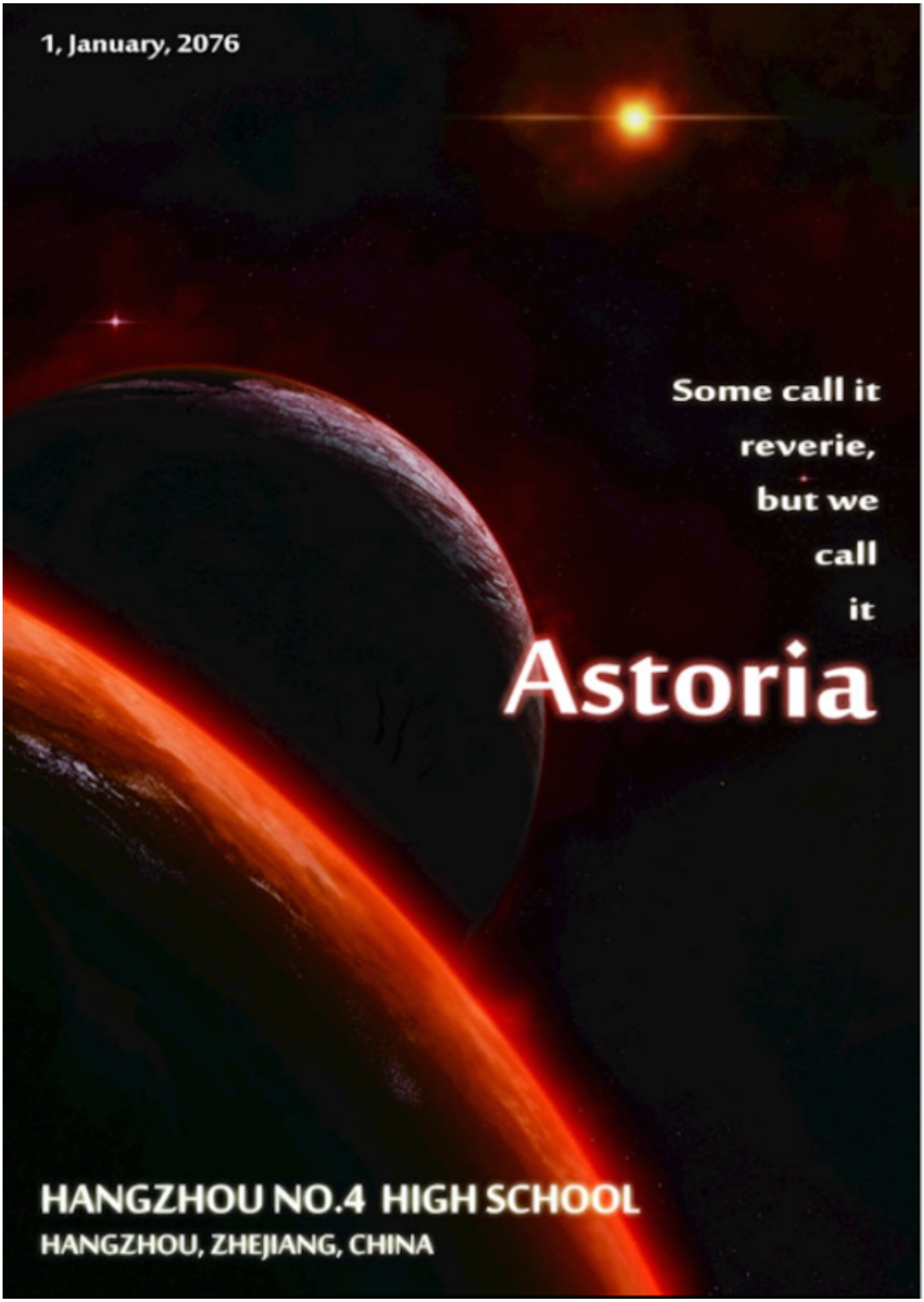
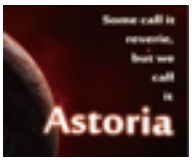

1, January, 2076
Some call it
reverie,
but we
call
it
Astoria
HANGZHOU NO.4 HIGH SCHOOL
HANGZHOU, ZHEJIANG, CHINA



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Executive Summary

1.0 Executive Summary

In spite of the fact that the immensity of the universe is difficult to grasp, in the past several decades, mankind's knowledge of the cosmos has increased beyond measure. In the near future, we are going to expand our living space into extraordinarily distant area in the cosmos where we have never conceived before. In a word, we will open a totally new episode in Astoria, the first large enormous space settlement community, located in solar orbit within the asteroid belt between Mars and Jupiter in the vast universe.

The whole structure design includes the out configuration as well as the internal arrangement. If we look the whole community outside, the Astoria settlement community is mainly consisted of three different-sized tori and a central cylinder with three sets of transparent protecting shielding that are used to prevent the community from the collision of some meteoric streams, and we are capable of predicting the path of the meteorites so that we can take action to avoid them several days or hours before the final collision. Among the three tori, those are agriculture apartment, residential sector, and industrial part from top to bottom. We set several viewing decks in different sides of the torus of the agriculture one, as it is located at the top with the wide sphere of vision. Concerning to the central cylinder, there are oxygen producing and storing part, nuclear power producing segment, fuel storage and propulsion system at the bottom. It is this structure that allows the operation in each segment work normally without affect each other, in addition, it is more convenient with both good order and good environment.

Concerning to the development in the society, the first thing we are going to do is to mine from the asteroid to get more resources to enrich ourselves, and to promote the development of economy. Furthermore, there will be some places for social activities such as the park, the artificial stream, and the sports field outdoors. Within the community, there will be places like the library, stadiums, schools to help advance the level of education and physical condition of the local long-term dwellers. Also, as I mentioned above, there will be observation decks in the settlement, which are capable of attracting a host of visitors to the society, and to let them be familiar with the settlement. Such spectacular outer space scene is very rare and is worthwhile. Another aspect that cannot be ignored is that we are competent to appoint some experts to explore more about the outer space beyond the asteroid belt to get more information about the places we live.

The construction process of the community is as follows. In the first step, we are going to establish the central cylinder on the ground of the Ceres which will cost for about 0.5 years, after which we will enter into the second step to set up the propulsion system and install the shielding plates in the consideration of the problem that it can protect the structure firstly as we send the settlement to the orbit. Then we will launch the cylinder with shielding to the orbit. In the third step, we pan to install the agriculture torus (including the observatory decks) at first, which may cost about a year. In the forth step, we will install the residential part which is beneath the agriculture sector, and it is going to spend 1.25 years for us to finish this, and then it goes to the industry segment in step 5 which takes 0.9 years. In the last step, we will finish the interior equipment and let people to move in. the whole process will cost 7.65 year. More importantly, we will collect most of the resources to construct in inner part of the settlement from Ceres that has a mass of minerals such as dolomite and siderite.

In the aspects of operation strategies and the maintenance, firstly we'll provide some basic life facilities like the provision of resources and the transportation of ore that we get from the asteroid. Besides, we are going to sell those extra surfeits of resources to other communities like us. What's more, in the consideration of the lack of labor in our settlement, we shall provide various welfares to the workers in different segments of the community, not only for satisfying the crews but also to attract more long-term or semi-term dwellers to the community. The maintenance of the whole community is mainly responsible for groups of robots, and different team will be in charge of different parts of in community. To take an instance to demonstrate this, there is a group of robots that are the functionaries of the repairing and the maintenance of the shielding and they will check and maintain the shielding in every certain period of time.

Structure and Design

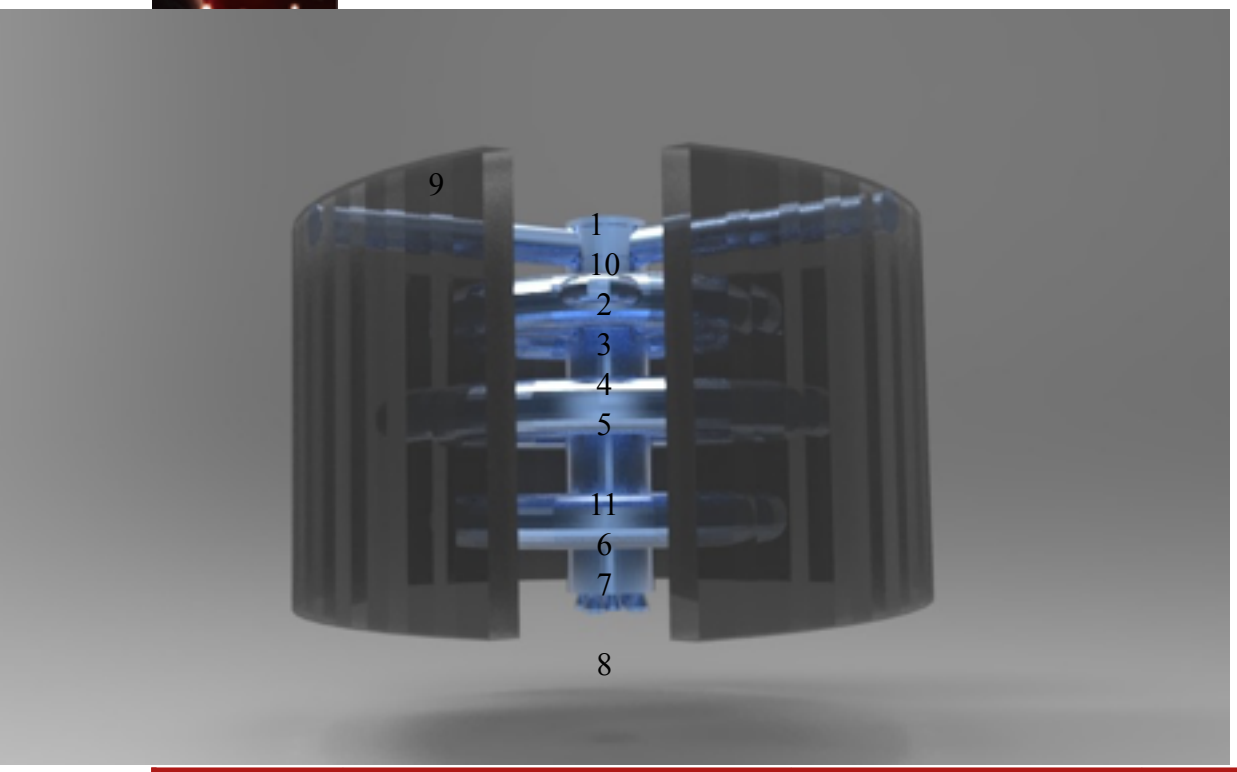
2.0 Full view of the city

The whole torus structure is spacious enough to accommodate 6000 long-term residents, 5000 semi-term occupants, and up to 500 short-term visitors.What's more, there are three "panoramic observation deck"in the Astoria settlement which are situating in three different sides of the Astoria and each of them can afford 100 people for maximum each time. The dwellers in the settlement can enjoy the spectacular views of the cosmos such as the Ceres and other minor planets. Additionally, material constituting the observation deck is aluminum oxynitride glass which has properties of transparency as well as high intensity. Therefore, it is absolutely safe and worth enjoying.

