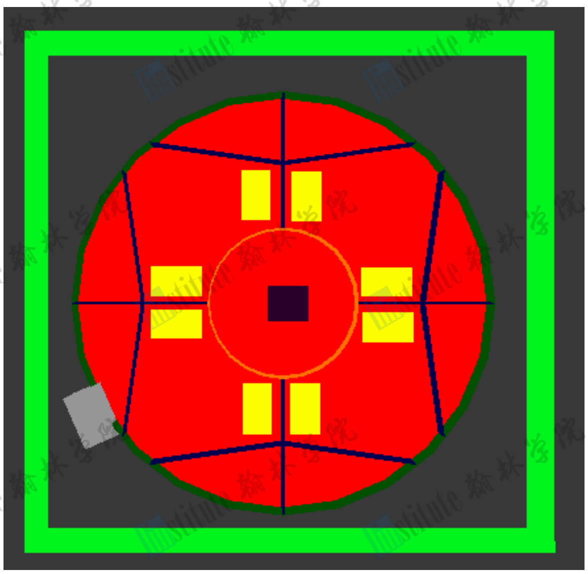
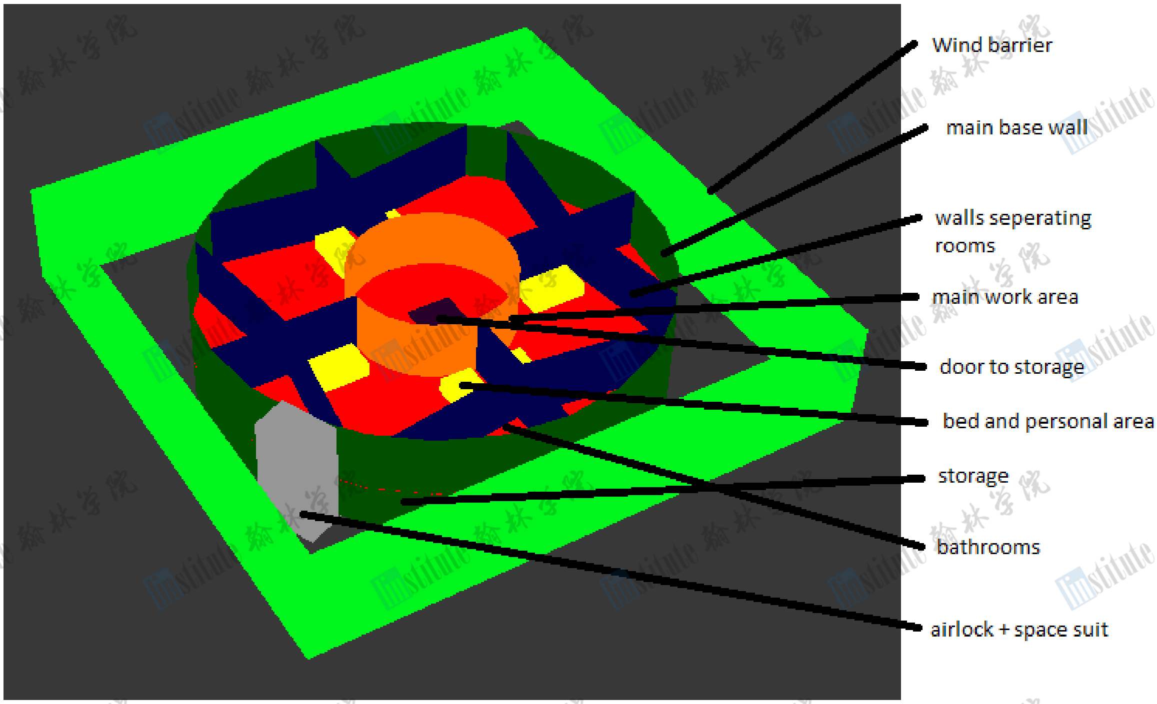
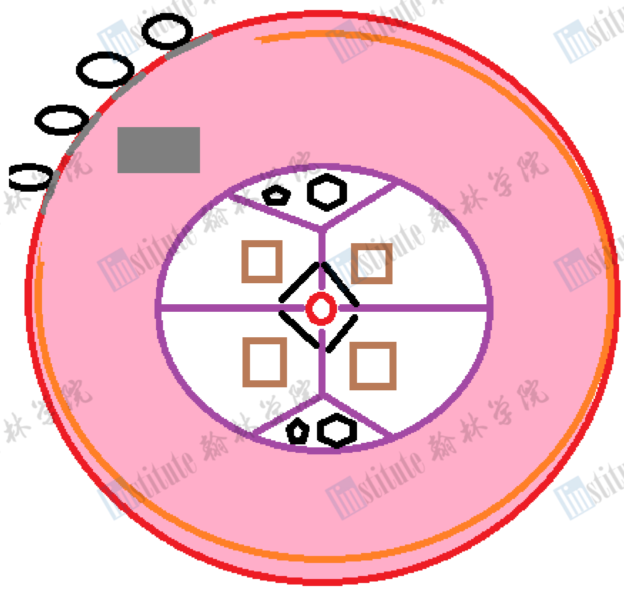


Figure 2.5.1Pre Fabricated Base Deployment process



2.5.2Prefabricated Base Overview



2.5.3 Prefabricated before deployment

Operations and Infrastructure

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Head of Operations

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Operations/Graphics

Holly Miles

Operations

3.0 Operatations and Infrastructure: The mining and infrastructure behind Aresam is crucial to it's survival.

3.1 The station will orbit around mars at a altitude of 15,000 kilometers above mars' equator. This will place the station in-between the orbits of mars' two moons phobos and diemos allowing for easy transport of materials to and from the moons. Materials to be scavenged from mars' moons include water, silicates, oxides, sulfides, olivine and serpentine. CO2 from mars' atmosphere can be converted into oxygen by local mars greenhouses for the station's use. Mars' surface can be mined for materials such as silicon and iron. Transports will ship materials from permanent facilities placed on the moons and mars. These transports will land on the moons slowly using horizontal thrusters so as to not disturb the small moons orbits.

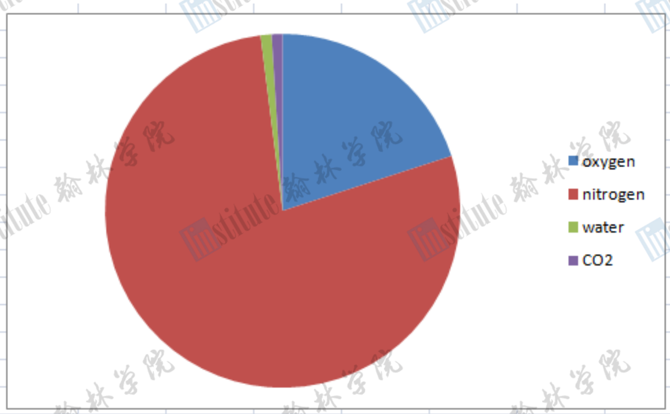
Materials	Amount /year	Location
H2O (water)		Mars poles
Silicates	More than 9,000 tons	Mars surface, phobos and diemos
Oxides	10600 tons	phobos and diemos
Sulfides	7000 tons	phobos and diemos
Olivine	7000 tons	phobos and diemos
Serpentinite	1625 tons	phobos and diemos
CO2	60000 m^3	Mars atmosphere
Fe (iron)	1.26 million tons	Mars surface

3.2 Operations and infrastructure

3.2.1 climate control

The atmosphere of the station will be comprised of 20% oxygen, air pressure will be kept at 101325 Pascals (1 atm.), and the temperature will remain between 16 and 27 degrees Celsius. In all, 55,201,673 m^3 of air will occupy the station. The means used to procure the oxygen will be: trees located throughout the station, electrolysis, and hydroponics. An emergency supply of oxygen will be able to supply the station with ten days of breathable air. The weather control system will be made up of a large grid of climate control packages. Each package has the ability to remove/add moisture to the air, as well as heating/cooling the nearby air. Usually each climate package acts independently based off of the immediate area's needs. An overall controller is used to coordinate multiple climate packages in the event of a large anomaly.

oxygen	20%
nitrogen	78%
water	1%
CO2	1%



3.2.2 food production

Agricultural products will be grown using hydroponic soil-less growing systems located in the Agriculture area. The plants will be grown on a large rotating cylindrical lattice which will rotate through a trough of water. In one (or several) location(s) lights will be illuminating the plants so that they rotate through light the appropriate amount of time for the plant species and spend a good amount of time in water. Harvesting is done by a series of mechanical arms built to most easily harvest the plant growing on the particular lattice which they are attached to. Changes to the plant's genetic material along with abundant nutrients are used to accelerate plant growth to allow harvesting four times a year. Cultured meat will also be grown in the agriculture area along with livestock farms in which cows, chickens, and pigs will be raised. (see system appendix) Additional food will be grown on Mars' surface in special greenhouses in a permanent settlement. Food will then be packaged and shipped to either the emergency ration storage facility, or a storage facility near the local markets and mainstream kitchens to be prepared and served. Occupants will have the choice to either have food shipped to them by the automated shipping service or to travel to local markets and restaurants.

3.2.3 Electricity

Electricity will be produced by solar panels lining the station and three nuclear reactors (one in each ring and one in the center) For every square meter the panels will produce 1.6Kw but will eventually slow down to .432Kw. the electricity for the station will be divided between residential, commercial, and satellite operations. Residential and industrial areas will be monitored to insure that any one group does not consume a majority of the energy available. Small stations located throughout the grid will oversee the operations and take care of any problems.

3.2.4 Water management

Water will go through a hydrological cycle so that it can be preserved and reused. Water will be piped to the different areas of the space station. There will be three different systems that will take care of water management. They will be divided into agricultural, commercial, and residential.

Industrial wastewater will go through the process of electrolysis. Hygiene water will be purified and reused only as hygiene water. Fresh water will come from urine and hydrogen fuel cells. Urine will be stripped of water through vapor compression distillation in large drums. It will then be hydrolyzed, while the condense water will be piped to agriculture. After leaving agriculture, water will be treated with UV radiation to kill micros and undergo filtration. This water can be redirected for consumption. Humidity condensate will also be filtered for portable water use.

Each area will be given an allocation of water, in order to avert water overuse.

A system of pressure and flow sensors will supervise the pipes and descry even the slightest breach. The water flow in that area will then be immediately halted for repairs.

