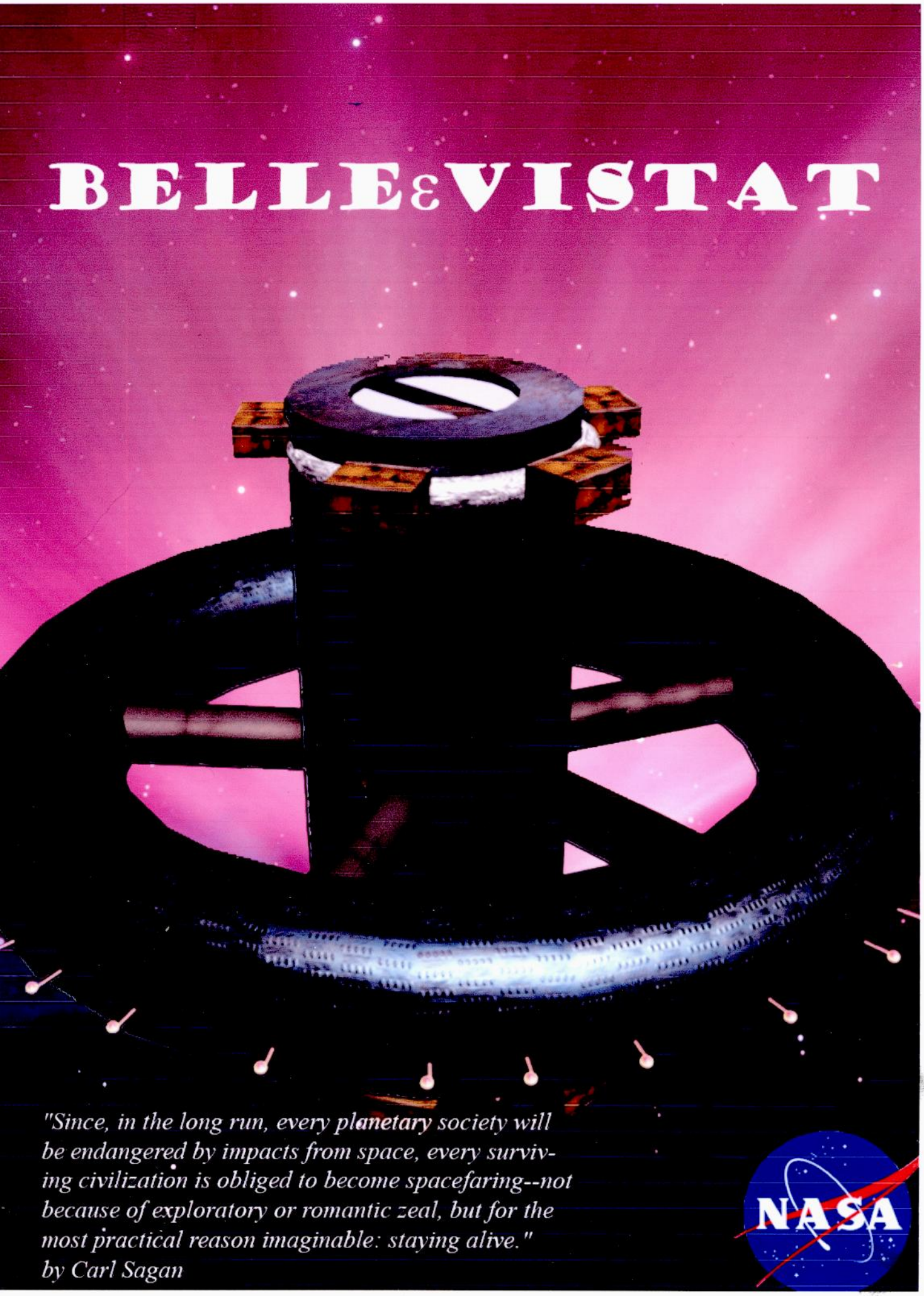
BELLE&VISTAT



"Since, in the long run, every planetary society will be endangered by impacts from space, every surviving civilization is obliged to become spacefaring--not because of exploratory or romantic zeal, but for the most practical reason imaginable: staying alive."
by Carl Sagan

NASA

I. EXECUTIVE SUMMARY

Because Alexandriat, the first settlement in Earth's orbit, has generated a mass interest in the various opportunities to be offered by an all-purpose human outpost situated in Earth-Moon L4 or L5 orbit, a second settlement is to be built in L4 (L5 is already occupied by the first orbital station) that will compensate for Alexandriat's limited usefulness. Although the investment may seem rather enormous (more than a small country's GDP), the fact that construction will be finalized in less than 5 years and that the investors would regain their money plus interest in fifty years at most turns "Bellevistat" into this century's most profitable business investment.