2.1.1 Astoria's exterior design

	Component	Function	Location
1	Repairing segment(including robots storage)	Mainly for repairing of the outside shielding, and also provide space for the storage of robot which is used to provide various kinds of service for the residents.	Situating in the top of the central cylinder
2	Agriculture torus(inclusing observation deck)	Cultivation of many kinds of crops and stock-raising. The overservation deck can give the chance to people to enjoy the fascinating view of university	The first torus (counted from top to the bottom) and the observation decks are inside the "U" shape in the three different edges of the agriculture torus
3	Oxygen producing and store	Producing oxygen and store it for future use	Betweent the first and the second torus in the central cylinder
4	Residential torus	Provide space for all the people (full-term, semi-term, and visitors)to live.	The second torus
5	Nuclear power station	Provide nuclear power for roating of every rotated section and other life-long energy.	Between the second and the third torus
6	Industrial torus	Refine the material or the mineral we collected from the asteroid region	The third torus
7	Fuel storage	Store the fuel used to run the propulsion system	Between the third torus and the propulsion system
8	propulsion	Provide motive power which can propel the Astoria, and avoid collision by asteroid	Under the central cylinder
9	Shielding	. Protect the whole settlement, prevent the meteriod from colliding	In the outermost location of the settlement which looks like three glasses
10	Control center	Control all the operation of Astoria	Beneath the repairing segment
11	Central cylinder	Transport and store all the energy and power that other sectors produced.	This is the center of the settlement structure

2.1.2Exterior views of Astoria with its major visible feature



		Rotating	Pressurized
NO.1	Repairing segment	×	×
NO.2	Agriculture torus（including observation deck）	√	√
No.3	Oxygen producing and store part（in the central cylinder）	×	√
NO.4	Residential torus	√	√
No.5	Nuclear power station（in the central cylinder）	×	√
NO.6	Indulstrial torus	√	√
NO.7	Fuel storage（in the central cylinder）	×	√
No.8	Propulsion	×	×
No.9	shielding(there are both radical and optical telescope attach on it）	√	×
No.10	Control center（in the central cylinder）	×	√
No.11	dock	×	√

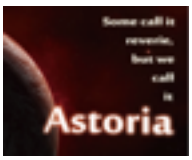
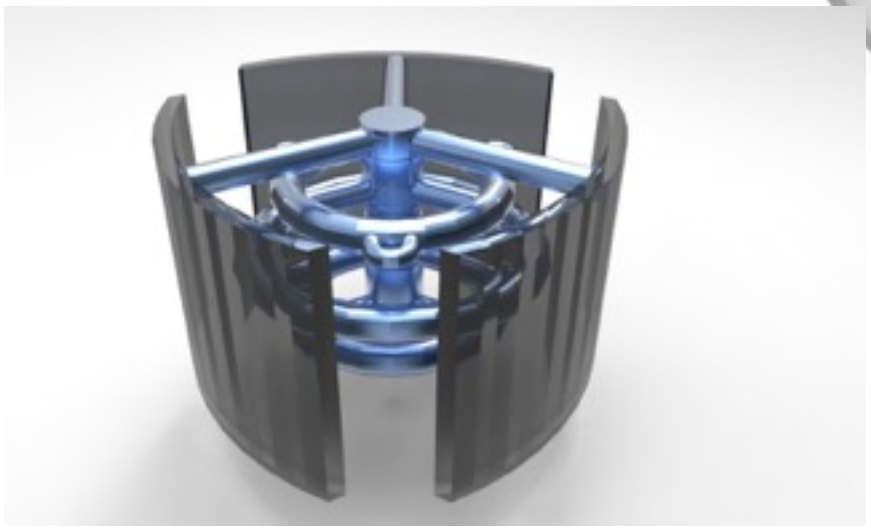
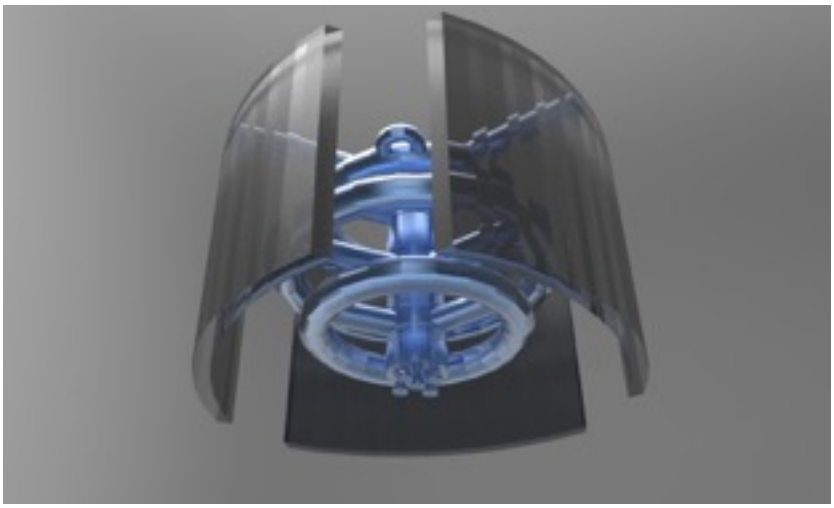


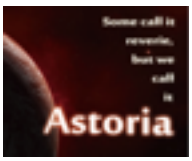
Fig2.1.2.2vertical view

Fig2.1.2.3 bottom view

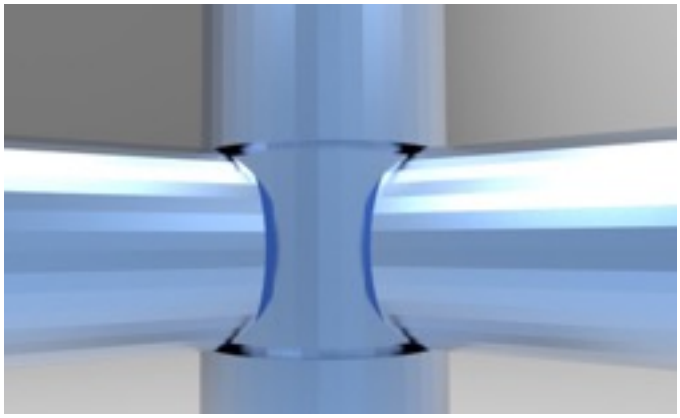
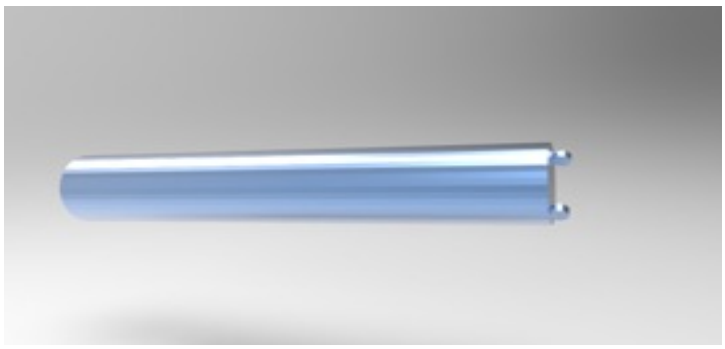
Fig2.1.2.4 side view





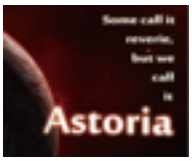


2.1.2.1 Structural interface between rotating and non-rotating sections of Astoria

	Track
Description of working	There are two grooves that like track, and the cylinders have two wheels which suit the grooves, then the engine in the wheels and cylinders are going to push them move forward, finally, the cylinders will move along the route which is around the central cylinder.
Advantages	Not expensive, easy to operation.
Disadvantages	Cost lots of power, need upkeep and should be observed all the time.
Pictures of interface	 

2.1.3 Dimensions of various components of Astoria

	RPM	Artificial gravity magnitude	Atmospheric pressure(psi)
Residential torus	0.96	0.82g	13
Agricultural torus	1.03	0.71g	13
Industrial torus	0.96	0-0.51g(variable)	13



	Residential torus	Agricultural torus	Industry torus	Central cylinder
Major radius(m)	800	600	500	180
Minor radius(m)	100	100	100	160
Vertical clearance(m)	Variable	Variable	Variable	\
Down surface area(m^2)	879645.943	628318.530	502654.8257	401750.408
Surface area(m^2)	3158273.408	2368705.056	1973920.88	1696460.033
Volume	157913670.4174	118435252.8131	98696044.0109	152681403

2.1.4 construction material

	Material
Residential torus	Alufer
Agricultural torus	Alufer and greenhouse glass
Industrial torus	Alufer
Shieding	Silicon carbide
Central cylinder	Alufer

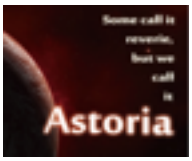
Means of protecting from radiation and debris penetration

The way to prevent the radiation is to paste PVC all over the three tori. And to protect from debris, we use the three huge shields which are made by Silicon Carbide (see specific information in 2.4)

2.2 Internal Arrangement

2.2.1 Percentage allocation of down surfaces

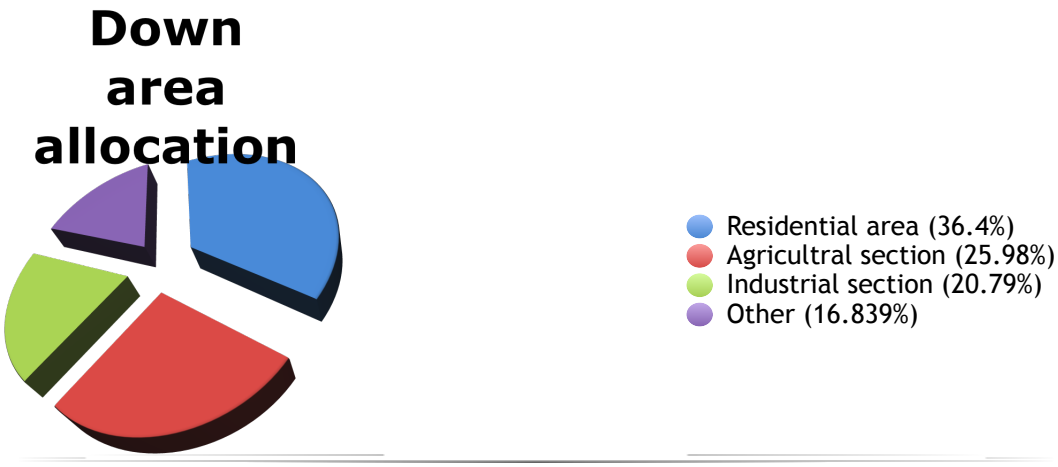
	Subsection	Down area (sq.m)	Percentage
Agricultural area (25.98% 628318.530㎡)	Crops	383274.303	61%
	Warehouse	69115.0383	11%
	Livestocks	81681.4089	13%
	Artificial river	94247.7795	15%

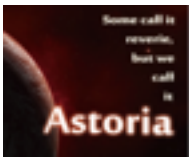


	Subsection	Down area (sq.m)	Percentage
Residential area (36.4% 879645.943㎡)	Community	439822.972	50%
	Parks	70471.6754	8%
	Road	131946.891	15%
	Library	43982.2972	5%
	School	87964.5943	10%
	Artificial stream	10557.513	12%

	Subsection	Down area (sq.m)	Percentage
Industrial area (20.79% 502654.8257㎡)	Factories and workshops	286513.25	57%
	Warehouse	125663.706	25%
	Transportation department	90477.8685	18%

	Subsection	Down area (sq.m)	Percentage
Other (16.8399% 407150.408㎡) (every department is in different layers of the central cylinder, so they all have the same area)	Repairing segment	101787.602	25%
	Oxygen producing department	101787.602	25%
	Nuclear power producing segment	101787.602	25%
	Fuel storage departmetn	101787.602	25%

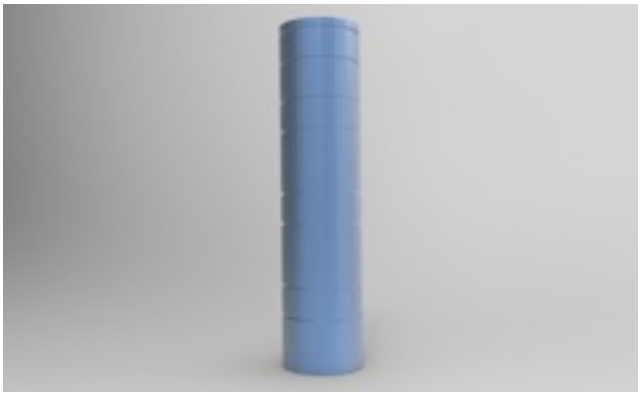
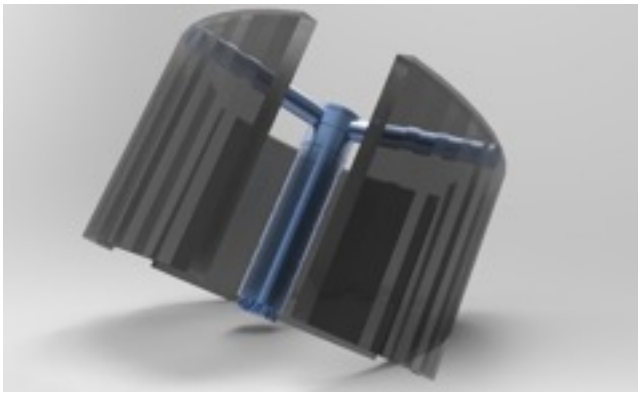
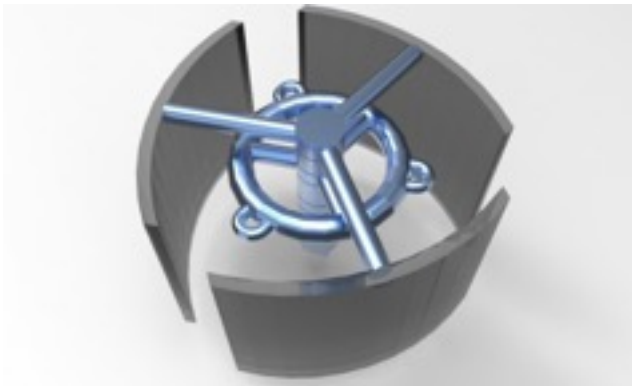