3.2.5 Solid waste management

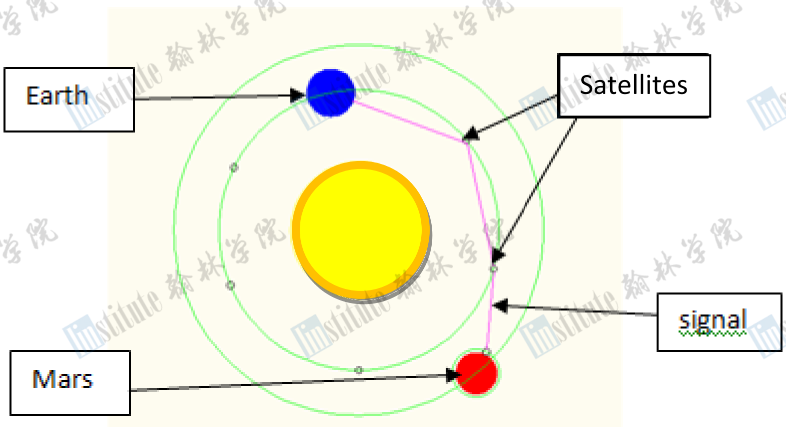
Waste management is a very important undertaking in any space settlement. Plasma incinerators will dispose of waste that cannot be reused. Reusable waste will be recycled by filtering and decomposing unneeded substances. Human feces will be stripped of nitrogen through chemical processes. Nitrogen will then be made into fertilizer or cleaned using ammonia.

Urine will be hydrolyzed into ammonia and carbon dioxide. Computer monitoring will separate all waste.
Urea _ Oxygen + Ammonium + Cyanide
2NH4OCN _ O2 + 2NH3 + 2HCN

3.2.6 Communication systems

Internal communications will be dealt with the PAM devices (see System Appendix in 5.0). All contact made to Earth will be provided by a simple e-mail system in which messages will be relayed by satellites around the sun for times when Earth and Mars are on opposite ends of the solar system.

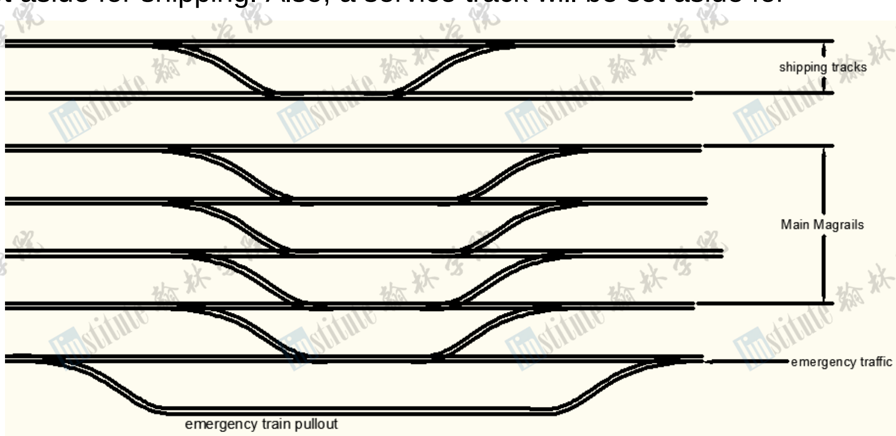
For computer access, a network of floating servers will be used to provide an incredibly fast integrated computing experience to all residents throughout the station. (see 5.4) Through the single ship-net, thousands of residents will be able to log on, using their own account, and do anything they could do on a normal computer. This would provide an efficient method of distributing information and save in the cost of manufacturing thousands of small scale computers. Each computer would have access to a station-wide internet along with a onboard cached World Wide Web similar to Google. The initial cache will shipped directly to the station aboard a ship and then will be updated every period when the earth and mars are in easy range.



3.2.7 internal transportations

Internal transportations within the artificial gravity rings will be provided by a maglev train system running around the gravitational ring. The Train system will work like a modern-day subway, allowing hundreds to board at a time and maximizing stops each train has to make to 4. Each train will be capable of carrying up to 150 occupants. A separate set of rails (one for each direction) will be set aside for shipping. Also, a service track will be set aside for emergency traffic.

Movement up and down in the rings will be provided by elevators and emergency staircases, while horizontal movement between train stops will be provided by hallways



equipped with moving sidewalks.

Movement from the rings to the center zero gravity area will be provided by heavy duty elevators capable of creating an easy transition between gravity changes.

3.2.8 day/night cycle

The day/night cycle will be based on a Mars day, 24.7 hrs. Night will last 8 hours with midnight starting when Mars is between the station and the sun (a short time of 1.8 hours) The lights will also be dimmed at this time.

3.2.9 Storage facilities for food commodities

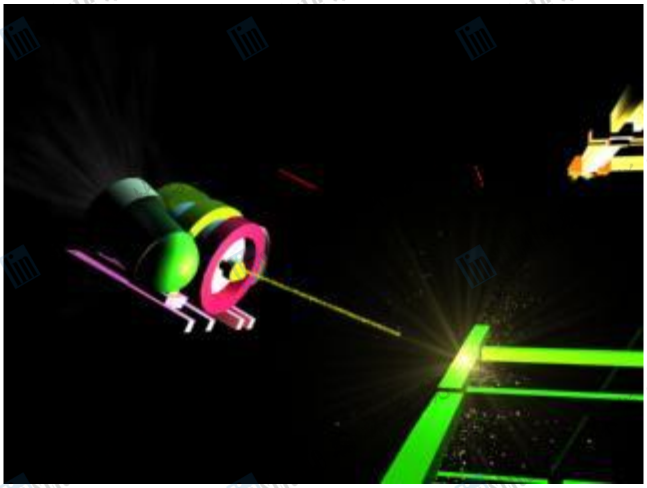
In the event of agricultural failure, a surplus of food will be acquired. Food from each of the four food groups will be stored in a holding facility. There will be enough food to last 20,000 people 10 months.

Food Group	Amount of Food (Kg)
Meat	17,708,246.1
Dairy Products	53,796,055.1
Fruits/Vegetables	64,201,464
Grain Products	18,134,623

3.3 construction machinery

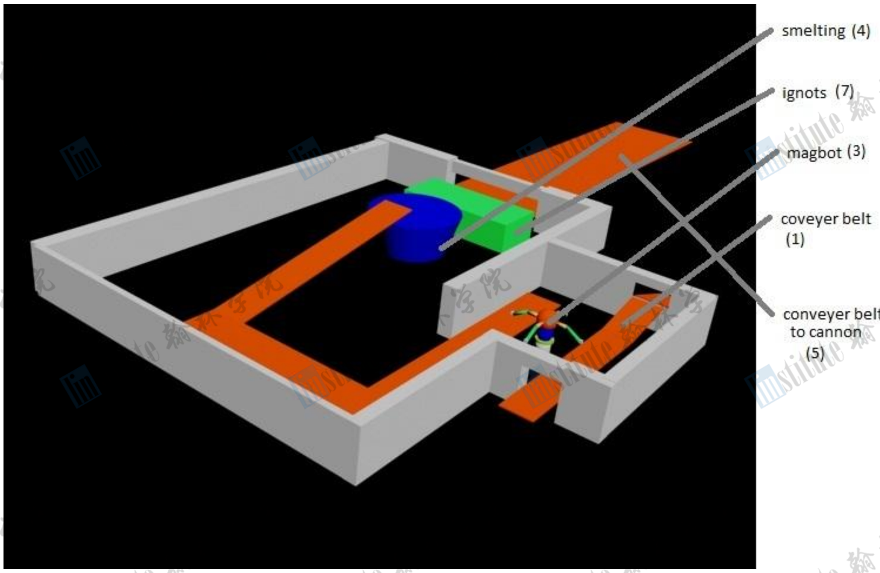
The super-structure of the station will be constructed by teams of Construction robots with TypeC chassis. (see automations) After the super-structure is in place the robots will then begin basic structure from the inner most section of the station outwards, and from bottom to top. (That is, planet facing to space facing) Additional Construction robots will be constructed on the planet and shipped up. Construction robots with TypeB chassis will be used to put together interior structure including homes and furnishing.

Items requiring complicated construction such as computers, computer screens, carpet, etc. will be constructed on earth or on a subsequent station and will be shipped to the new station. A section will not be closed off until it has been completely furnished and built except for those parts that require a pressure-environment. These parts will be added just after the section is closed off.



3.4

First, the base will be preassembled on either Aresam or Earth. Rockets will be attached to both the mining base itself and a holder box. The holder box will contain all the mining and scanning robots. Before the base is deployed, a scanning robot will be sent down to locate the best place to mine and the best place to set the mining base. Sending the base down is equivalent to sending down a Lunar Lander. After the base lands, a boot up will be initiated, which places everything into position. While the base is initiating, the mining robots will begin breaking up the surface of the moon and collecting minerals. The minerals will be placed on a conveyer belt and sent to the base for processing. After processing, the minerals will be packaged into bullet-shaped, metal containers, and loaded into the gauss cannon. The cannon will shoot the minerals to Aresam. When the minerals arrive at Aresam, they will be processed again and then



distributed for use on the station. The entire base will be mechanized; humans need only be on the moon to observe and repair the robots.

3.5 Operations and infrastructure of prefabricated Mars base

3.5.1 air control

The atmosphere of the prefabricated base will be comprised of 20% oxygen, air pressure will be kept at 101325 Pascals (1 atm.), and the temperature will remain between 16 and 27 degrees Celsius. In all, 40m^3 of air will occupy the base. Oxygen will be provided by super pressurized tanks that will come down with the structure. The initial blowup of the base will be powered by a pressurized tank of Nitrogen. After that, the oxygen tanks will slowly expel their contents while an air purifier removes the CO_2 and heats the air. The provided oxygen will easily be able to support the bases occupants for up to a month and a half.

Air Composition	Percent Composition	Pressure (Pascals)	Temperature (Celsius)
Oxygen	20%	101,325	16-27
Nitrogen	80%		

3.5.2 food production

Food will be sent down from the station and also transported from the surface greenhouse. Food from each of the four food groups will be available. Also, snacks will be provided to keep conditions on the base bearable.

Meat				

Source	Calories	Protein	Carbs	Fat
Fish	110-140	20-25g	0g	1-5 g
Chicken	160	28g	0g	7g
Lamb	250	30g	0g	14g
Beef	275	30g	0g	18g
T-bone	450	25g	0g	35g

Vegetable	Nutrients Included	Benefits to Human Inhabitants	Servings /Day
Beans	fiber	Lowers cholesterol	1/2 cup
Rice	Insoluble fiber	Reduces bowel disorders	1/2 cup
Lettuce	Vitamin A	Reduces heart disease and birth defects	1 cup
Tomato	Lycopene	Reduces heart and lung disease	1 cup
Peas	Lutein and zeaxanthin	Reduces age-related macular degeneration	1 cup
Carrots	Alpha carotene	Reduces free-radical damage	1 cup
Spinach	Lutein and zeaxanthin	Reduces age-related macular degeneration	1 cup
Eggplant	Anthocyanins	Protects against heart disease by preventing blood clots	1 cup
Broccoli	Sulforaphane	Helps ward off	1 cup

3.5.3 Electricity

Electricity will be produced by solar panels lining the base and a large battery that will come down with the initial box   For every square meter the panels will produce 1.6Kw which, if not used will recharge the battery.