The first phase, building the station, will take advantage of Alexandriat's specialization for quick construction until the new station is able to sustain its progress by itself. "Bellevistat" will also possess important building capabilities that will decrease the construction required time, capabilities that will be diminished after the building stage is completed to make room for more prosperous activities' development,

The settlement will represent a very important distribution point because when finalized it will connect the lunar and asteroidal ore harvesting facilities to Earth. Heavy manufacturing will probably also be one of the most well-developed industries because the reduced gravity would greatly enhance its productivity.

Tourism and scientific explorations will be highly regarded of on the station because of the reduced launching costs and its strategic positioning. The passenger ports are designed to enable passengers to easily change terminals because this settlement will probably represent the passing point to more distant projects and most passing persons will spend a small amount of time on the station. Because of the well-developed telecommunications system, the orbital station will also serve as a signal strengthening point for space transmitions.

II. STRUCTURAL DESIGN

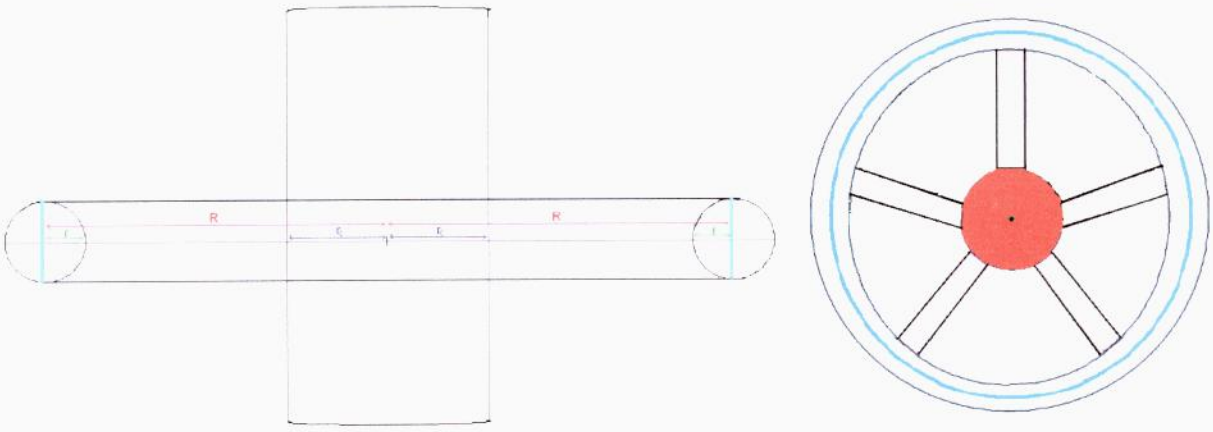


Fig. 90

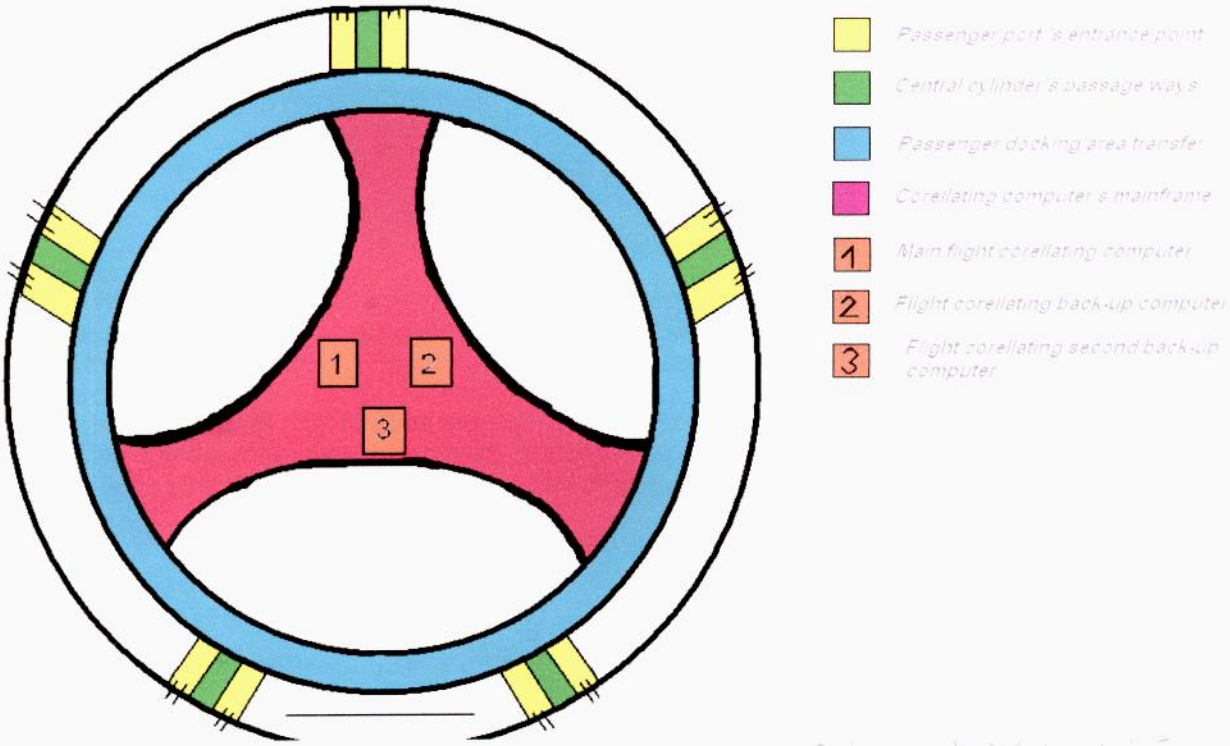
The light blue section in Fig. 90 represents the torus's human inhabitation area and the red segment the industrial area.