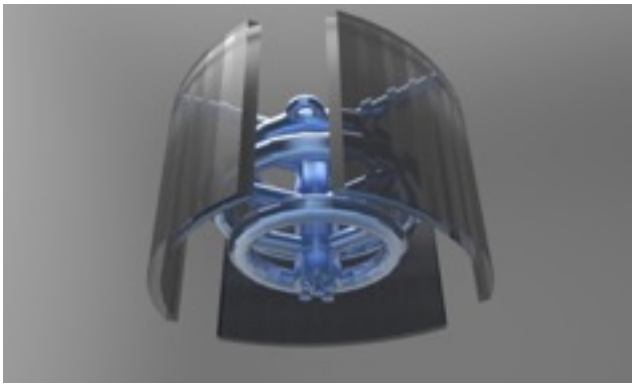


2.3Assembly of Astoria

Initiation of artificial gravity

The artificial gravity will be supplied to the agriculture torus after step 3, the residential torus after step 4, the industry torus after step 5. And also, once the Astoria launching to the space, the shielding will began to rotate in order to protect the Astoria. These rotations will not stop unless there is something forcing them to so. In addition, the energy needed for rotating and the operation except propulsion which gets energy by burning liquid hydrogen and liquid oxygen comes from the nuclear power station in the central cylinder.

	Processes	pictures	Time taken
Step 1	Establish the central cylinder on ground of the Ceres.		0.5 years
Step 2	Set up the propulsion at the end of the central cylinder, and also put the shielding and the connected cylinder between shielding and central cylinder on the right place. And then launch to the universe.		2 years
Step 3	Install the agriculture torus (including observatory deck) and the connected cylinder between it and the central cylinder.		1 year

Step 4	Install the residential torus and the connected cylinder between it and the central cylinder.		1.25 years
Step 5	Install the industry torus and the connected cylinder between it and the central cylinder.		0.9 years
Step 6	Interior fitment finish and folks move in.	NA	2 years
Total	NA	NA	7.65 years

Initiation of artificial gravity

The artificial gravity will be supplied to the agriculture torus after step 3, the residential torus after step 4, the industry torus after step 5. And also, once the Astoria launching to the space, the shielding will began to rotate in order to protect the Astoria. These rotations will not stop unless there is something forcing them to so. In addition, the energy needed for rotating and the operation except propulsion which gets energy by burning liquid hydrogen and liquid oxygen comes from the nuclear power station in the central cylinder.

Construction technique for interior structures making use of materials from asteroid

As the Astoria is revolving around the Ceres which has lots of carbonate minerals which include dolomite and siderite. We can collect these materials by sending a collection team to the Ceres. And dolomite can be burned in the industry torus then repress as bricks used in the Astoria. In addition, siderite can be refined in the industry torus through heat treatment which can produce magnetic material, later, these magnetic material can be used in daily life, for example, magnetic health products,, magnetic bottles and so on. And in addition, there are a lot of dusts in the space outside Astoria, and the Astoria has equipment which is installed around the Astoria, and they can absorb dust and repress them as brick to us in the construction.

2.4 Manufacturing Facilities

Defensive Mechanism

If we know that there will be collisions between Astoria and asteroids, then we use the most cheap way which is escaping to prevent Astoria from damage. If we get the conclusion form calculation that we cannot escape the collision effectively, then we adjust the position of Astoria to have the possibly smallest angle of collision and ensure that the asteroids will not intrude the inner part of Astoria through the gap between three shields.

Repair Mechanism

We will maintain the shields periodically. During the maintenance, we will test the stress tolerance of the shields, and robots are responsible to repair the deficient part of the shields. If the extent of damage is too large to restore. We will replace the whole shields. The material used in repair and replacement is from the asteroid belt.

Detection Mechanism

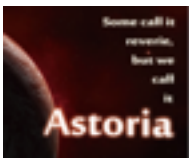
We use the radar system to monitor the coordination of asteroids, and calculate orbit of the asteroids that have high velocity and are closed to the Astoria. If we find that the orbits of Astoria and asteroids overlap with each other, then we use the Defensive Mechanism mentioned above.

2.5Mining camp

The complex was an underground project which will be establish on the Ceres, with the exception of its transparent material which is made by Aluminum oxynitride glass covers on the ground, which are the entrance and exit for mining robots to get back and go out of the mining cap. It is worth mentioning that, there are two kinds of transparent cap covers in this project, a big one that are used as a protection for a hardstand of spaceship which will be bid into the biggest. Spaceship can land on it or being delivered here waiting to take off. The others will be used as an entrance for mining. And all the transparent cap cover is retractable so it will be convenient to open and close it. And the mining camp is resembled to an octopus and the real HQ will be placed underground. When it comes to the tentacles of the octopus, they are used for transporting the robots and labors in and out, there are tracts inside of it, in which capsule shaped "train" will be laid up with the aim to sent the devices above the ground and bring back raw materials in. And there is a special platform designed for workers to get in and out of the "train".

Lastly, the interior of the headquarter will be divided into 3 floors and there will be a elevator in the middle of the HQ for the sake of send materials to each departments for different processing, deliver spaceship to the hardstand, a terrace used to fix spaceship like a operating table and load and unload. And several layers will encompass different functions. (e.g. staff's dormitory, a laboratory to do research to some unknown resources.....)

Operations and Infrastructure



3.1 Construction material sources

Orbital location

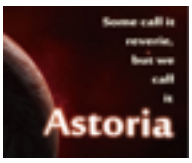
Now we make a decision to make the orbital position in the Ceres. There are several its special features and the reasons for choosing it.
The mantle layer consists of mixture of ice and water. Water vapor comes from shallow-colored are at the speed of 6kg/s.
The Ceres is the biggest celestial body in the asteroid belt in volume (accurate volume is 3.59x10^ 9kms),1/300 of that of the earth, it means that Ceres has more resources available comparing to others.
It is located between the mars and the Jupiter. It is 2.8 astronomical units away from the sun, which is close than europa and enceladuss, in other words, it is convenient for human beings to migrate.

Types and sources of construction materials

	Means of transportation	Source
dolomite	Spacecraft	Ceres
Bauxite	Spacecraft	Ceres
Basalt	Spacecraft	Ceres
Siderite	Spacecraft	Ceres

3.2 Community Infrastructure

The names of infrastructures	Types of the infrastructures	Resources of the infrastructures(including some explainations)	Ways to get infrastructures
Green house Stockbreeding area	Food	Greenhouse grasses Grasses（meadow）	Earth
Oxygen making machine Nitrogen making machine CO2 making machine	Atmosphere	Steam, air, electricity, carbon	Ceres（to get steam for oxygen） Earth (to get air for nitrogen)
Climate regulator	Weather	Silver iodide(AgI) for artificial precipitation) Greenhouse glass	In the earth
Robots	Mineral	Skycrane, Pica ,Nuclear Bettery, Lad	Earth



laser communications	Communication	Laser communication system equipment includes sending and receiving of two parts. Sending parts: laser, optical modulator and optical transmitting antenna. Receiving parts: optical receiving antenna, optical filters, optical detector.	Earth
Pipeline transport	Transportation	Ultrahigh molecular polyethylene pipe areas of application: Solid particles, powder conveying, slurry, fluid transportation, gas transmission Ultrahigh molecular polyethylene pipe areas of application: Mining industry The coal industry The power industry Petroleum chemical industry utilities Sea lake chemical Ocean engineering	Earth
time server	Day/night cycle provision	A time server is a server computer that reads the actual time from a reference clock and distributes this information to its clients using a computer network. The time server may be a local network time server or an internet time server. The most important and widely used protocol for distributing and synchronising time over the Internet is the Network Time Protocol (NTP), though other less-popular or outdated time protocols continue in use. The time reference used by a time server could be another time server on the network or the Internet, a connected radio clock or an atomic clock. The most common true time source is a GPS or GPS master clock.	Earth
perpetual calendar	Day/night cycle provision	the formula, paper or screen	Earth

3.3 Construction Machinery

This kind of machine hand will be placed in the central cylinder and both side of the connected cylinder between each torus and the central cylinder. When raw materials pass by, the machine hands will react automatically, and carry them

to the destination, which have been ordered in their system. In addition, we will tend to use these machines to transport all the material and so on from outside to interior space.

3.4 Propulsion System

Requirement for the propulsion

Supposed that the Astoria is just on the path of one closing asteroid.

We use d to represent the distance between the Astoria and the asteroid when we detect the asteroid. The unit is m.

v_1 represents the speed of the closing asteroid. The unit is $m \cdot s^{-1}$.

$\bar{v}$ represents the average speed when the Astoria escape the impact. The unit is $m \cdot s^{-1}$.

t represent the time used to escape. The unit is s.

a represents the acceleration during the escapement. The unit is $m \cdot s^{-2}$.

m_1 represents the mass of the Astoria. The unit is kg.

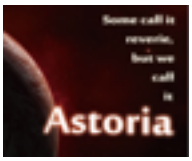
m_2 represents the mass of the hydrogen burned during the escapement. The unit is kg.

F represents the propulsion force exerting on the Astoria. The unit is $kg \cdot m \cdot s^{-2}$

W_1 represents the useful energy which is done during the escapement. The unit is $kg \cdot m^2 \cdot s^{-2}$.

W_2 represent the total internal energy released by the fuel hydrogen. The unit is $kg \cdot m^2 \cdot s^{-2}$.

The rate of the transformation from the inner energy of the fuel hydrogen to the useful energy is 80 percent.



The calorific value of hydrogen fuel is $143000000J \cdot kg^{-1}$.

Then

$\because \bar{v} \cdot t = 1600$

$\therefore t = \frac{d}{v_1}$

$\therefore \bar{v} = \frac{1600}{d} \cdot v_1$

$\therefore a = \frac{2\bar{v}}{t} = \frac{3200 \cdot v_1}{dt} = \frac{3200 \cdot v_1^2}{d^2}$

$\therefore F=ma= \frac{3200 \cdot v_1^2 \cdot m}{d^2}$

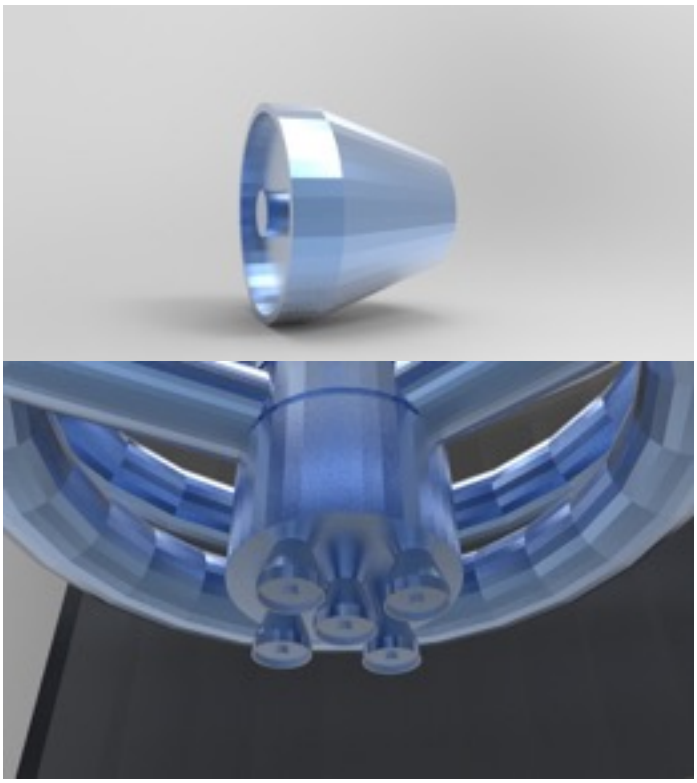
$\because W_1 = Fd=1600F= \frac{5120000 \cdot v_1^2 \cdot m}{d}$

$=0.8W_2$

$\therefore W_2 = \frac{6400000 \cdot v_1^2 \cdot m}{d}$

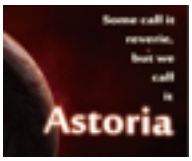
$=m_2 \cdot 143000000$

$\therefore m_2 = \frac{32 \cdot v_1^2 \cdot m}{715d}$

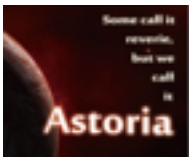


3.5SURFACE EXCAVATING VEHICLE

Name	Material
Crusher（eg. Cone Crusher）	Cone crusher's structures are frame, the horizontal axis movable cone, and the balance wheel, an eccentric sleeve, breaking wall (fixed cone), broken walls (cone), fluid coupling, lubrication system, hydraulic system.
Grinding mill（eg. Ball grinding mill）	The ball mill is composed of six parts: feeding device, supporting device, rotary part, unloading device, driving device, lubrication and cooling device.
[magnetic separator	Drum permanent magnetic separator is mainly composed of a cylinder, a roller, brush roller, magnetic system, tank, transmission parts.