3.5.4 Water management

Water will be sent down from the station. The water will be allotted for drinking, showers, and a reserve tank will hold extra water in case of problems. Used water will be put through a hydrological cycle that will purify it for reuse.

Water distribution	Amount of water (liters) per person	Total water consumption for four occupants
Drinking	3.75	15
Hygiene	100	400

Reserve	25	100

3.5.5 Solid waste management

Reusable waste will be recycled by filtering and decomposing unneeded substances. Human feces will be stripped of nitrogen through chemical processes. Nitrogen will then be made into fertilizer or cleaned using ammonia. Urine will be hydrolyzed into ammonia and carbon dioxide. Computer monitoring will separate all waste. Finally, all waste, usable and unusable, will be shipped to the surface greenhouse.

Type of waste	Amount of waste (Kg)
Natural	.45
Unnatural	1.35

Human Factors

Kendra Harris

Head of Human Factors

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Human Factors

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Human Factors

4.0 Human Factors

It is very important to keep the quality of life as close to the lifestyle that is expected on Earth. Human factors will provide several amenities to keep the residents in sync with their natural habitat. Human factors will specify the details of the amazing entertainment provided on the station, which includes sporting ground, space for pure enjoyment like picnics and even a chance to swim in a beautiful swimming pool. Residents will enjoy the natural view of space during the day and will be showered with comfortable and relaxing homes at night.

4.1 Community

In order to provide the highest degree of comfort available for our residents, Northdonning Heedwell will have a community set up in a grid-like shape. This residential area will consist of two communities of two grid shapes with a small square in the middle, which makes up the business portion of the residential area. This area will include entertainment, offices, and more. There will also be unpopulated area around the populated areas, which will allow for growth in our cities.

4.1.1 City Design

This community will be set up in a grid of 15 by 4, with each segment constituting a block. Each side of a block could possibly have in it 10 small houses, 9 medium houses, 8 large houses, 8 condo houses, or 2 apartment buildings. On the blocks with the apartment buildings there will also be a small park at one end. In order to break up the monotony of homes that all look alike, blocks will be places across from blocks with differing home types. Also, residents may create their own exterior to meet their wishes. In the middle of these grids will be our city center. See Image 4.1.1 and 4.1.2.

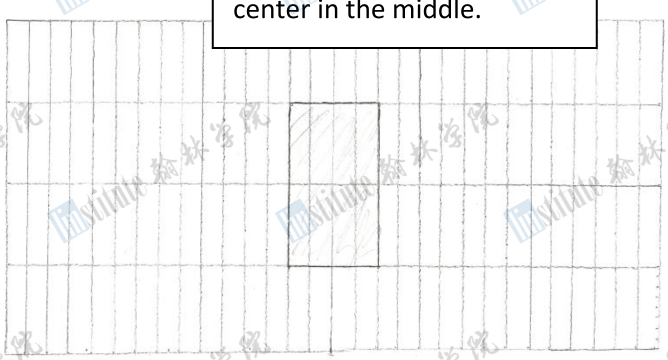

Image 4.1.1- the typical community, made up of 120 blocks, including the city center in the middle.

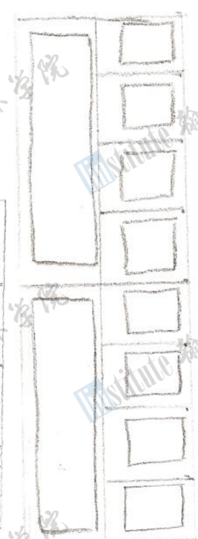

Image 4.1.2-The typical block. The block depicted is of 8 large homes and 2 apartment buildings, but each block split in half could include 10 small homes, 9 medium homes and a park, 8 large and 2-story homes, or 2 apartment buildings.

4.1.2 City Center

The city center will have everything a resident could wish for. In the center of the city center there will be provided three centers for schooling: kindergarten through sixth grade, seventh through eight, and ninth through twelfth. For further schooling we suggest residents of Aresam return to Earth or go to online school. Next to these schools there will be a large park available, with a sporting field and small lake, for aesthetic purposes. Situated across from the school is the hospital. The medical hospital will be stations off to include emergency care, offices for the staff and regular examination rooms with a waiting/reception area. Doctors will have the facilities to vaccinate the new children born on the station in order to prevent any airborne diseases. The doctors will have research facilities in order to accommodate for both new viruses and the growing population. Throughout the city center there will be various entertainment available. There will be a sports center offering a wide variety of activities, such as weight rooms, mats for wrestling and other aerobic activities. There will be an auditorium for actors, actresses, and others involved in drama. Once the station is up and running, there will be opportunities for professional performing groups to visit in six-month intervals. There will be a multi-purpose court that can be used for physical activities such as tennis, basketball, and even hockey. There will also be multiple restaurants, centers for gaming and arcades, movie theaters, and bowling alleys. Also, for visitors, there will be a lavish hotel available.

4.1.3 Food Distribution

Food distribution will be accomplished by robots hat will deliver the food through tubing to each house upon order. The residents can expect all the gourmet foods that they are used to on Earth. For more information, see Automations Systems Appendix.

4.1.4 Consumables

In order to provide comfort to our residents, we have available every consumer they could hope for. We have also anticipated the amounts of these consumables that the residents will requires (see Graph 4.1.1). Distributing consumables to Aresam residents will receive their consumables through the automated system in their houses. All distribution will be done by robots; residents need only to communicate their needs and wants. For more description, see Automations Systems Appendix.

4.1.5 Transportation

In the residential sector of the community there will public transportation in the form of a tram system. In the business area there will be moving sidewalks to maximize a resident's daily activities. Approximately 17% of our area will be designated for these purposes. Private transportation will be available in the way of bicycles and segways.

4.1.6 Psychological Factors

In order to improve the psychological effects of being in space, we have provided factors to ease a resident's discomfort. One of these main factors is a raised ceiling, to provide the sense of freedom and the outdoors to our resident's (see 2.3.1). We also have screens in each room of the homes, apartments, offices, and hotels. These screens can be programmed to show pictures of the outdoors, green slopping lawns, or mossy tree trunks. This will provide a sense of comfort to the resident. To keep in time with the resident's internal clock we will have a 24- hour day, the same as on earth, with natural sunlight available for 12 hours.

4.2 Residential Design

Housing structures are designed with the intention of promoting a spacious and productive living area, with the hope of decreasing the claustrophobic feeling caused by the environment of a space station.

There are five types of accommodations of Aresam. The first four are spacious houses of varying sizes: one, two, three, and four bedrooms are all available, along with homes with moving walls to accommodate a resident's housing needs. For those residents who would prefer to live in an apartment, we have a one-bedroom apartment available. Each apartment in the building has its own balcony, in order to accommodate a resident's need for a private outside space. Due to the closeness of the station's ceiling, high-floor balconies also include a balcony overhang.

It is felt that if the living accommodations were all alike the station would look rigid and unnatural. This could cause severe agitation among the residents because of the perfection of the design. Therefore, residents may pre-design their homes if desired, and they will custom-built at the time of construction. This will provide for a break in the monotony of the station. Along with this, there is also extra-unused space in each grid, allowing for current or potential residents to create their own home after construction of the space station.

Also, special attention has been paid to the layout of homes, markets, and parks in order to create long-lines of sight. This will help residents deal with the uncomfortable symptoms of the coriolis affects.

4.2.1 Homes

Here at Aresam our greatest desire is to make our residents comfortable, and we plan to do this by allowing residents to live in the home they want. They can choose from a multitude of general home plans, or customize one of their own.

The first home, a one-bedroom, has a large living and dining area. It also has spacious laundry and storing facilities, along with a comfortable master bedroom and bath. It also has a full kitchen, and a patio in the back. This home is moderately priced, and comes with a back yard. The home is 83.612736 sq. m and the backyard is 13.0064256 sq. m. In each compound there will be 90 homes of this size available, equaling 8.1% of all the homing choices available in one residential compound.

See Image 4.2.1.

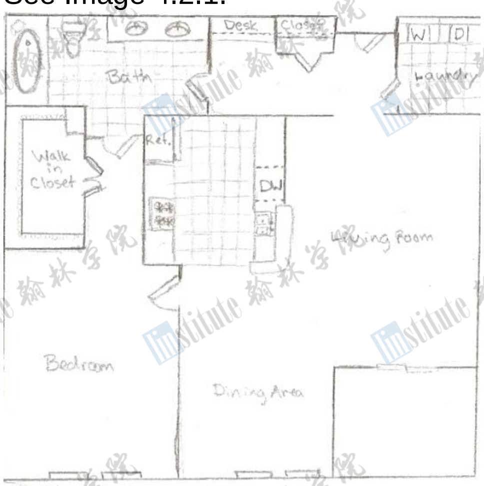

Image 4.2.1- A one-bedroom home.

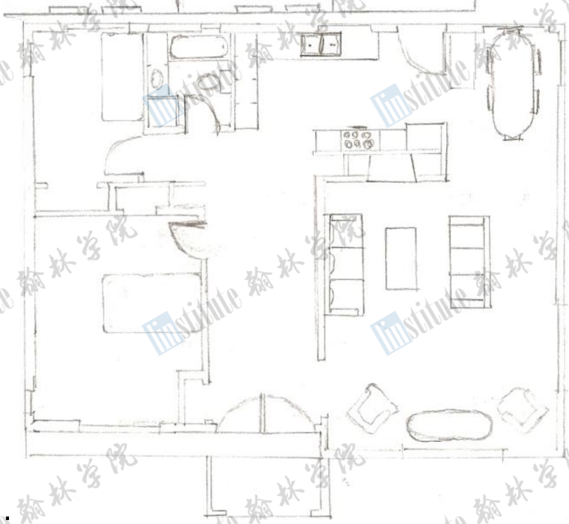

Image 4.2.2- A two-bedroom home.