The industrial port leads directly into the materials stocking area so that pre-refined materials can be easily stocked until required and has a direct connection with the ore refinery so that raw resources can be processed before stocking to reduce required space. The ore refining utilities do not require a large area because there is a continuous flow of materials through the system and no stocking is done along. If the flow of raw resources exceeds the processing capability of the refineries, some materials will be stocked to be refined when the flow decreases.

The passenger ports are placed between the refining facilities and the construction facilities because, even though longer passage ways are required between the docking area and the cylinder-torus connecting bridge, the chances of and the aria affected by a missed approach are much slimmer.

The recreational environments are located closest to the torus-cylinder connecting bridge to minimize traffic inside the central cylinder

Fig.91 – Central cylinder's specialization repartition



2.3 Sequences

The construction process will be divided into ten major sequences, almost half of them depending mostly on the resources provided by the existing station, the Alexandriat.

The first stage(fig.100) will be mostly automatic and will consist of building a section of the central cylinder. The construction will be done by robots and only supervising will be left to humans. The supervising crew will be made up of three alternating shifts to avoid A sustaining grid of titanium will be built by assembling parts manufactured on Alexandriat. Afterwards large blocks of titanium oxide (TiO_2) will be placed into the grid, thus constructing the cylinder's outer shield. On the inner part, a layer of honeycomb-structured FeTi-70, polyurethane and then a layer of carbon fiber will be placed.