Human Factors



4.0 Light effects

Natural view of outside and natural light.
The residents can enjoy natural view of outside by going to the “U” shape construction, and we the Astoria will provide artificial sunlight for each torus.

4.1 Living Community

The living community is shaped as a quarter, three layers are included. Primarily, the short bottom layer is a labyrinth shape underground road, except this, general road and air train are all serves as mode of transportation. So that annoy affairs something like traffic jams that happen on earth will not occur. Additionally, the inner part, which has largest volume, is dominant zone that people doing activities. It contains residential buildings, school, and museum, sort’s field office building hospital, entertainment skyscraper, civic center, indoor stadium and even banks (in order to restore the earth life). Last but not the least; the top is regarded as outdoor zone. Four topics, depending on thermal control system, are distinguished to spring, summer, fall and winter which are a bonus for the natural living enjoyment. Furthermore, oversize elevators connected these three layers. All of the design is for the sake of convenience and treat. Constructing a natural condition as far as possible, reflecting the inherent beauty of earth. In addition, this kind of community is all around the residential torus.

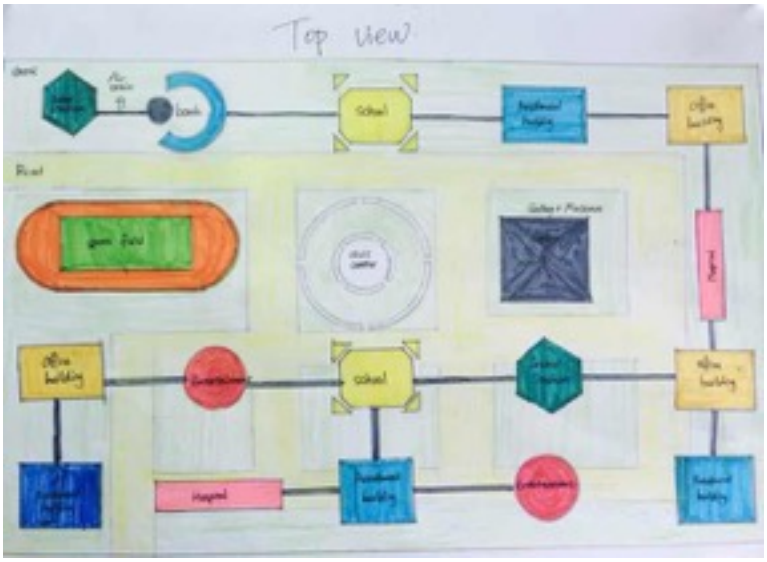
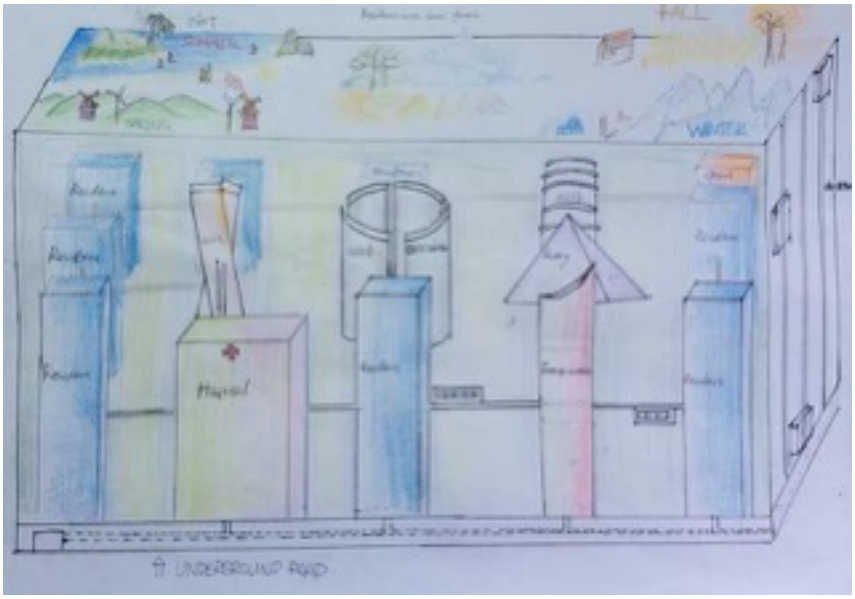
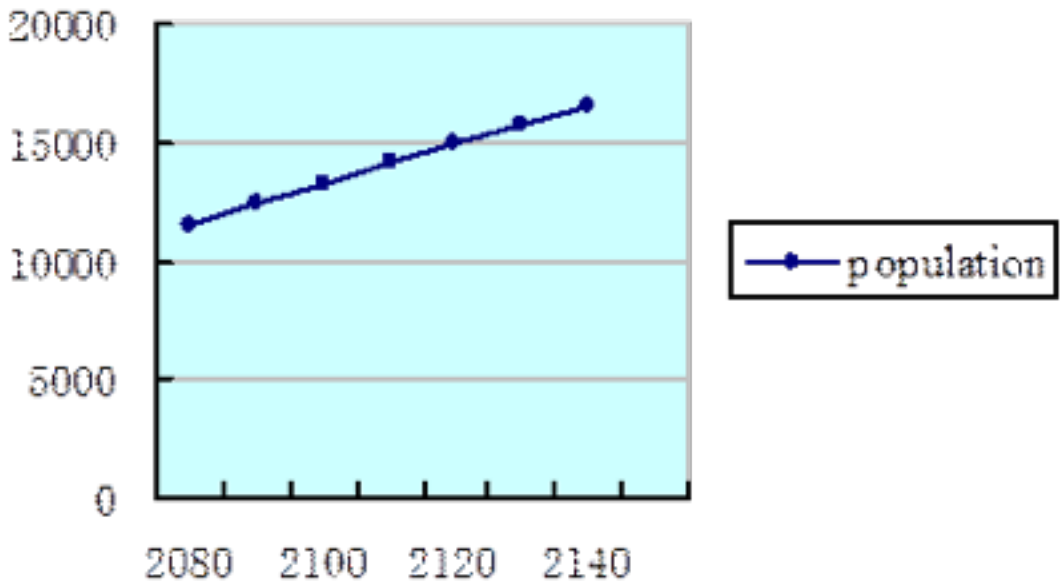


Fig4.1.1 Top View



4.2 RESIDENCES

Population growthAs the room in Astoria is limited, thus the population growth must be regulate to a certain level or remain the same. In Astoria, every married woman has to put intrauterine device inside their body, and every year, Astoria will randomly select appropriate women who will remove IUD and able to pregnant, the ratio is 5 to 100. IUD only can prevent woman top regnant, but will not affect residents' sexual life. If a selected woman doesn't pregnant in one year, hence there will be a new quota in the next year for other woman. One family only can have one child, except those woman can give birth to 2 children at one time. Though this commendatory regulation is seems not follow humanitarianism, this is a really effective and safe way to control the population growth. There are approximately 3450 married adults in Astoria,so there are 1725 ma rried woman, and 87 quotas.

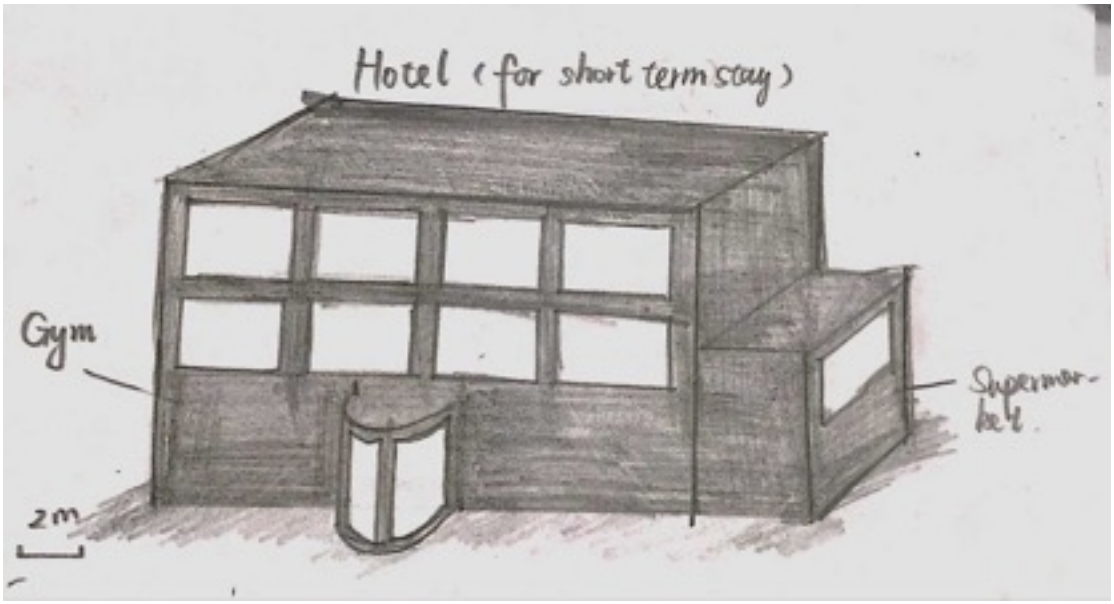


4.2.1Villa(The first floor)

4.2.2The second floor

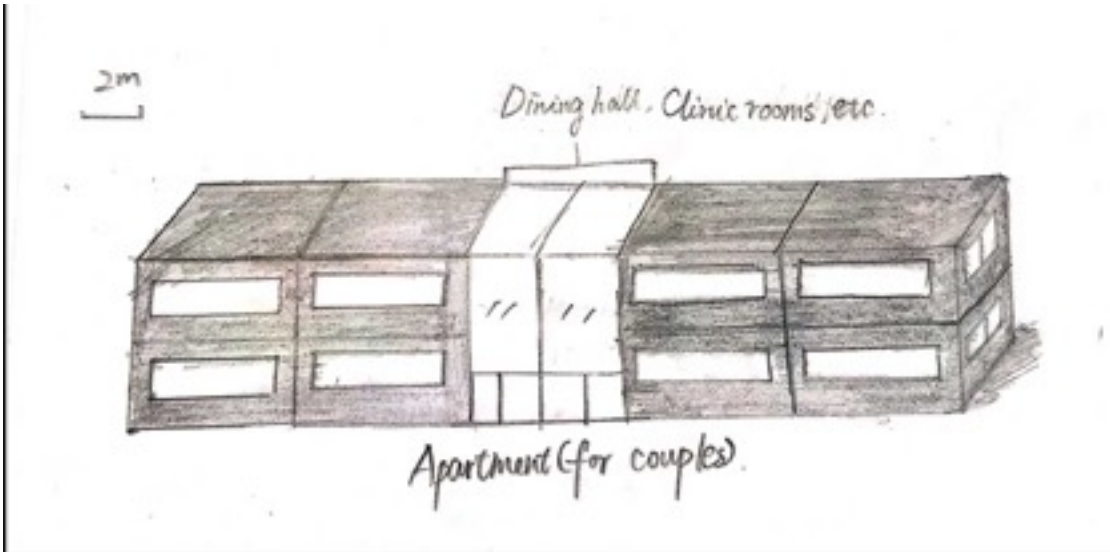
Villa is a more advanced family housing, since the formation of a set, not worthy of supporting facilities, but has their own entertainment and leisure services. It is especially for the richest families or families with two or more children.