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The second home, a two -bedroom, has the same amenities as the one-bedroom, but also includes a second-bedroom. This additional room enlarges the area of the home to 95.13271296 sq. m., and is the perfect addition to a home for the growing family. This home also includes a backyard of 5.5741824 sq. m. There will be 351 homes of this size available in each compound, equaling 35.1% of all the homing choices available in one residential compound.
See Image 4.2.2.

The third home, a three-bedroom, is the most space-saving home on the market in Aresam. It includes a master bed and bath, along with two spacious bedrooms, and a second full bathroom. It also s equipped with a full kitchen, and spacious living and dining rooms. This home is 113.806224 sq. m, and also has a backyard, which is 6.967728 sq. m. There will be 96 homes of this size available in each compound, equaling 10.8% of all homing choices in the residential compounds. See Image 4.2.3

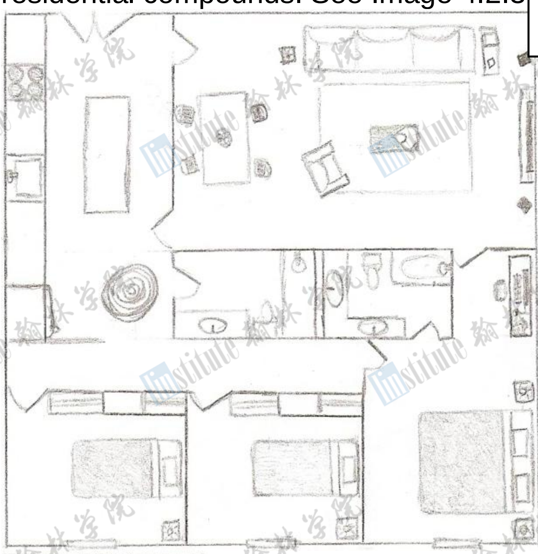


Image 4.2.3

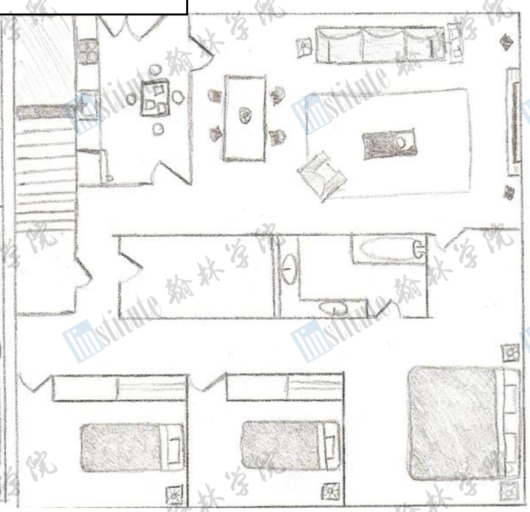


Image 4.2.4- the bottom half of the 4-bedroom home.

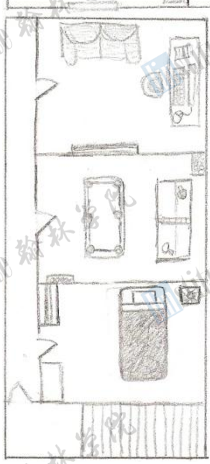


Image 4.2.5- the top half of the 4-bedroom home.

The fourth home, a four-bedroom, is the largest home in Aresam. It is much after the design of the three-bedroom home, but includes a split second story, with one to two extra rooms, totaling four to five bedrooms in the home (depending on the resident's preference). The second story will also include a family room, and study den. This home is a total of 16.611063552 sq. m, and the backyard is also 6.967728 sq. m. There will be 72 homes available of this size in one residential compound, equaling 8.1% of all homing choices in each residential compound. See Image 4.2.4 and 4.2.5.

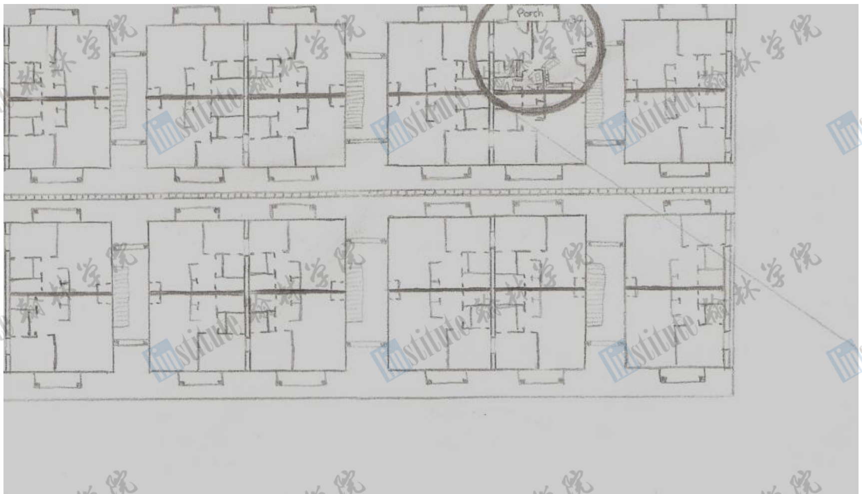


Image 4.2.6 – The Apartment Building. One apartment in the building is represented below.

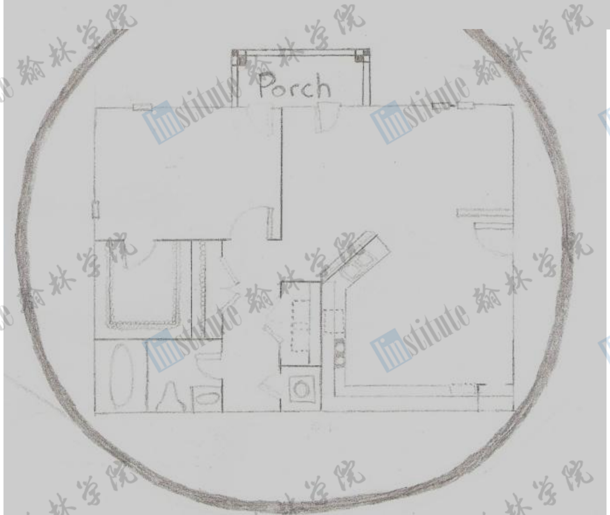


Image 4.2.7- an apartment

	Area	Avg. People/Home	# /Compound	# Total/First Construction	% Allocation
1Bedroom Home	274.32 sq. m	2	90	360	8.10%
2Bedroom Home	312.1152 sq. m	3	351	1404	35.10%
3Bedroom Home	373.38 sq. m	4	96	384	10.80%
4Bedroom Home	586.74sq.m	6	72	288	8.10%
1Bedroom Apartment	247.49760 sq. m.	1	3024 (in 42 buildings)	12096 (in 168 buildings)	37.80%

4.2.2 Apartments

In order to accommodate those residents seeking smaller and more economic living areas, we also have proposed two apartments. The apartment is a one-bedroom with a spacious living area, dining room, full kitchen, porch with an overhang, and bathroom. The area is 75.43726848 sq. m. for this spacious living facility. There will be 72 apartments available per building, with 3 stories, and walkways between every two apartments. There are 42 apartment buildings available in each community, which accounts for 37.8% of all the housing availability in each community. See Image 4.2.6 and 4.2.7.

For complete guide to the size of the housing, please see graph 4.2.2.1.

Graph 4.2.2.1

	Area	Avg. People in Home	# In Each Compound	# Total At First Construction	% Allocation
One-Bedroom Home	83.61 sq. m.	2	90	360	8.10%
Two-Bedroom Home	95 sq. m.	3	351	1404	35.10%
Three-Bedroom Home	113 sq. m.	4	96	384	10.80%
Four-Bedroom Home	178 sq. ft	6	72	288	8.10%
One-Bedroom Apartment	75 sq. m.	1	3024 (in 42 buildings)	12096 (in 168 buildings)	37.80%

4.2.3 Furniture

Because of a lack of efficient space, we here at Northdonning Heedwell will provide furniture that is elegant yet space saving. Some appliances in the kitchen fold out to the standard size they also fold back in to make the kitchen more spacious. An example of this would be an extra counter that slides out above the dishwasher. Also, the dishwasher in the apartment and small home in only half-sized, due to a smaller amount of people living in the homes. In order to provide physiological security for our residents, the standard bed will be a normal immobile bed. For residents who wish to have a more spacious bedroom they may order a bed that folds up. Depending on resident preference, the appliances in the bathroom could either be stackable; a cylinder which will allow separate appliances to rotate for use and then move back into the efficient space-saving position, or for the pipes in the house to be set up for the sanitary water that is used to go into the tank of the toilet can first be used to wash hands after a flush and then will return to the toilet tank. This will decrease the amount of water used in the bathroom. All furniture can be bought online and will be delivered by a cargo bin on the transport unit (see Automations).

Also, in order to break the monotony of look-like homes, we have innovative furniture available as well. Examples of this furniture would be a bookcase in differing shapes, and a kitchen sink that folds out into a table.

Our beds and couches will be made of memory foam, which is naturally light, so it will be easy to import from Earth. Also, all furniture will be made out of a lightweight yet heavy-duty polymer, also imported from Earth. All other appliances will be pre-made on Earth and shipped up according to the resident's preference (this will be reflected in the price of the home).

4.3 Safety and Spacesuit Procedures

4.3.1 Space Suit Design

The design of the space suit to be used by the residents of Aresam will allow for maneuverability and flexibility at a low cost to produce. The space suits are designed using mechanical tension to apply the forces required to keep pressure on the on the body to maintain a livable environment. The use of mechanical tension instead of barometric pressure applied through gas filled compartments in the suit exponentially reduces the weight, cost, and safety issues. Any rips or tears in the suit can be easily fixed by applying a quick fix elastic bandage that will reapply the pressure for a long enough time to reach a safe pressurized location to change out of the suit. The tension of the suit will cause any tears or punctures to only affect the damaged areas of the suit and not compromise the entire suit as a whole. The material used to make the suits, bio-film, is made of a highly elastic polymer with a cost approximately one-tenth the current price to produce a space suit. On the dorsal side of the suit there will be a fixture to mount a lightweight oxygen tank that will hold 0.5kg of oxygen rich, air. A high-density plastic helmet will be affixed to the top of the neck portion of the suit using airtight seals. See Image 4.3.1.

Image 4.3.1

Image from IEEE Spectrum, "What to Wear on Mars," June 2009, pg. 34.