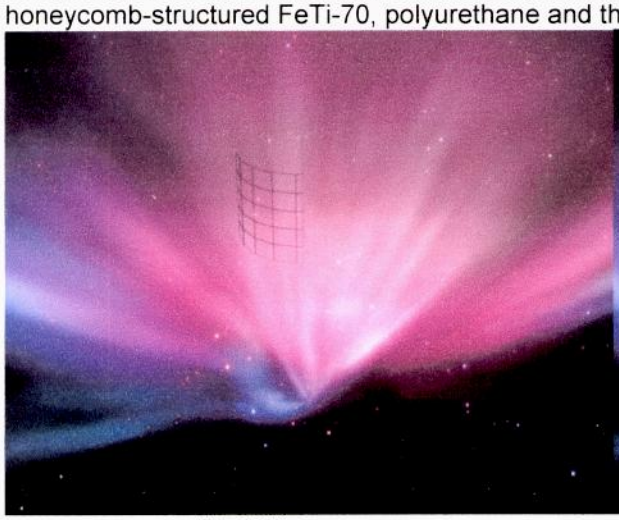


Fig.100a

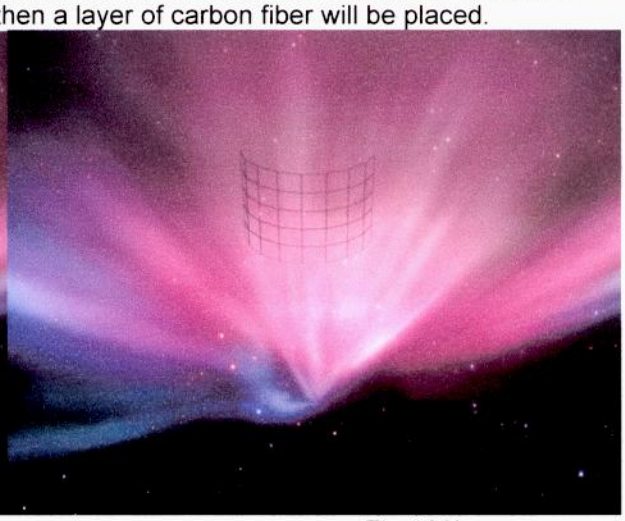


Fig.100b

Fig.100c

The second sequence will represent providing temporary housing with life-sustaining systems to enhance productivity by eliminating the time required to transport the supervising personnel back-and-forth to the Alexandriat station. The cylinder will also be equipped with utilities to build basic construction-needed components.

In the next step (Fig.101)) an industrial port and an ore refining facility will be constructed on one base of the cylinder. After their construction is finalized, a rotation effect with the period of 100.255 seconds will be imparted upon the structure, providing approximately 0.3g on the margins of the cylinder.

Fig.101a Fig.101b

During the fourth sequence ore harvesting shuttles will be constructed and transported from the Alexandriat to the station. A main computer frame for correlating activity will also be built.

The next stage (Fig. 102) consists of increasing the station's personnel and the finalization of the central cylinder and its construction utilities. The personnel will be brought using a route through Alexandriat. Construction will be done by using mostly the new station's own refining facilities, therefore greatly reducing the transportation costs. Raw materials will be gained by harvesting nearby captured asteroids and by importing the resources not found on asteroids. Importing will be done using the transport shuttles from the SELENA lunar extracting complex. After the central cylinder's construction is completed, a central life-sustaining system will be activated to eliminate the energy consumed at the pressurization and depressurization required when personnel enters or exits the temporary housing. A second industrial port, identical to the first, will then be built to increase the flow of raw materials.