Hotel



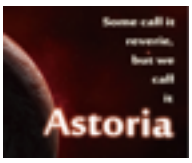
Hotel is only for short-term stay. It provides luxurious living and enjoyment, as well located near beautiful sites. There is no doubt that it is the best choice for vacation.

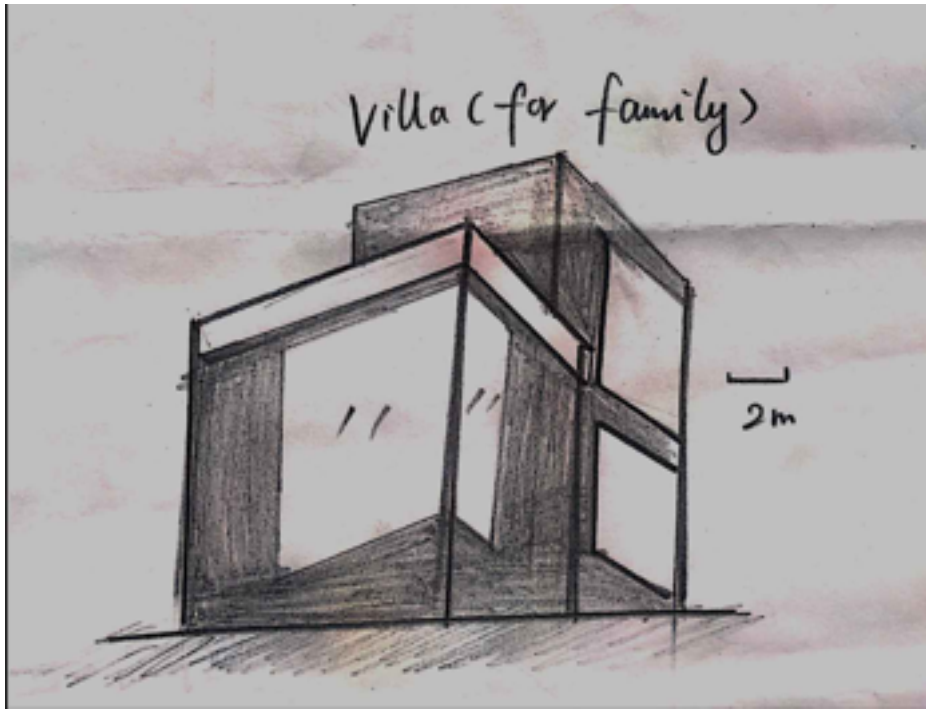
4.2.3Apartment of couples

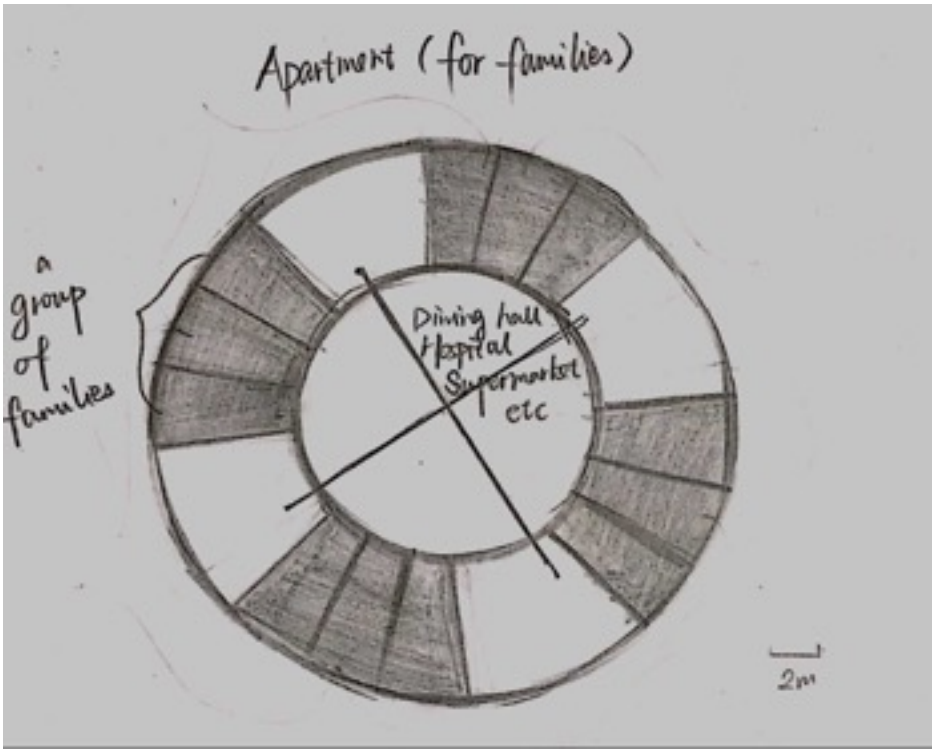


This townhouse is prepared for couples without children. Their private room is in great safeguard. Every 8 couples mak e up a group, and can be given a set of public facilities.

4.2.4Apartment for family

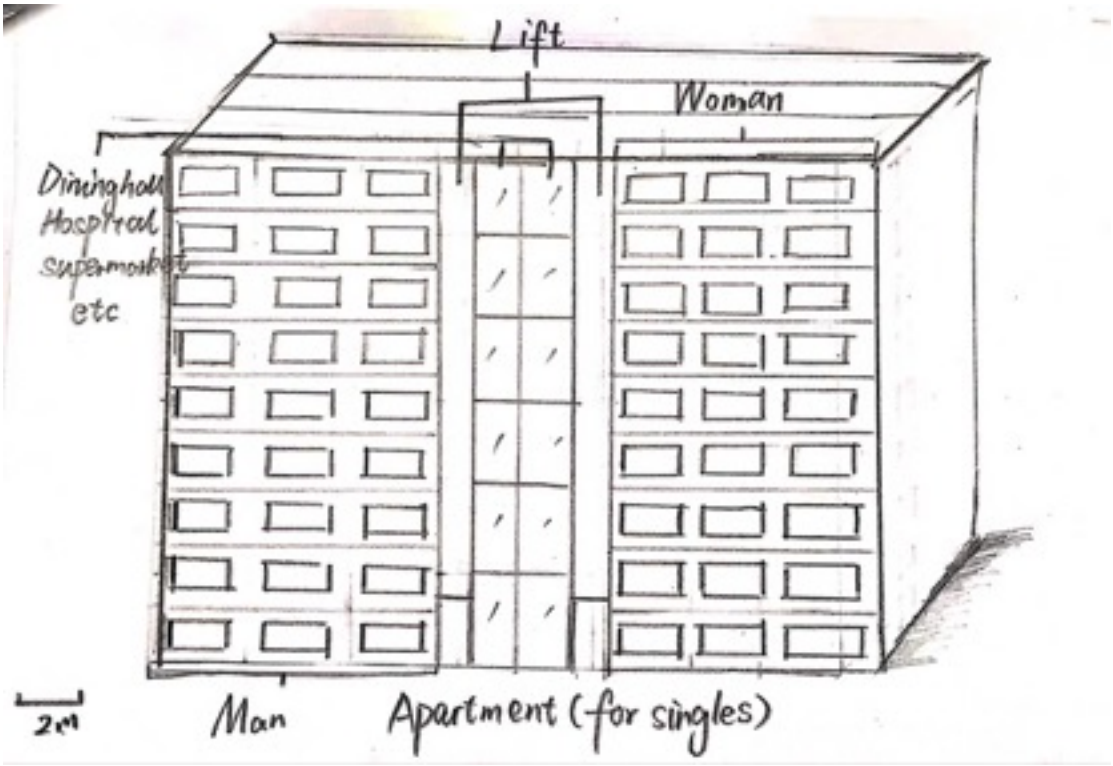






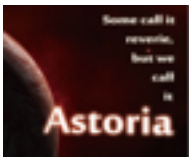
The first idea for the design of families' residences is the conception of "community ". Every family living in has at least one child, and a warm community is able to full the childhoods of them. Besides, make sure they all have wonderful education opportunities.

4.2.5Single apartment



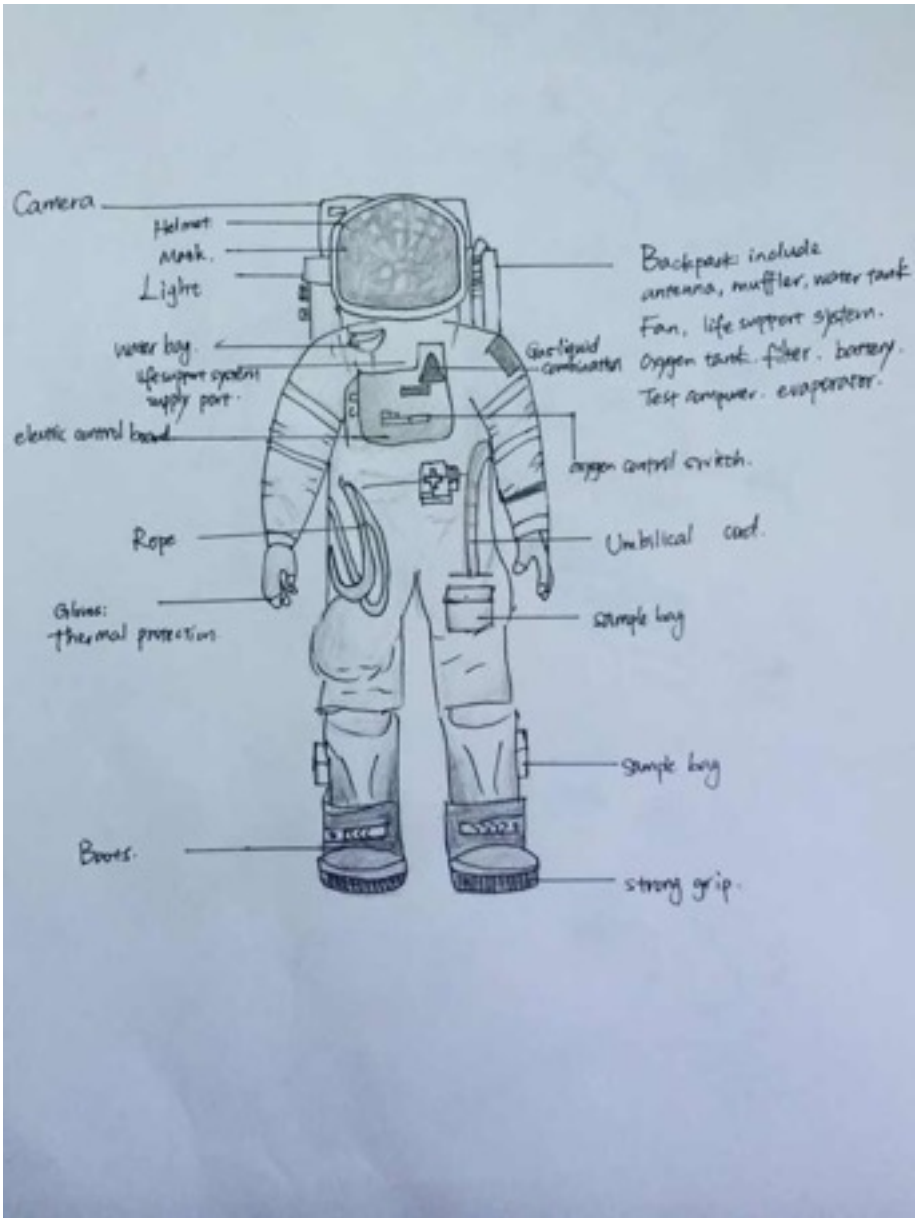
The single is arranged to be living together. Their apartments are design to be as space saving as possible. At the same time it is guaranteed to be comfortable and convenient.