4.3.2
Space Suit Donning/Doffing

The space suit donning and doffing procedure for terrestrial walks on the Martian soil will be carried out by means of a pressurized airlock with the donning consisting of a pre-breathing pressurized airlock where the residents will acclimate to the changes in pressure. After the residents complete the pre-breathing they will enter a separate airlock where they will don their suits by merely stepping into the tension bio-film suits and sealing them before stepping out to the outside. The doffing procedure will be performed in the same room as the donning procedure and will implement blasts of air from air vents in the air lock to remove the Martian dust and high-powered magnets to remove the remaining high ferrous dust from the suits. After all of the dust has been removed from the suit the suit can be removed and the resident can continue to the pre-breathing room where they can acclimate to the normal conditions of the base.

4.3.3 Tether and Rail System

The tether and rail system that will be used in Aresam will follow safety protocol in zero gravity and provide a quick means of transportation for the residents of Aresam. The transport will have be on two rails to guide it to its destination. Beside these transports there will be

Image 4.3.1

tethers put into place to allow those not in the transport to safely move as need be. See

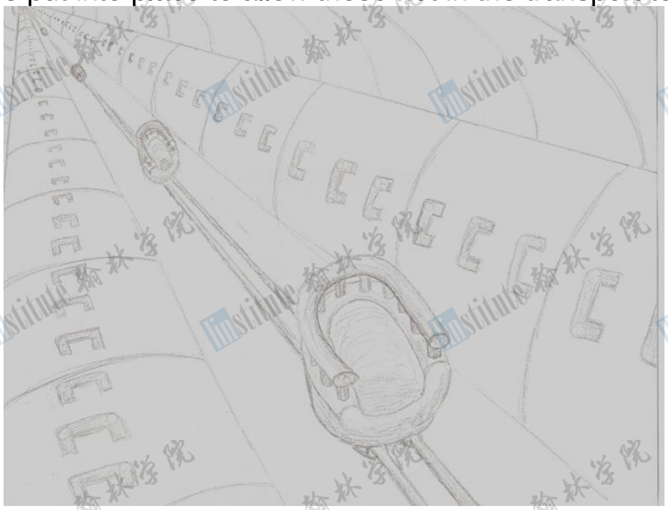


Image 4.3.1.

4.4 Anticipated Demographic Shifts

The residents of Aresam will be offered a variety of housing choices, as shown above. In order to accommodate expected demographic shifts in our neighborhood, Aresam will also have flexible and easily accommodating housing options.

4.4.1 Ethnic Variety

From 2050-2100, it is anticipated that the Caucasian population on Aresam will decrease by 10%, the Hispanic will increase by 2%, the African will increase by 4%, the Asian will increase by 3%, and the other populations will increase by 1%. In order to accommodate these shifts, Aresam has large unpopulated areas around each neighborhood for growth. Aresam will also have multiple places of worship for the anticipated religious variety

4.4.2 Family Growth

In each of our Family Homes we will have included expandable rooms, up to one room in our small houses, two rooms in our intermediate houses, and four rooms in our largest houses. These rooms will be expandable through a grid system. In this system the walls will be attached to a grid, and a resident will be able to expand their house by detaching their walls from the grid by using a portable computer located on the south wall. After detaching the wall, the resident only needs to pick it up with attachable handles (the walls that are movable will be made of a plastic polymer) and move it to another attachable site on the grid (see Image 4.4.1).

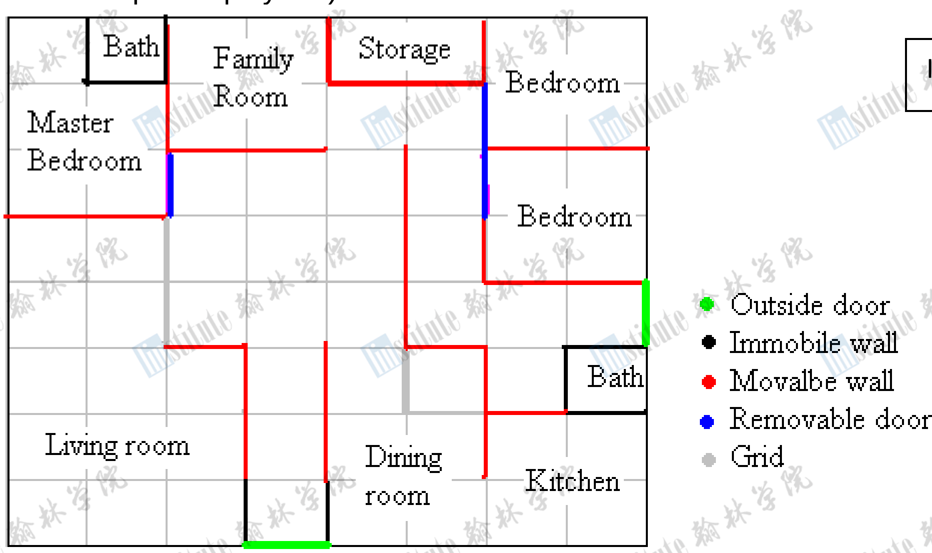


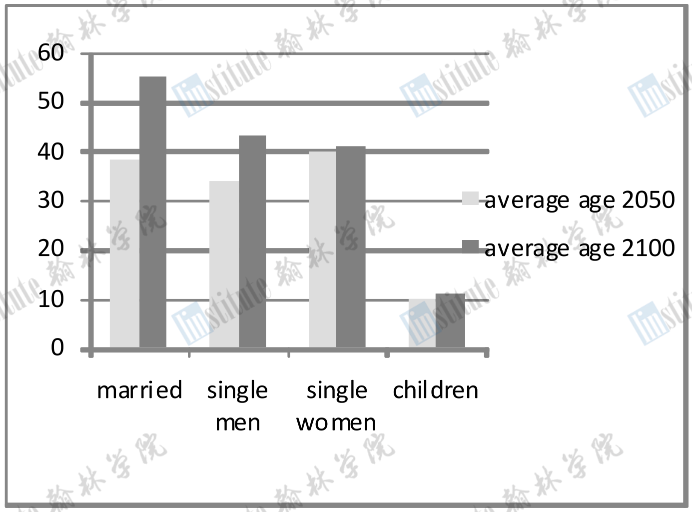
Image 4.4.1

4.4.3 Age Diversity

In order to accommodate age diversity, including various age shifts in the future, we have available room to build neighborhoods in lower gravity areas. Elderly people will be able to move to these areas in order to live in a more comfortable and less straining environment for their bodies. See Graph 4.4.2

4.5 Prefabricated Base

The prefabricated base will be circular with a hole in the middle (Image 4.5.1). Each occupant will have separate sleeping quarters, each equip with a bed, and other amenities such as a fold out desk, cabinet, or workspace. Surrounding the sleeping quarters is a main living and working area, which will have accessible wind non-pressurized wind barriers, along with a kitchen, and exercise area. There will be a total of two bathrooms at each end of the base. These bathrooms will both have space showers and toilet, and will have a recyclable plumbing system.



Graph 4.4.2

4.5.1 Storage

In the prefabricated base, there will be fold out storage from the ceiling, along with a storage area beneath each fold out cabinet in the separate sleeping areas. For work purposes, there will be a storage area beneath the living and areas. There will be four spacesuits stowed near the trap door to the storage area.

4.5.2 Exits

There are four doors on the base, on each wall of the compound. There is also a trap door to the storage area.

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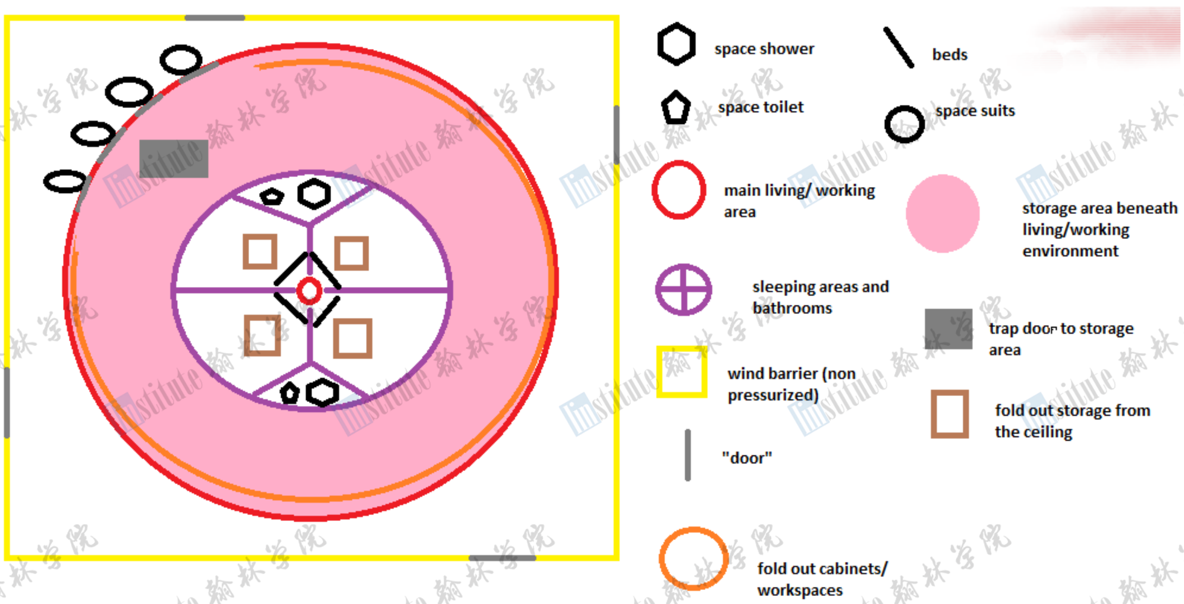
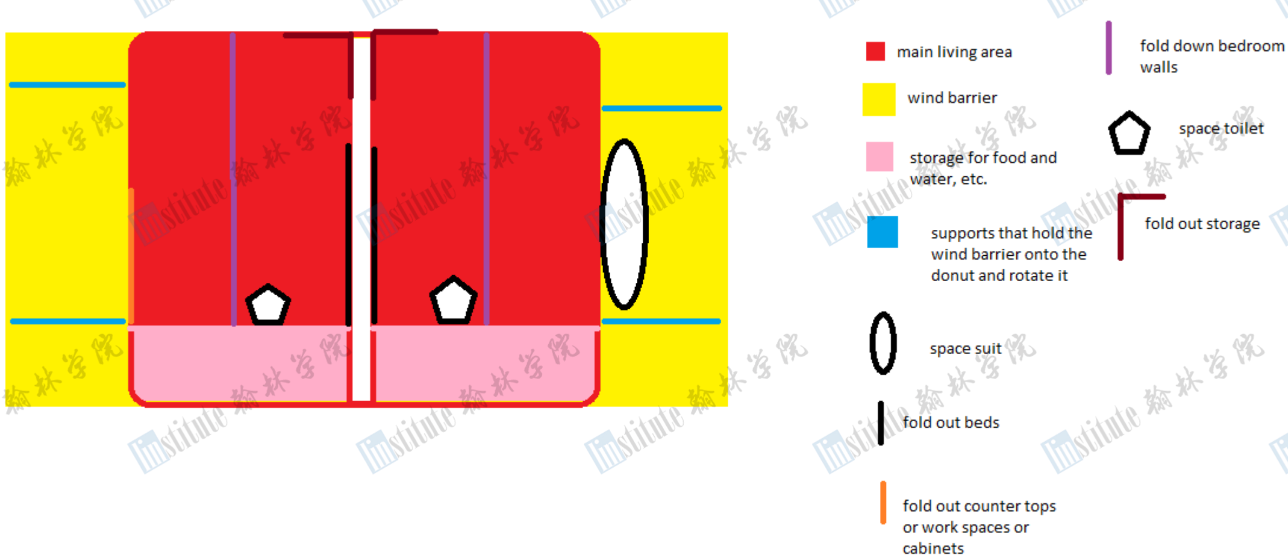