Fig.102a Fig.102b

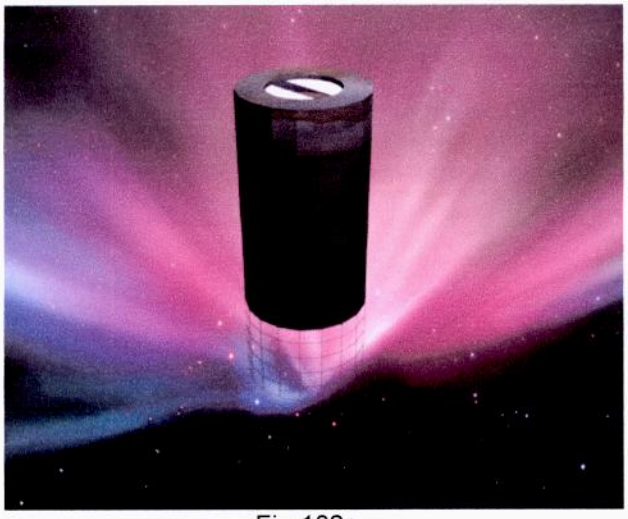


Fig.102c

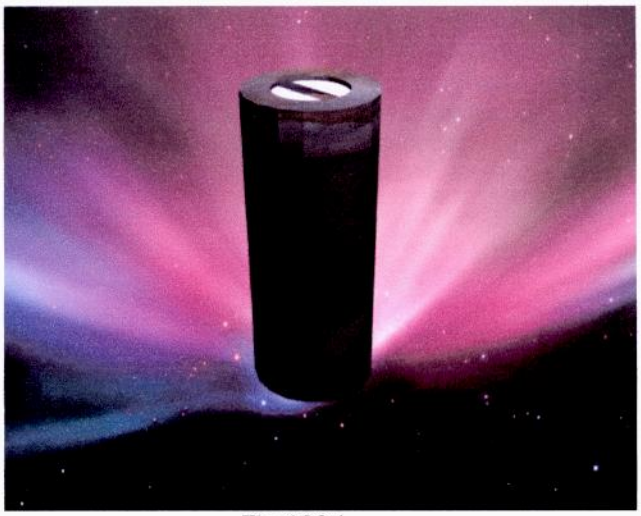


Fig.102d

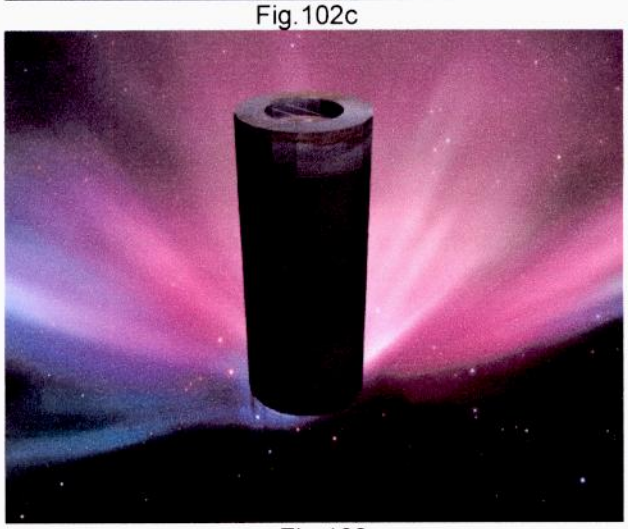


Fig.102e

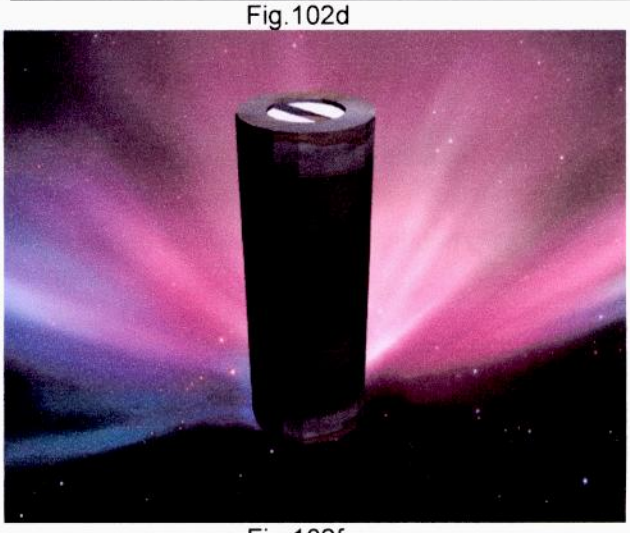


Fig.102f

The sixth step (Fig. 103) will be the construction of the pressurized access gates and of the connection terminals. This will be done simultaneously on all five sides to avoid affecting the station's rotation effect.