Type of house	Purposed crowds	People/unit	Quantity	People that have home	Area/m²	Total area/m²
Apartment	Single Man	1	2000	2000	80	160000
Apartment	Married(with kids)	3-5	1000	3000-5000	150	150000
Apartment	Married(without kids)	2	1000	2000	70	70000
Apartment	visitors	2	1000	2000	85	85000
Vila	Married(with kids)	3-5	200	600-1000	330	66000
Apartment	Single woman	1	1500	1500	110	165000



4.3 DEVICES

4.3.1Space suit

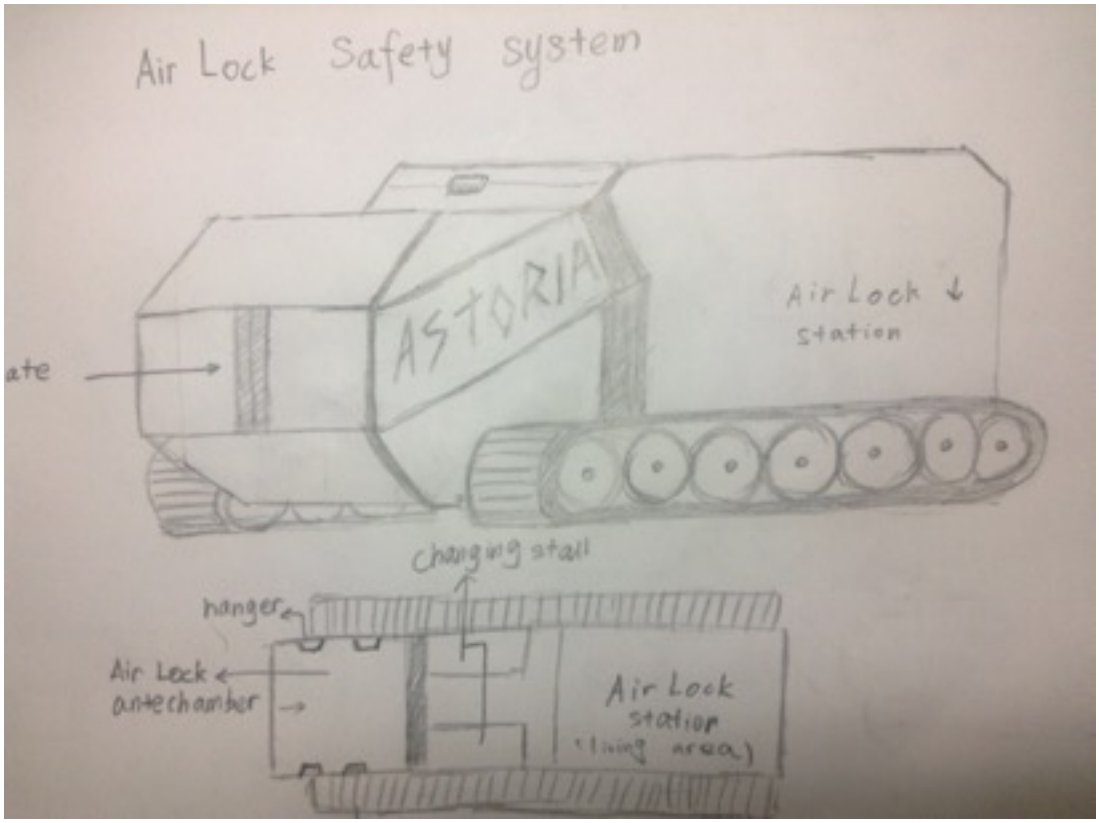


This kind of space suit will be introduced from top to bottom. To preserve head, helmet and transparent mask should be tough. Adjustable light is located near the helmet, so that it is also close the eyes. Water bag just stay below the helmet, people is capable of drinking easily. After that, solid electric control board is installed in front of chest, since it is as firm as armor, it can be used to protect body. Life support system supply port is inlayed in the gap between the water bag and electric control board, because we must use the finite space effectively. There are ropes tie on the waist. On the other side, is the umbilical cord, which can be regarded as an alternative rope and used for communication. In addition, gloves are thermal protection, as we never know what will happen while discovering. A sample bag is put in front of one lap; the other two are designed on both calves. Texture of boots should be thick, and boots must be strong grip. Lastly, on the back is a condensed backpack, it consist of antenna, muffler, water tank, fan, life support system, oxygen tank, filter, battery, test computer, and evaporator. All of the above mentioned objects are all in mini size, in order to make people move conveniently.

4.3.2Airlock safety system

the airlock safety system are designed for the low gravity working situation.Inside the system,there are two parts which are airlock antechamber and airlock.Also this system can move freely at other planet, because of it have two rotating

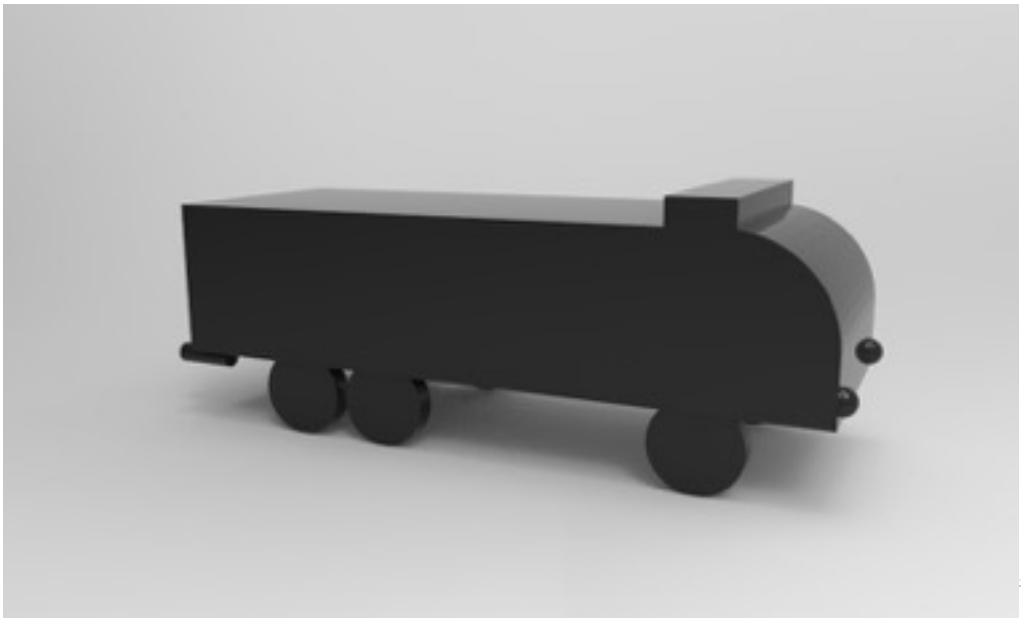
track.Inside the antechamber ,there are several hanger for the astronauts to hang on.More inside,there are two changing stall for astronauts to use.Then,the living area is just behind it,it provide every basic needs for people who living on the system.



4.4 Means for children to spend time in 1g

for children to spend time in 1g for 3 hours per day.
Schools (including nursery school, primary school, middle school and high school) and indoor amusement park will all have special equipments which will provide 1 g gravity. And in school days, children can go to school which definitely more than 3 hours, in addition, in weekends, their parents can bring them to the indoor amusement for about 3 hours for a day.

4.5 instant move-in house



The instant move-in house is just like a normal car at the earth,
but it has a larger space and more comfortable indoor settlement for human being. It has 6 wheels and every basic need for human inside the house,
so it can move in the Astoria easily.The reason to build this kind of moving house is becau se to satisfy some citizens who need to change living place frequently.

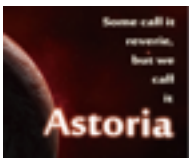
Automation Design And Services

5.0Automation design and services about computer in the Astoria

The total amount of the device is 12000, which is approximate to the total number of all the dwellers. The device is designed as a kind of micro portable computer. The computers have the basic function of computing and information processing and the access to the Internet. In addition, the functions and the properties of the devices can vary based on the users. The normal citizens hold the ordinary version of the device. The government engineers and policemen hold the devices which have higher capability and more access to secret information. The computers have the solar energy battery with high efficiency, so the computers have the constant supply of energy during the day. Also, the computers can be charged by the traditional way, the plug base. All the data in the computer is stored in the online data base. The government will have the special ministry to monitor the data security. The Internet signal will cover all parts of the Astoria, so everyone can use the device everywhere.
In addition, the computers of that time have great capacity and are able to communicate from a really long distance, like between Asteroid Belt and Earth. The data can be returned from Asteroid Belt to Earth in real time.

5.1AUTOMATION FOR CONSTRUCTION

To transfer raw material and other things from outside to inside, we will use the machine hand in the central cylinder and the connected cylinders to transport them to interior space(see specifically in 3.3). And in the interior Astoria will use a automatically operate machine hands which can operate on the ground of the Astoria. This kind of machine hand can turn around for 360 degrees and help to construct the construction.



5.2 AUTOMATION FOR MAINTENANCE, REPAIR, AND SAFETY FUNCTIONS

5.2.1 Settlement maintenance

As the total Astoria is controlled by the control center, we should take good care of it. We should observe the operation of the Astoria all the time and schedule many things, like how will the propulsion thrust and the rotation of the shielding to protect the Astoria, also keep the normal rotation of the three tori.

5.2.2 Repair

We always have a team of robots which will get around the shielding and check the place that being attacked by the asteroids to find out whether it can afford more impact or need to be recycled. If one place is replaced, the robot will put a new one on it. In addition, in the internal Astoria, there is repaired robots patrol around the Astoria, once they know some infrastructure or something else are broken, they will immediately arrive there and repair them.

5.2.3 Backup system

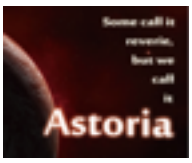
Assume that something broke which lead to system collapsing, once it happen, a particular software will inform leaders of the Astoria immediately, and initiate the backup system to keep the normal operation of Astoria.