SIDE CUT OUT VIEW



Automations

Anthony Poplar

Head of Automations

Phillip Deporto

Automations

5.0 Automations

5.1 Construction of the ship
Station construction via. Automations

The super-structure of the station will be constructed by teams of Cons robots with TypeC chassis. After the super-structure is in place the robots will then begin basic structure from the inner most section of the station outwards, and from bottom to top. (That is, planet facing to space facing) Additional Cons robots will be constructed on the planet and shipped up. Cons robots with TypeB chassis will be used to put together interior structure including homes and furnishing.

Items requiring complicated construction such as computers, computer screens, carpet, etc. will be constructed on earth or on a subsequent station and will be shipped to the new station. A section will not be closed off until it has been completely furnished and built except for those parts that require a pressure-environment. These parts will be added just after the section is closed off.

Maintenance can be very important within the station. This is because it is vital for most services such as electricity, life-support, and others, to operate non-stop. Because of this, many smaller repair bots will be built towards the end of the construction segment. Teams of these bots will be assigned to specific sections both interior, and exterior. The following chart details this.

See 3.3 for images of use in assembly and construction

5.2 Maintenance

Section Maintenance	**Maintenance Required**	**Amount of Matbots Assigned to Job**
Exterior Hull	Possible patches, replacement sensors for sensor network,	50 robots stationed at various parts on the hull. During off time they position themselves near recharge points.
Interior Furnishing	Cleaning, uses specially fitted attachments to robots with typeA, even smaller custom chassis used for houses.	200 robots throughout the station with 25 charging at any one point.
Moving Parts (Interior)	Oiling will be required regularly on moving parts such as transports/elevators. The robots will move around through a special network fit for typeA chassis throughout the station.	15 robots. 5 charging 10 working at any one time.
Moving Parts (Exterior)	These parts include mechanisms such as docking clamps. Repairs and re-fits will be regular.	35 robots, as well as 15 refit Cons robots using a TypeC chassis.

Backup systems & Backup plans

Authorization System

The station uses a system of digital tags similar to RFID tags today. Unlike these tags which can be read by any passerby the digital tags will issue an encrypted challenge which well be answered by the tag. These tags are recharged by weak magnetic-resonance fields like those used to power the robots as described in the robotic appendix. Emergency operators will have special tags that can be used to grant themselves access to most systems, physically and virtually.

Recovery/Backup System

Though there is a significant amount of solidstate storage around each of the three central computers. However because all processes and tasks are capable of floating from computer to computer the storage is similar. At any one point there will always be at least three copies of critical files moving throughout the system.

In the event of damage which cripples the regular supply of energy to the station only high priority tasks will run. Personal attendants, maintenances bots, some recharge centers, and unnecessary internal lighting.

5.3 Human Livability

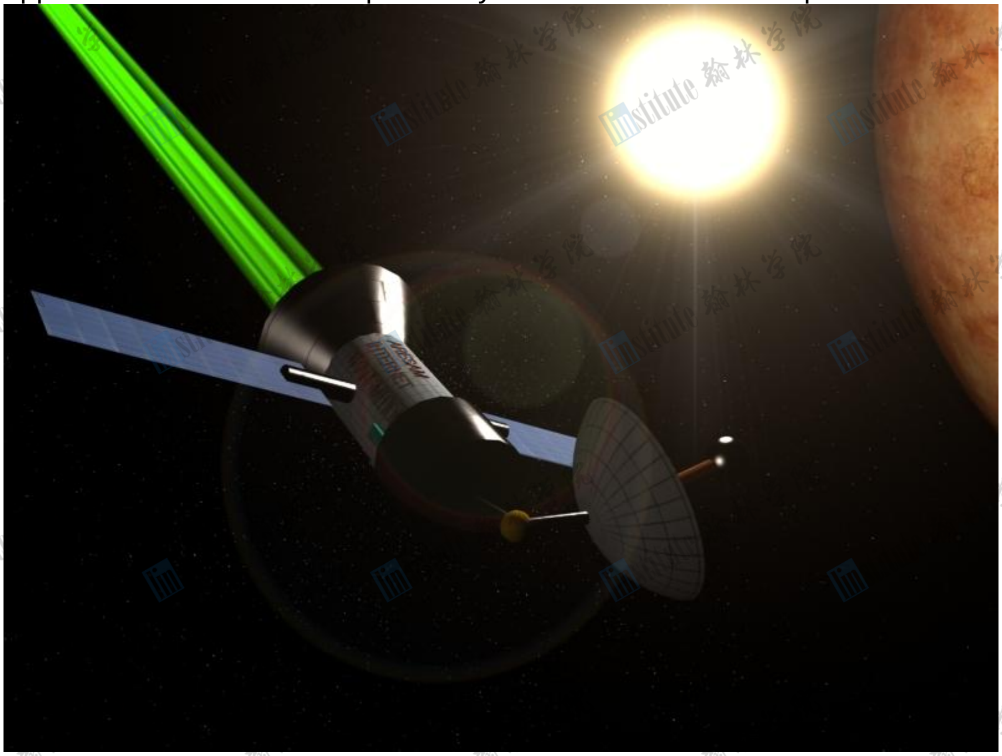
Every day life is filled with many mundane tasks which can easily be achieved by a robot. In Aresam robots will help free residents from mundane task such transportation of food from warehouses to residential areas. Several ship wide systems allow for residents to travel with ease through a system of tram-like public transports.

Inside the house/apartments there are a variety of machines to speed up daily life. First there is a specialized dish washer. Since all dishes on Aresam are standard issue the washer itself is only built to handle these dishes. The dishes/pots/pans are slotted into a specialized holder and put into a slit in the wall. The dishes are then blasted by a stream of high pressure steam. The waste is collected ground up and transported to a waste desaturation facility where the water is removed and if possible it is used as nutrients for the plants. Surfaces are cleaned through use of small robots capable of automatically cleaning an entire room. Each robot is coordinated so that rooms are cleaned in the absence of people and is done very quickly.

5.4 - External Communications

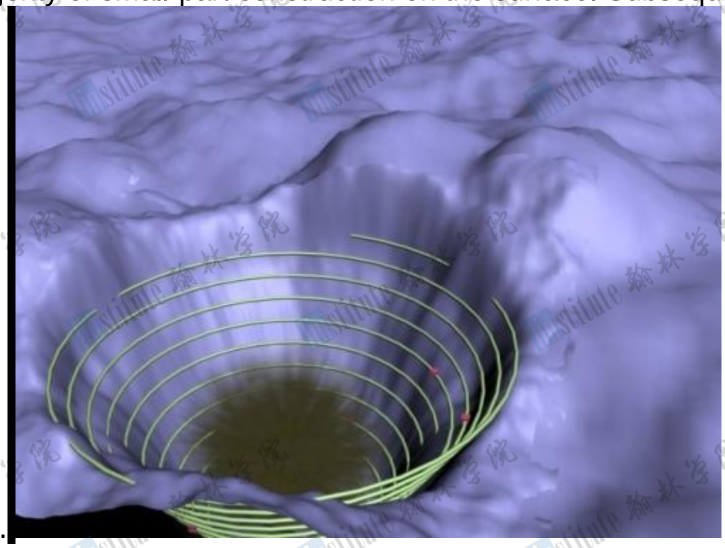
The connection with earth has two primary problems, one is speed, and the second is data verification. The first problem to deal with is the delay. Users will want various web pages may times a day. The frequency of page visits are recorded. Anytime a page is visited, it is cached on the station. This way any other visits can be gathered directly from the cache. The user can request a cache update, but there is a limit to the amount of cache updates allowed per user per day. Cache updates are automatically requested for materials that are often used. This ensures that many popular web pages are often fully updated.

The second problem is data integrity. Due to the huge delay it would be almost impossible to reply to every packet verifying the integrity of that packet before the next packet would be sent. Instead *summary* packets are sent containing hashes and other verification techniques which the sender can use to pick out corrupted data. Instead of waiting for this verification packet, the sender continues sending. If a mistake is found, an update packet is sent which the station can use to update data after the fact. The protocol and the networking applications will be built to specifically allow for these sort of updates.



5.5 Gathering Materials

Construction is a complicated process involving gathering resources from earth, though even more so from the nearby moons. The great diversity of resources on Phobos/Deimos are incredibly useful because of the greatly reduced gravity. In the interest of lifting resources off of the surface of the moon a temporary base will be set up on both moons. Refineries and factories will do the majority of small-part construction on the surface. Subsequent construction will take place in space.



The Surface Base

Two dozen preconstructed Cons robots (See Robot Appendix) will be brought to the moons and will be used to begin construction of a factory and a mining center. At the completion of both, attention will be focused on creating a circular ramp with a launching mechanism. This mechanism with a small chemical rocket assist will be used to transport refined materials and simple parts to space. The lower gravity will allow this to be possible. It should be noted that this system will not be capable of transporting humans. The forces applied to the cargo would surpass all forces a human could survive.

This base will be set up in the earliest stages of construction. A temporary nuclear reactor will power all operations of this base including large recharge fields (See robot appendix: Power) so that the robots can work non-stop except for maintenance. Raw materials will be mined, refined, and then shipped up to the station through use of the circular-launch system previously mentioned.

Robot Appendix

Robot Power Source

The power sources are a series of powerful rechargeable batteries in a series. This power source is attached to a magnet within a coil of wire. To recharge the robot simply needs to be within a recharge field in which another magnet is being moved at the resonant frequency of the robots' magnet. When the robots' magnet resonates within this field, it will generate power and thus recharge the batteries. Sensitive electronics will be shielded so that they are not affected within these fields, however these fields will usually be in isolated sections of the station as well as the ground base so as not to cause undue problems.