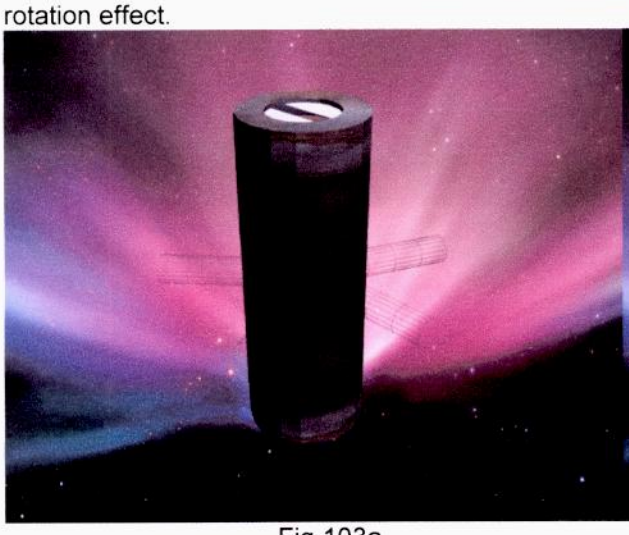


Fig.103a

Fig.103b

In the seventh stage (Fig.104) sections of the torus will be built simultaneously on both sides of each terminal. After a section of 250m will be completed, it will be isolated, pressurized and then equipped with a life-sustaining system. During the construction of the next section, in the completed one houses will be constructed and the agricultural process will be initiated. After the second section's construction is finalized and it is life-suitable, their dividing wall will be disassembled in order to be used when the now-under-construction section will be completed.

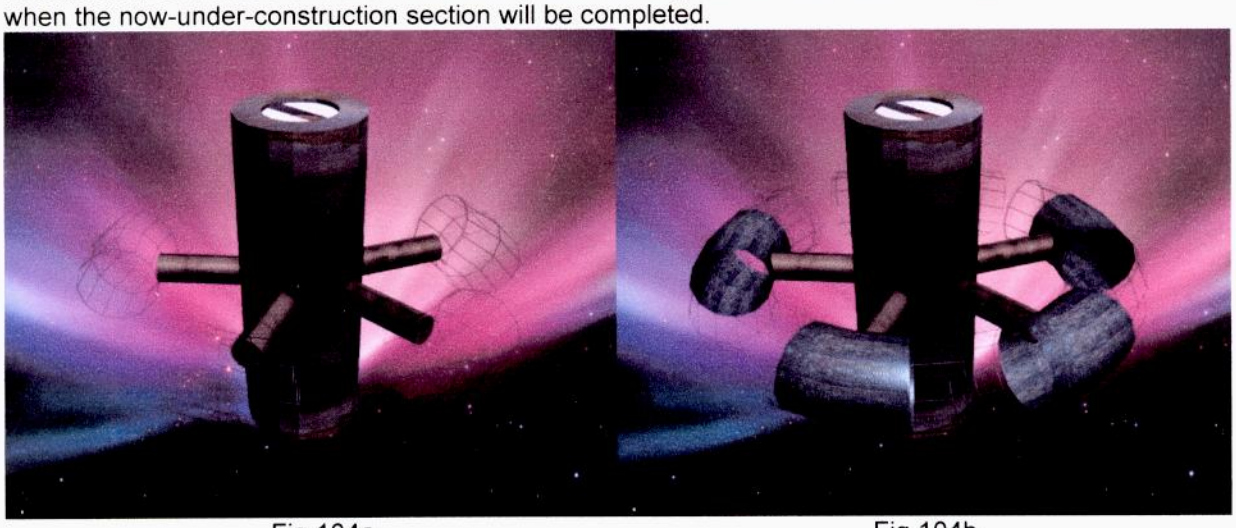


Fig.104a Fig.104b

After housing for current personnel is assured, the eighth sequence will be initiated (Fig.105). The two passenger will be constructed to ease personnel increase.