5.2.4 Contingency plan

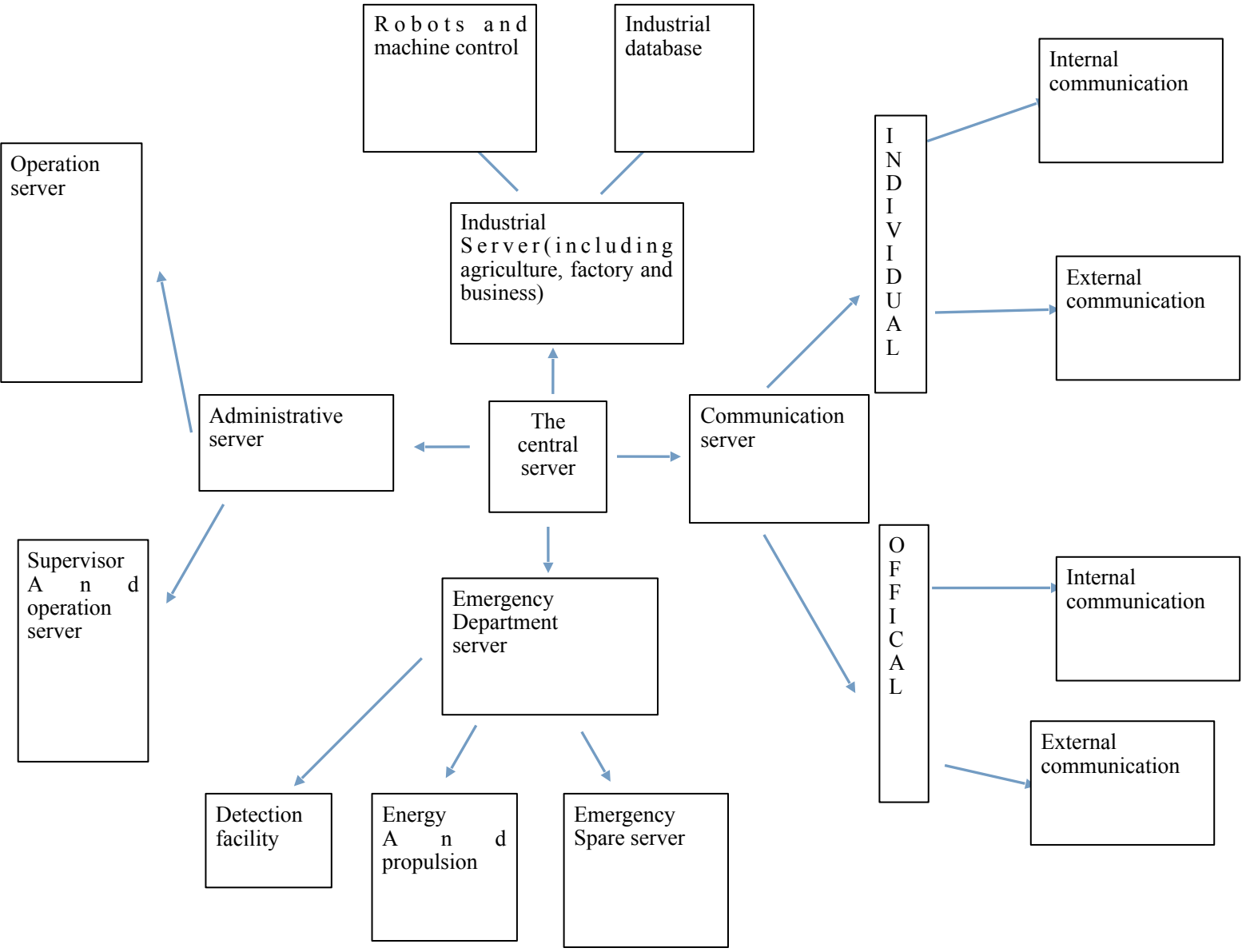
Emergency	First reaction	Second reaction	time gap between the first reaction and the second reaction
Widespread virus	Insult the patients that get the virus alone and try to research and develop the medicine for it.	If we cannot control the situation. We will Blockade Astoria which prevents the virus to be transmitted to another place.	20 days
Fire disaster	Send a team of robot to control the situation.	Evacuate people around it and send more teams of robots	20 minutes
Shielding dramatically damage	Send lots of robots to repair the damage as quickly as possible.	Try to land on the Ceres as the shielding is not being repaired and there are lots of asteroids in the space.	30 minutes
Lost communication with out of the Astoria	Try to get reconnection with out of the Astoria	Save the energy as much as possible and limit the food supply. Still, try to get reconnection.	3 days

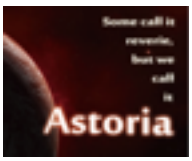
Means for authorized personnel to access critical data and command computing and robot systems

We can use DNA and fingerprint, even pupil to check up whether this person has the command to get access or not. And before a person get his or her command of accessing, there will be a very strict exam to ensure your positive purpose.

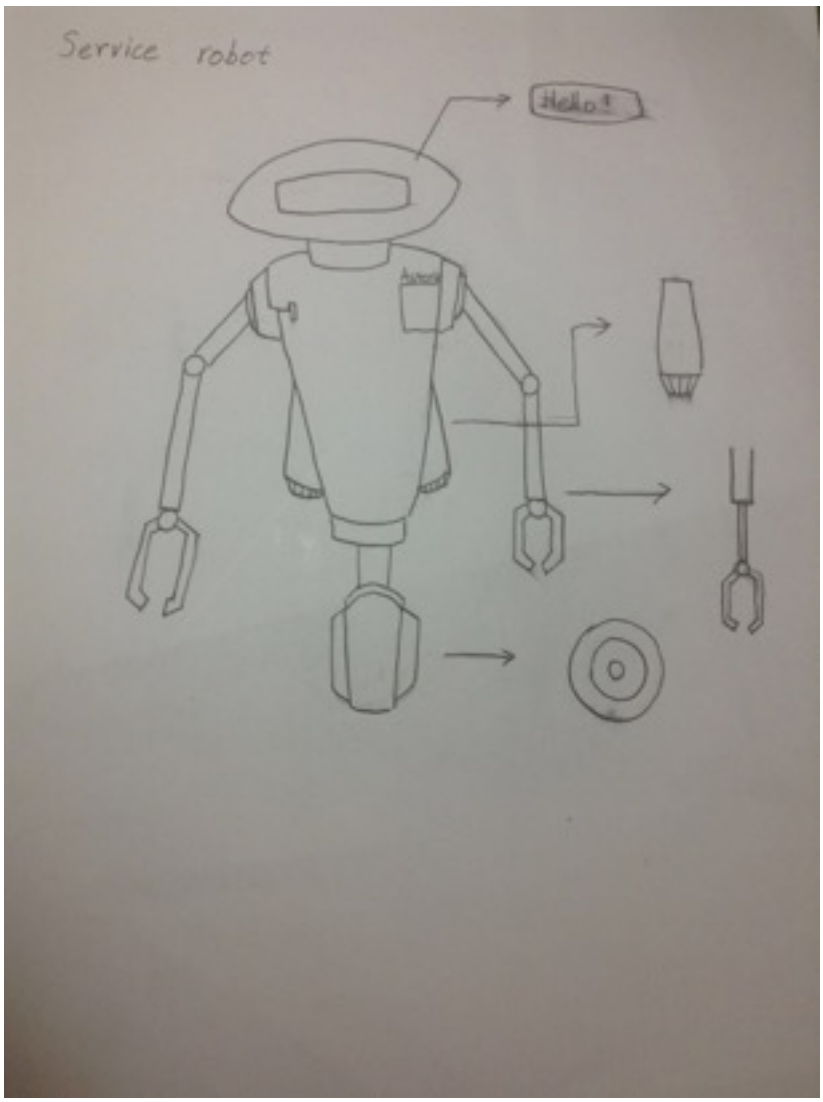


5.3Computer system

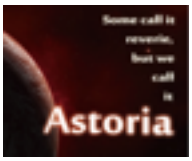




5.3.1The automatic service robot of Astoria

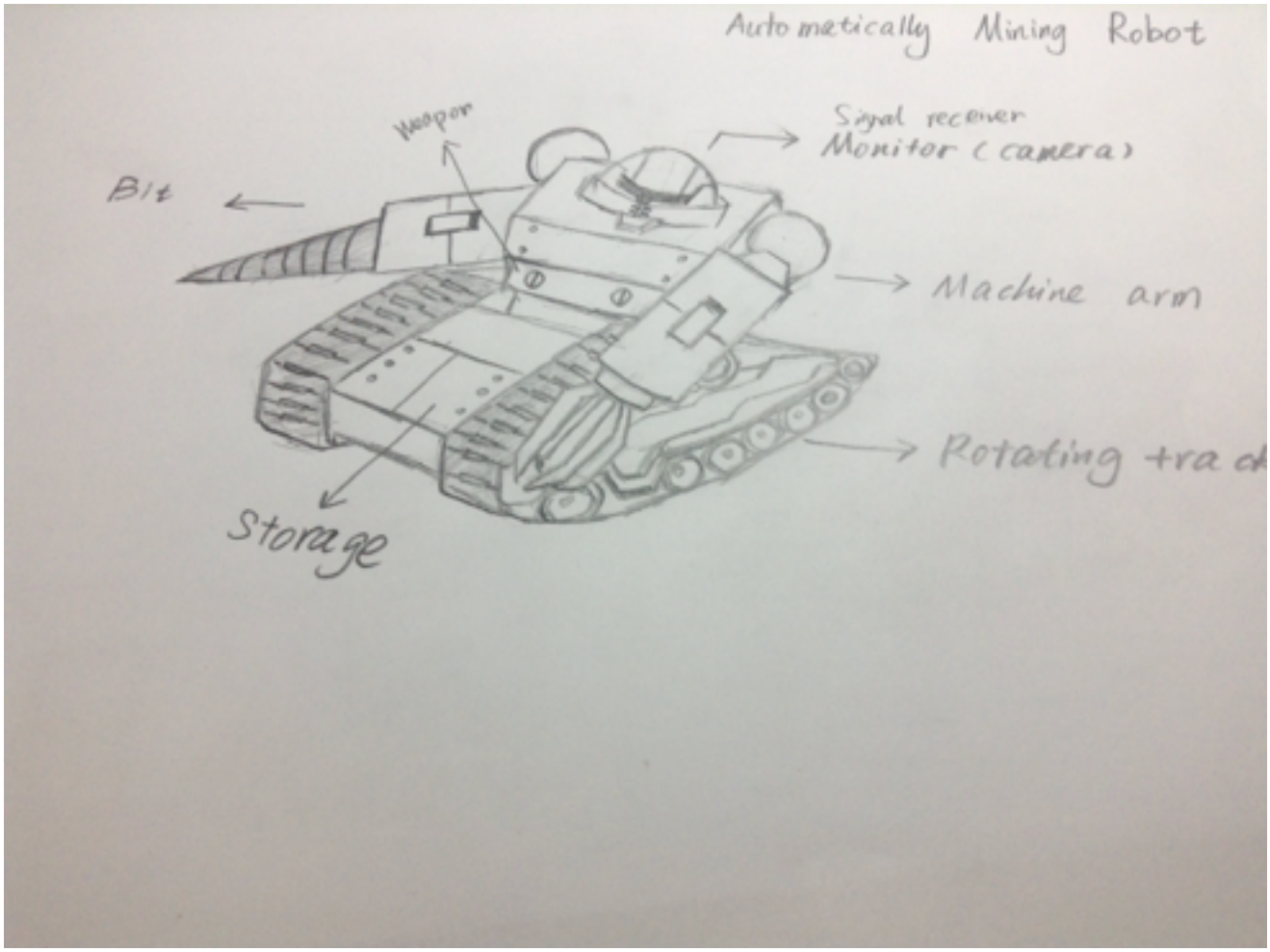


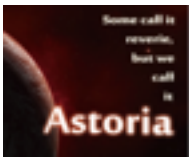
This kind of robot are invent to provide service for citizen who lived in Astoria.It has two machine arm which are very flexible,it also can use the machine arm to fix the broken shield of Astoria.It has one wheel to keep balance and move inside the Astoria. However it also has two flying backpacks which are use at space.The scream of the robot is at the top of the body,it can use several different language to satisfy different people's need.



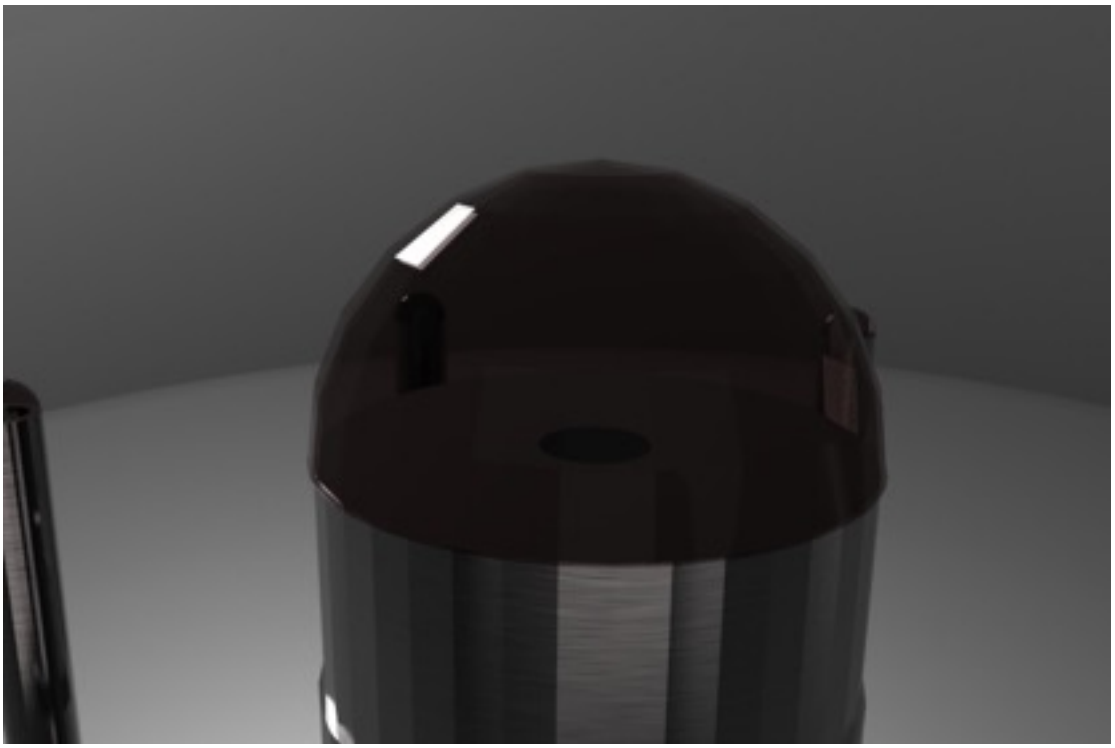
5.4Automatically mining robot

In Astoria， mineral products from different planet are important for scientific research and produce industry.As a result ,mining become really significant.But it’s dangerous to sent human to other planet to do this stuff ,so the automatically mining robots are invented.It can be remote controlled by driver in Astoria.The signal receiver and the camera is on the top of the robot,it’s also a camera which can let the driver know how to control it.There are two machine arms on the body part which have different function.One is a bit and another is plier.On the waist ,there is actually a place to store weapon, it can store two little missile,used for blasting task.Furthermore,the storage is just between two rotating tracks.