Robot Chassis

TypeA: This chassis type is for small robots and is .609602 m by .609602 m with an extendable metal cage for attachments. This cage is capable of extending .609602m in any direction to due multiple interlocking pieces. These pieces are fixed in place upon completion of the robot. The chassis is fitted with a wireless connection capable of handling the traffic generated by using two manipulators and running a drive system. The power source can be switched from a heavier stronger battery for repair bots that might need more power for say a welder or a lighter, though lower capacity power source that is more suitable for cleaning bots, or other simple robots.

TypeB: This chassis type is for medium sized robots that need to be able to be versatile and/or spend a long time away from a recharging center. The medium sized robot has a fairly powerful power source. This power source is capable of keeping a robot using this chassis running for up to eight hours without need of entering a recharging area. The chassis size is 1.0668m by1.0668m by .609602m. (Wider/Longer than taller)

TypeC: This chassis is the largest of the three and is almost never used after construction is completed except for heavy repairs. This chassis is capable of storing fuel for chemical rockets that would be used for free movement in space. The chassis size is variable, though the minimum is 1.219304m by1.219304m by .609602m. Additional modules for adding space for raw materials, parts, or fuel can easily be added to this chassis. The wireless module on this chassis is capable of handling the bandwidth required by complicated operations.

Cons Robot

This robot is built using either the TypeB or TypeC chassis. TypeC chassis is used for ground mining operations as well as space major construction and major repair. This robot has two manipulators. The first is a multijointed arm-like appendage used for gathering raw materials as well as holding components in place. This arm can have a drill-like capability or a magnetic capability for better handling of ferrous parts. Which capability it has depends if it has been outfitted as a mining robot or as a construction robot. During space construction only TypeC chassis is used to allow for movement in space via chemical jets.

Matbot

These robots are for regular maintenance and are capable of emergency repairs. Using TypeA or TypeB chassis, these robots are capable of maintenance both within and outside the station. TypeA is primarily indoor, while TypeB is primarily in space. Because the TypeB chassis is incapable of navigating by chemical boosters, these robots use a series of magnetic legs to creep along the outside of the station. The magnetic bond is electromagnetic, though it does not have to be that powerful to hold itself to the station as there is little force trying to throw it off except at the outermost limits of the station.

This robot is equipped with three manipulators, a simple arm for clamping on and moving metal patches, a welding arm to apply patches and fuse metal plates, and a second arm with a more powerful magnetic grip for better manipulating ferrous metals. The third arm also has a small tube which can be used for applying oil to moving parts.

<u>System Appendix</u>

Atmosphere/Climate/Weather Control: The weather control system is made up of a large grid of climate control packages. Each package has the ability to remove/add moisture to the air, as well as heating/cooling the nearby air. Usually each climate package acts independently based off of the immediate area's needs. An overall controller is used to coordinate multiple climate packages in the event of a large anomaly.

Food Production: Plants are grown on a large rotating cylindrical lattice. The lattice rotates through a trough of water. In one (or several) location(s) lights will be illuminating the plants so that they rotate through light the appropriate amount of time for the plant species and spend a good amount of time in water. Harvesting is done by a series of mechanical arms built to most easily harvest the plant growing on the particular lattice which they are attached to. Changes to the plant's genetic material along with abundant nutrients are used to accelerate plant growth to allow harvesting four times a year.

Livestock: Cows, Chicken and Pigs are the three types of livestock housed within the station. Cows are contained in a large, several storied, hanger like structures where they like in free ranged colonies. Chickens are kept in several storied coops, also free ranged. Free ranged areas are simply small areas designed to allow the animals to roam short distances. Pigs are kept in smaller pens.

Electrical Power Distribution: This system is responsible for detecting problems in the power distribution grid. Quotas are established for residential areas as well as industrial areas. These quotas are used to ensure that no one person or group of people is using all of the power available to the station. Small stations throughout the grid are used to detect shorts or power leaks and direct maintenance robots towards the fault.

Water Control System: This system has only two purposes. The first is to enforce a quota on water used preventing overuse, and the second is to contain water breaks. This second function is incredibly important in the enclosed environment of a space station. A system of pressure sensors and flow sensors are used to detect even the smallest pipe breach and used to cut off the water flow in that particular area. Water in the air is reclaimed through use of the climate control system.

Communication System: The in-ship communication system is facilitated internally through personally assigned mechanisms (PAMs) units which relay voice, video and text messages to the user. These units would be used to relay both personal messages and ship wide news. Additionally, these units will track the movements of the user and help with statistics for future development of the station and human traffic monitoring.

Day/Night Cycle: The cycle is run based off a pseudo-earth system. Ship wide lights except in critical section lower during the night cycle and run at full during the day cycle. However most of the day/night provisions are provided per-residential area. Each apartment/house would have its own light controls allowing them to customize the settings to suit themselves.

6.0 Schedule and Cost

While ARESAM is an ambitious undertaking there is a great potential to use this bold new station as a platform to mine Martian materials and to Earth. Later, perhaps another decade or so down the road, it could even be used as a launching point for establishing mining colonies in the asteroid belt. This alone shows how versatile the station can be economically, and how great a tool it can be in the hands of those who would wield it.

6.1 Schedule for Completion

Figure () gives a list of all the steps in construction. These are based around a contract signing in mid-2055. Also, the prices and timing of each step is also given. Care was taken to ensure detail and accuracy as to avoid unnecessary expenditure.

6.2 Construction Expense

Included in the data table is a list of all expenses incurred during construction, including fuel and labor. Labor costs are based around the idea of a 2,000 man team of workers.

6.2.2 Annual Costs

In the following tables is a 10 year financial plan easily adaptable around group needs and changing economic climates. It is a detail ridden template that can serve other stations like ARESAM down the road.

()()

6.2.3 Revenue

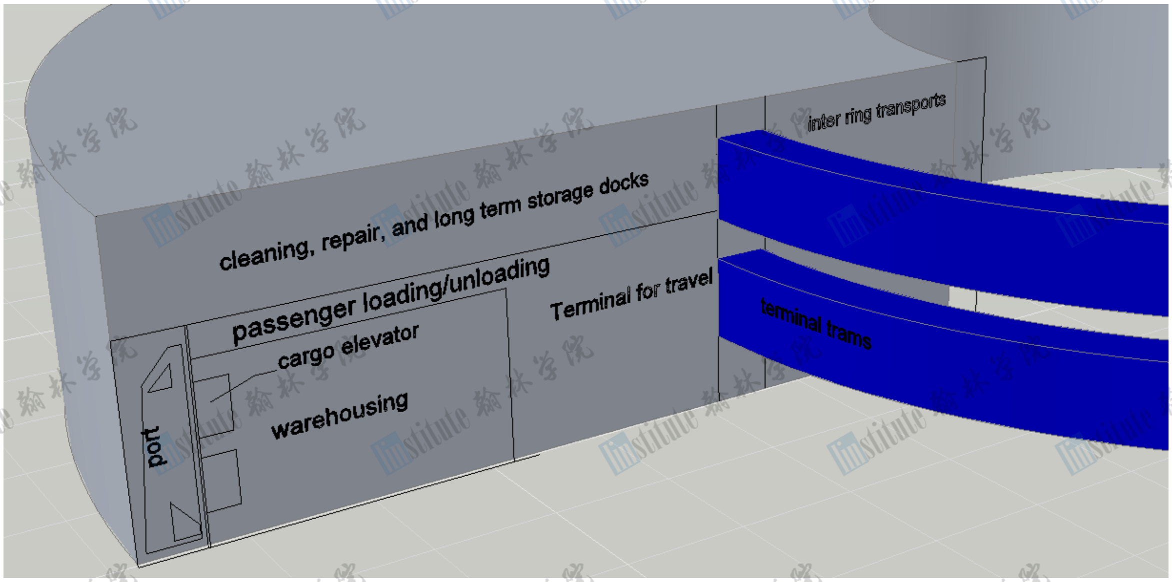
Revenue will be mostly generated by traffic going from Earth to Mars and vice versa, as well as profit from mining Martian metals and providing materials for colonies being established on the surface of Mars as well.

Schedule Beginning June 25th 2055

Task	Beginning	Duration	Completion	Cost
Hiring of Personnel for Construction	July 1st 2055	3 Months	October 1st 2055	$405,000,000
Construction Phase One:Gathering of Resources	October 15th 2055	12 Months	October 15th 2056	42,429,850,000
Construction Phase Two:Materials Transport	October 15th 2056	6 Months	April 15th 2057	610,000,000
Construction Phase Four: Orbit Movement	May 1st 2057	1 Month	June 1st 2057	430,000,000
Construction Phase Five: Assembly of Middle Layer	July 1st 2057	6 Months	January 1st 2058	560,000,000
Construction Phase Six: Assembly of Upper and Lower Layer	January 15th 2058	3 Months	March 15th 2058	575,000,000
Construction Phase Seven: Basic Interior Phase	April 1st 2058	3 Months	July 1st 2058	155,000,000
Construction Phase Eight: Rotation Phase	July 15th 2058	2 Weeks	July 29th 2058	2,225,000
Construction Phase Nine: Advanced Interior Phase	August 1st 2058	6 Months	April 1st 2059	1,775,000,000
Construction Phase Ten: Residents Move In	May 1st 2059	4 Months	September 1st 2059	155,000,000
Foundation Society Assumes Control	September 14th 2059			

Total Amount of Time	4 Years, 2 Months, 2 Weeks
Total Cost (Separate From Annual Cost)	$47,672,075,000
Annual Costs (Beginning January 1st 2060)	
Workforce (2000)	350,000,000
Maintenance	17,750,000
Imports	2,250,000,000
Industrial Costs	220,000,000
Total	3,837,750,000
Annual Revenue (Beginning January 1st 2060)	
Tourism	550,000,000
Exports	200,000,000
Commerce	100,000,000
Industry	100,000,000
Repair of Space Vehicles	100,000,000
Miscellaneous	250,000,000
Mining	3,500,000,000
Total	4,800,000,000
Total Profit	962,250,000

7.0 Business Development
- Transportation, Node, and Port



Ships will dock parallel to the station. Computer guided hooks will lock onto the ship and guide it fully into the port. After the ship is locked into place an airlock will extend and attach to the exit of the ship. Simultaneously the cargo hold will be lowered directly into the storage/warehousing area. The passengers can also disembark at this time. Passengers will disembark in a fashion similar to contemporary airplanes; they will exit through a side hatch and pull themselves down a pressurized rail-lined hallway which leads to a large lounge/ check-in/ orientation area. Meanwhile the cargo, which is all in standardized boxes, travels in the elevator to be temporarily stored or transferred between spacecraft for further use. The elevator lowers into the warehouse where the boxes can be put onto tracks and moved by motorized vehicles. The dock will be able to accommodate both station-to-Mars shuttles and Earth-to-station shuttles. Because the docking and cargo transportation are standardized, large-scale Mars surface operations and industrial operations are easily accommodated as well.