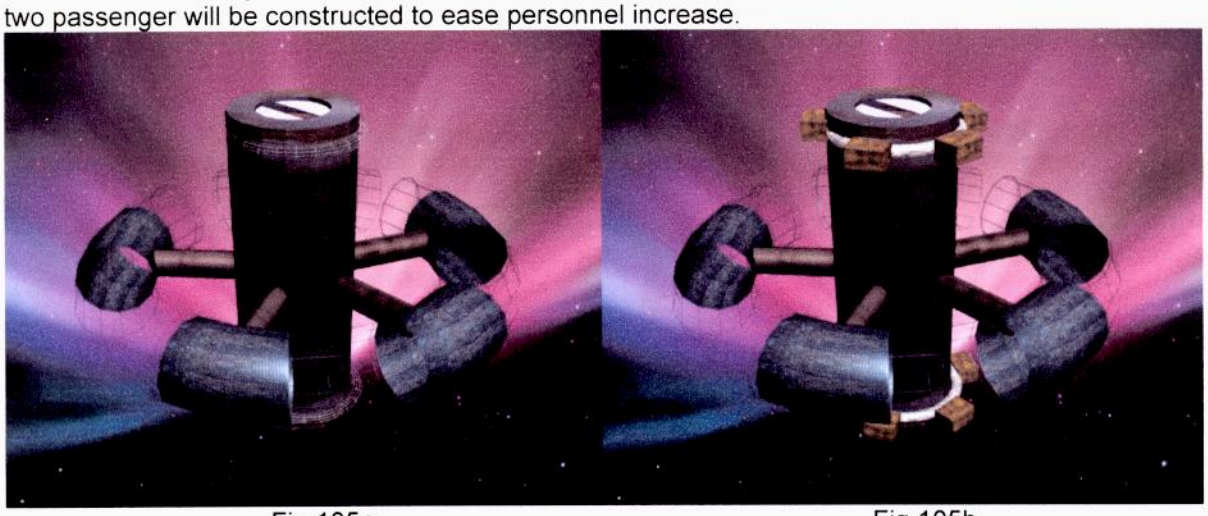


Fig.105a Fig.105b

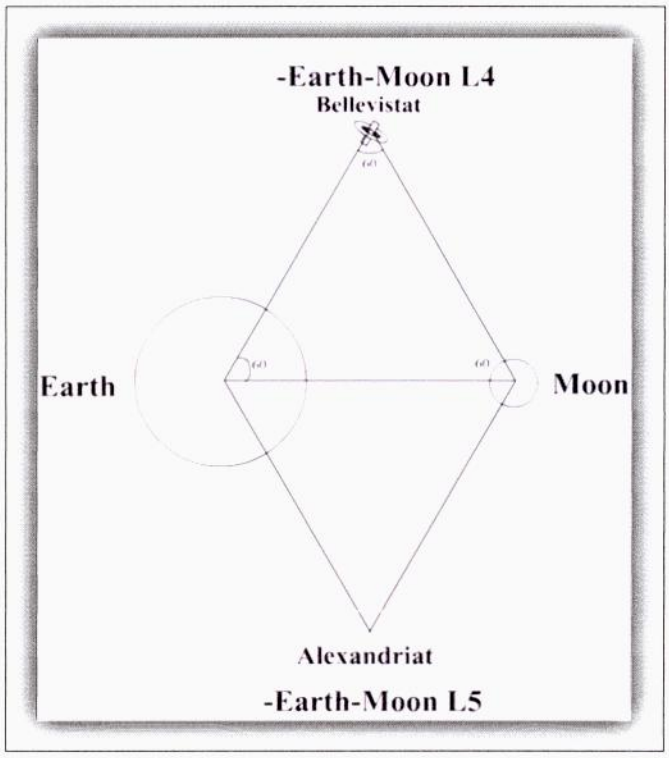
During the ninth sequence (Fig.106) the torus construction will be finalized. After this will be completed, the life-sustaining systems will be centralized, the timetable differences for the five main sectors will be instated, the public transport system and the primary telecommunications system will be enabled and OLEDs for the simulated sky will start being manufactured.

Fig.106

The final step (Fig.109) will consist of constructing the administrative centres and the commercial centres, installing the OLEDs and their support systems, initiating the educational system, installing and enabling the wireless network etc.. Also, the construction facilities will change their specialization to appeal to the contractors' needs.

III. OPERATIONS AND INFRASTRUCTURE

As the second settlement, with already booked customers, Bellevistat must complete all the demands, not only in becoming a center for on-orbit refining of extraterrestrial materials and heavy manufacturing but also an all purpose human outpost, capable of holding 20 000 people, full time residents and transient population. In accomplishing such a thing there will be involved almost twice as much people, and they're purpose will for sure leave a mark in human history, helping it to make another "big step" as Neil Armstrong says.



The plans have been done, the space station's construction plans have been finished, as written in the chapter 2 of the article and so Bellevistat starts to get shape, the construction robots, described particularly in chapter 5, are doing they're work.

3.1 Location

The Bellevistat space station will be located strategically in one of the Lagrangian points, also called Libration points. These points represent key positions in our Solar System, ideal for space station locations, where an object that is only affected by gravity can theoretically be stationary relative to two larger objects, in our case the Moon and the Earth. We so position our extraterrestrial habitat in Earth-Moon libration point L4. We choose this because it's the closest libration point to Earth and L5 was taken by Alexandriat, which will help us in building the station (chapter 2). Figure 3.1.1. shows a

better view of the location.