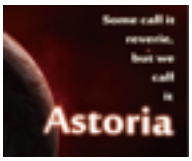




5.5 ON-SURFACE OPERATIONS



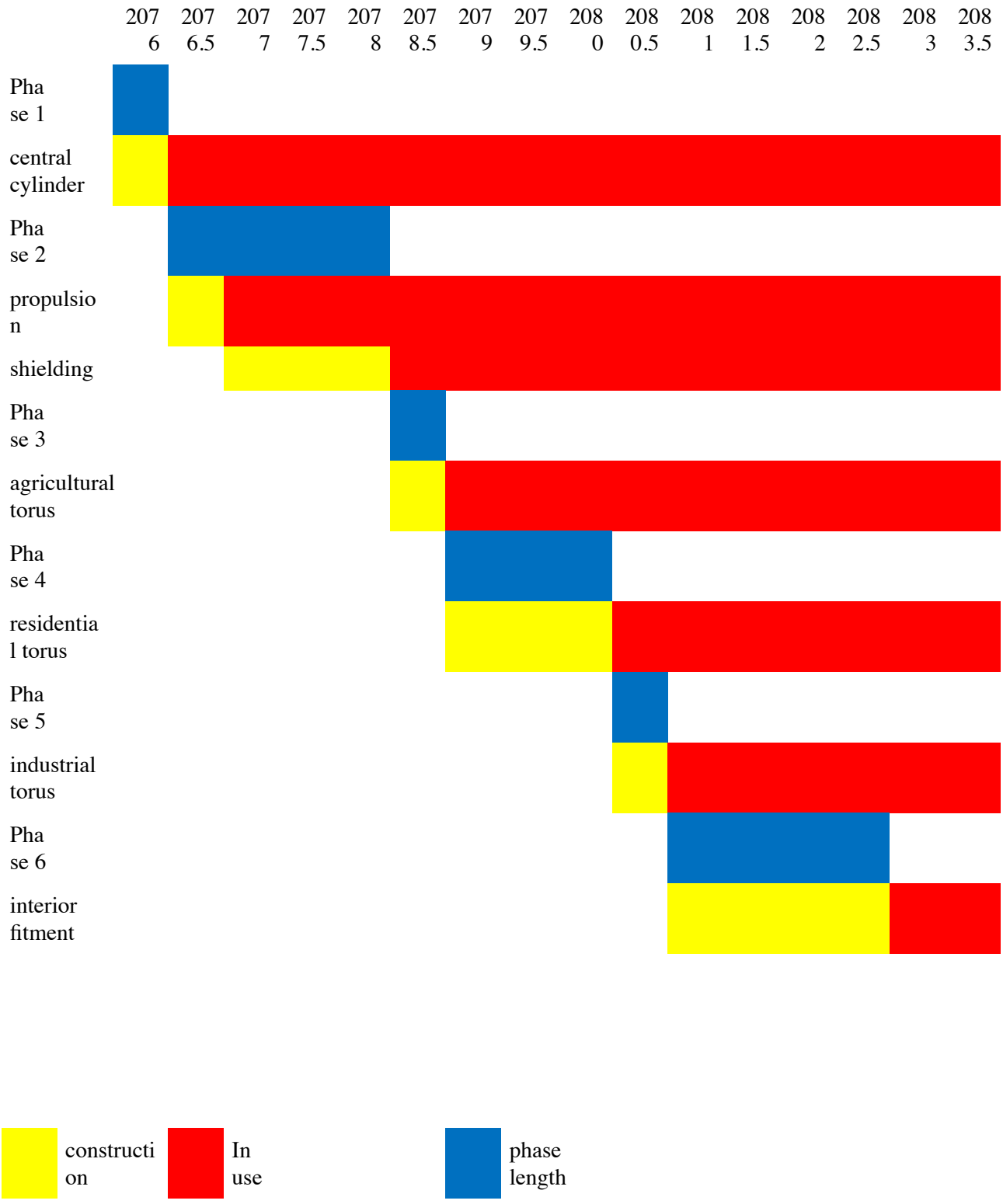
We will load the row material at the top of the major cylinder which has a transparent material, and after the spacecraft loading all the row material or material that have been refine harshly, then the spacecraft will transport these things to the dock of central cylinder of the Astoria, and use inclined ladder and container to unloaded the material and later use machine hand to transport to the internal Astoria.



Schedule And Cost


Astoria

6.1 Schedule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Phase 1
central cylinder
Phase 2
propulsion
shielding
Phase 3
agricultural torus
Phase 4
residential torus
Phase 5
industrial torus
Phase 6
interior fitment
construction
In use
phase length

6.2 cost

6.2.1Cost of labor during construction

	Annual salary(in thousands)/people	Amount of people	Number of years	Total(in dollar)
Foreman	200	20	8	32m
Worker	20	200000	8	32000m
Entrepreneur	300	1	8	2.4m
Roboticist	280	15	8	33.6m
Mechanical engineer	280	16	8	35.84m
Architect	290	14	8	32.48m
Electrical engineer	270	15	8	32.4m
Chemical engineer	280	10	8	22.4m
cosmologist	280	5	2	2.8m
Pilots	230	100	8	184m
Geologist	240	10	3	7.2m
Astronomer	260	12	3	9.36m
Total				$32394.48m

6.2.2Cost of operation during construction

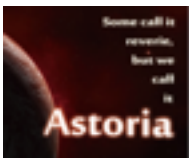
	Start year	End year	Annual cost	Total cost(in dollar)
Delivery	2076	2085	120m	960m
Exploit	2076	2085	130m	1040m
Total				$2000m

6.2.3Cost of construction material

	Volume/ m^3	Price/m^3(in dollar)	Total cost(in dollar)
Alufer	5.28^8	276.08	145.8b
Greenhouse glass	1.1810^8	1159.3	136.8b
Silicon Carbide	7.210^8	234.75	169.02b
Total			$451.62b

Total cost： $456.01 billion

Business Development



7.0Business Development

Astoria will host various commercial and industrial ventures, which may change with time. The basic design must be sufficiently flexible to add compatible business types with little configuration change.

7.1Infrastructure for conducting major asteroid materials harvesting and processing operations

7.1.1 Astoria will either build, or import and then deploy, equipment required to conduct asteroid harvesting operations

(see specifically in 2.5)

7.1.2 The settlement will provide capability for refining or otherwise processing asteroid materials to enable as much self-sufficiency as possible, and create commodities and products for export and trade

(See specifically in 2.1)

7.1.3Port facilities must enable receiving incoming raw materials, warehousing import and export products, and shipping of commodities and other products

(See specifically in 2.1)

7.1.4Vehicles spending time on asteroids will accumulate dust on exterior and interior surfaces; show method(s) for preventing dust from entering enclosed areas in Astoria • Services for remote asteroid mining operations and outer planet expeditions

(See specifically in 2.3)

7.1.5Excess agricultural production, storage, and processing capability (beyond the needs of settlement residents) will service provisioning needs of visiting spacecraft

(See specifically in 2.1)

7.1.6Provide suitable facilities for visiting spacecraft crews “rest & recreation” (R & R)

(See specifically in 2.0 and2.1)

7.1.7Provide a full-service repair depot for major maintenance and repair of space vessels

(See specifically in 2.1)

7.1.8Provide fueling services for spacecraft traffic using port facilities; show fuel production and storage facilities for at least 40,000 cubic feet of LOX and 110,000

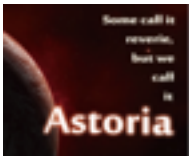
(See specifically in 2.1)

7.2cubic feet of LH2, replenished monthly

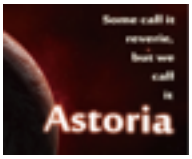
7.2.1“Space Tug” services will be available to assist disabled vessels

(See specifically in 2.1)

7.2.2Capability to send rescue operations for asteroid miners requires at least one ship fully provisioned for a mission up to ten months long, ready to leave in 24 hours • Sensing and imaging research appropriate to Astoria’s outer solar system location (see specifically in 2.1)
7.2.3 Radio telescope with dish diameter of at least 500 feet (150 meters) (See specifically in 2.1)
7.2.4Optical telescope with mirror diameter of at least 20 feet (6 meters) (See specifically in 2.1)
7.2.5Structural isolation from vibration-causing activities on Astoria(See specifically in 2.1)
7.2.6Data processing and communications capability to return data to Earth in real time (See specifically in 5.0)



APPENDICES



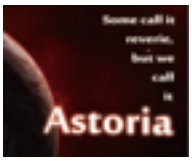
8.0 APPENDIX A

As usual, Jim (10 years old boy) got up at 7 a.m., and when he went downstairs from the second floor of family villa, he saw his mother Jane (35 years old woman) was trying her new shoes, and his Dad（38 years old man）, Frank, who was reading books with milk and hold Jim's sister, Monica. Meanwhile, the door was knocked and Jim went out and found out that was the food delivered by robot today. After they had breakfast, they go to the underground rail, Jim would go to the school and Frank would went to his office, in addition, Jane would bring Monica to the nursery school and then she would go to the reparation.

After their school and work, they came back home, and the mother began to prepare for the dinner by using the food delivered by robots. During the cooking time, there were something got on fire, which made them called the robot to deal with such an emergency. And like half minutes later, the robot team came and controlled the situation. It is being more scared than hurt, they began to have dinner and meanwhile they opened the TV, watched the daily news that happened in Astoria and some other places. Later, Monica ate her medicine because of her bad cold, the Jane suggested to go theater and play snooker for several hours and then went for shopping. After, when they arrived at the theater, they began to watch movies and just a few people there, which was really weird. What was surprised to him was that at the end of the movie, there is a episode about him, and almost at the same time, lots of people came in and said, "happy birthday to you". Subsequently, they played snooker and went to supermarket which enable Jim choose a birthday present by himself. Eventually, they backed to home and had a good night.

Appendix B

http://baike.baidu.com/
www.wikipedia.org/
http://www.kujiale.com/



APPENDIX C. Compliance Matrix

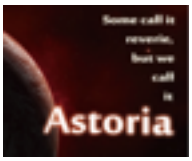
2 structure

sl.no	Requirement	Page No.
Structure&Design		
2.1.0	Full view of the city	6
2.1.1	Astoria's exterior design	6
2.1.2	Exterior views of Astoria with its major visible feature	7,8
2.1.2.1	Structural interface between rotating and non-rotating sections of Astoria	9
2.1.3	Dimensions of various components of Astoria	10
2.2.0	Internal Arrangement	10
2.2.1	Percentage allocation of down surfaces	10,11
2.3.0	Assembly of Astoria	12.13
2.4.0	Manufacturing Facilities	13
2.5.0	Mining camp	14

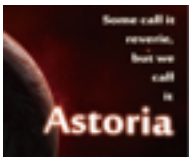
3 operations and infrastructure

sl.no	Requirement	Page.No.
Operation and infrastructure		
3.1.0	construction material sources	16
3.2.0	community infrastructure	16
3.3.0	construction machinery	17,18
3.4.0	Propulsion system	18,19
3.5.0	Surface Excavating vehicle	19

4 Human factor



5human factors and safety



6 schedule and cost

7 Business development