To board an aircraft passengers must first travel to the docking ring via an elevator to enter the terminal. To travel around the terminal passengers must don Velcro shoes (the “floor” will be covered in Velcro carpet). Once in the terminal passengers must scan their ID cards to receive instructions about the location of their desired craft. They will then board a tram to get to the right terminal. Once there they will scan their ID once more before entering the pressurized rail-lined hallway and boarding the ship. All passengers boarding and disembarking will be escorted by flight personnel. To enter the station the same process is done backward.

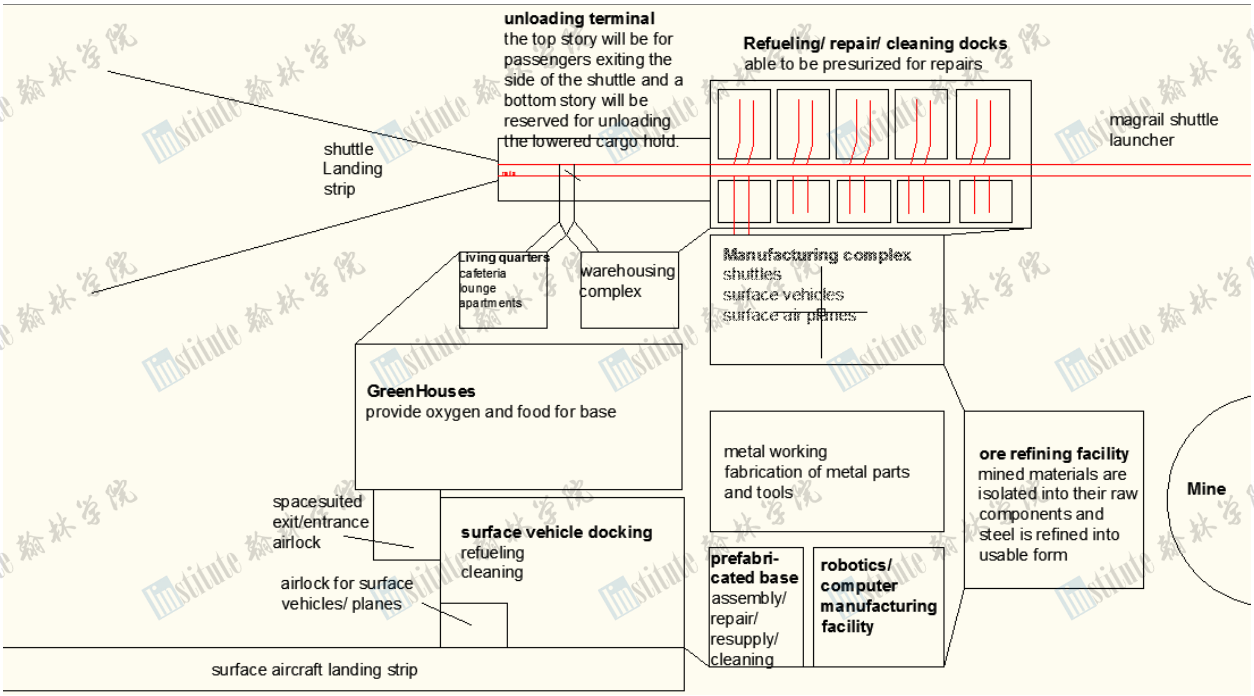
Every time a ship docks it will automatically be refueled by a gas pump located near the elevator. It will also be reprovisioned if it is scheduled for a soon departure. This will be done by refurnishing the cargo hold with supplies before returning it to the ship.

The repair depot for Mars surface vehicles will be located on the landing strip of the Mars base. It will be easily accessible by any craft and directly connected to plant that manufactures new craft. It will be able to house 10 vehicles at one time and be repairing 10 vehicles. The spaces for vehicle repairs can be used for storage if there are not vehicles needing repair. The depot will be regularly cleared of dust to prevent damage to the machines and machines will be cleaned before they enter the facility.

Because only the cargo hold of a ship actually enters the station, the surface area that must be cleaned is greatly reduced. High powered vacuums will thoroughly cleanse the hull and remove all traces of dust after ships have docked. There are also vacuums stationed at all joints and breaks to catch any errant dust particles that can escape from tight places. After a ship is unloaded it can either leave, stay, or be moved for more intensive cleaning or repairs. To be moved a ship is hooked up to a tram system that runs on tracks and moved to the interport transport of ships, cleaning and repair docks.

- Manufacturing Center for elements of Mars and Phobos/Deimos infrastructure

There is a shuttle landing strip specially designed to slow ships for landing. Shuttles will be piloted onto automated tracks to be guided through unloading and refueling/repair/cleaning docks and to be unloaded and parked. For departure shuttles will be transferred onto the loading/unloading tunnel to be loaded with manufactured goods and passengers. The shuttle will travel along the tracks, exit the complex, and will be accelerated rapidly by an electric magrail shuttle launcher providing most if the velocity required to escape Mars' gravity, rocket thrusters will guide the shuttle the remaining distance. See figure 7-1. Greenhouses will provide oxygen and plant materials for the inhabitants. All meat is grown on the station so it and other food products not manufactured in the greenhouses will be shipped down from Aresam. The manufacturing complex will include accommodations for miners, manufacturers, and pilots (both temporary and long-term occupants) including a cafeteria and living quarters.



A Mars mining facility will excavate iron and silicone from Mars' surface and refine it into usable forms to be distributed to the various manufacturing complexes in the manufacturing center. See Operations for a complete list of available materials.

Vehicles and robots are transported in the cargo holds of shuttles. They will be packed into the standardized storage boxes, which may require some assembly and disassembly. The boxes will be loaded onto the shuttles and the contents will be transported as described above. Food and other commodities will be transported in a similar fashion. Anything that can be fit into a standardized box will be shipped in one. For anything that does not fit into a regular sized box, larger versions will be kept in storage that can be pulled out and used.

There will be medical and quarantine and services treatment as outlined in 4.1.2. The products what will be needed in launching and landing and tools are outlined in 2.2. Sources of materials -for vehicle, robot and prefab base construction are in 3.1. Manufacturing processes are conducted in pressurized volumes in Appendix A and 5.5. A representative scene from the production line is in 3.2.2. Vehicles and robots intended for surface operations and their transportation are covered in 2.5.Foods and commodities will be transported as noted in 3.5. Laboratories for assay and experiments with materials collected on Mars are expanded up in 4.1.2. The capability to quickly begin producing products (identified as having commercial potential) are detailed in 6.2.3. The cost criteria for such products are in 6.2.3 Quarantine for hazardous materials are also taken care as detailed in 4.1.2.

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Appendix A

	Outer ring 1	Outer ring 2	Inner Ring	Inner Sphere
Efficiency of moving in-process products between work locations	Medium	Medium	Medium	Medium
Appropriate gravity and pressure environment for each in-process activity	Low	Low	Medium	High
Environmental impact of processes on communities and individuals	High	High	Medium	Low
- Access for maintenance and repair of automation systems employed in manufacturing	Medium	Medium	High	Medium
- Human oversight of manufacturing operations	High	High	Medium	Medium
Safety	Low	Low	Medium	High
Overall Area	High	High	Low	Medium
Storage Area	High	High	Low	Medium
Overall	Low	Low	Medium	High

The reason why the inner sphere is selected is due to its efficiency of transporting supplies from any place in the station to another without having to travel long-distances and having low gravity for most of the trip allowing heavy object to move easily. The low environmental impact comes from its isolation from the residential and agricultural sections of the settlement. Its access for maintenance is a little longer than the inner ring, but it makes up for it due to its central location and allows any automated system to travel no more than the radius of the sphere to fix a problem. Human oversight of manufacturing is not a problem due to the accessibility of the sphere from the inner ring. This allows any overview of manufacturing to occur rapidly. The inner sphere allows maximum safety since it is separated from residential areas, if it has a problem citizens need not be alarmed, because they are a safe distance away from harm. The area of the inner sphere allows manufacturing to occur with enough space, for such activities as smelting, assembling, dismantling, and shipping. Overall, the inner sphere is the finest location for manufacturing products from nearby locations.

Appendix B: Works Cited

Work sited page

URLs of Resources

"Arroyam" Previous THS Entry

"Bellevestat" Previous THS Entry

Hawkins, Dale. Personal Interview. 26 Jan. 2010

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Appendix C: Compliance Matrix

Section	Statement of Work met	Page Number(s)
1.0	Basic Requirements and Executive Summary	1
2.0 Structural Design		2
2.0.1	Provide a safe and pleasant living and working environment	2
2.0.2	20,000 full time residents and transient population	2
2.1 Exterior Design		2
2.1.1	Dimensions of major hull components	2
2.1.2	Construction materials of major hull components	2
2.1.3	Rationale for rotation rate and artificial gravity magnitudes	2
2.1.4	Exterior Design drawings/ Structural interfaces between rotating and non rotating sections	2
2.1.5	Protection from radiation and debris	3
2.1.6	Isolation of Separate Areas	3
2.1.7	Pressurized and Non Pressurized Sections	
2.1.8	Functions of each volume	3
2.2	Interior design	4
2.2.1	Percent Allocations and Dimension of Down surfaces	4
2.2.2	Orientation of Surfaces	4
2.2.3	Vertical Clearance	4
2.2.4	Drawings of interior/ Overall Map with Usages	4
2.3	Construction Process	4
2.3.1	Six stages of construction with illustrations	4
2.3.2	Implementation of Artificial Gravity	7
2.4	Expansion overview	7
2.4.1	Features that enable expansion and illustrations	7
2.4.2	Features that reduce construction costs and future disruptions during expansion	7
2.4.3	Port modifications	7
2.4.4	Illustrations of interfaces that enable expansion	8
2.5	Prefabricated structures	8
2.5.1, 2.5.2, 2.5.3	Pictures of prefabricated structures after deployment, during deployment and before deployment	10
3.0	Operations and Infrastructure	11
3.1	Mars Orbital Location/ Sources of materials and Equipment used in construction/means for transporting materials to Aresam/ Table identifying types, amounts, sources of	11