L4 and L5 offer a high stability point and even if a body at these points is perturbed, It moves awa from the point, but the Corrolis effect brings it back. Stability at L_4 and L_5 depends crucially on the station being pulled in three different directions, namely the outward centrifugal force away from the barycenter, balancing the inward gravitational forces towards the Moon and Earth.Located in Earth-Moon L4, the resources needed to construct the space station and later, for Earth selling, can be easily mined from asteroids, meteorites, comets, Moon but also shipped from Earth. The mining procedures will be done by Selena, which will be capable of collecting resources from any astronomical object beyond the orbit of the Earth.

The first objects likely to be mined are the near-Earth asteroids. This asteroids can be silicate dominated regolith, metal dominated regolith, or mixed silicate/metal regolith. From these types of asteroids, the metal dominated regolith will be the most wanted, mostly because it contains needed manufactory materials. Example of useful asteroids can be seen in table 3.1.2.

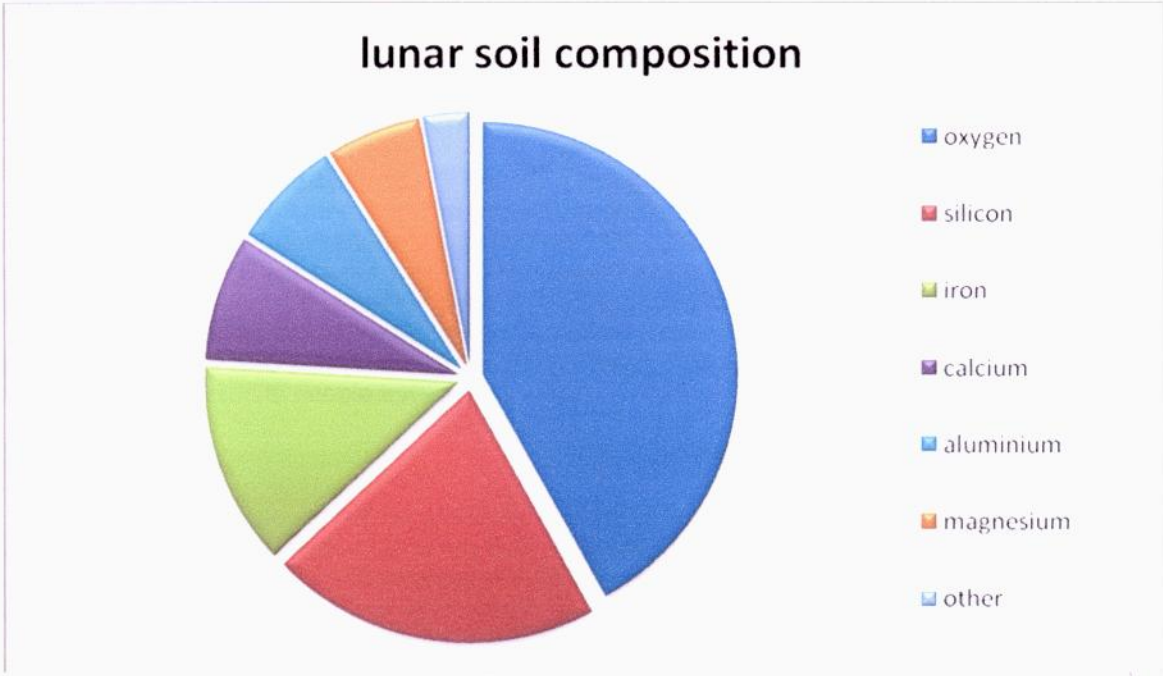
But the main source of materials remains the moon, which will also be the main base for Selena, our general resources collector. From the surface of the moon we will extract raw materials, such as titan, magnesium, but also water that can be found mostly at the lunar poles. The materials extracted from the moon can also be found in table 3.1.3. *3.1.1.*

From the bombardments of the moon by comets and meteoroids, there is a small amount of water to the lunar surface. Some near craters near the poles never receive direct light from the sun, so it may still be water, a quantity approximated of 1 cubic km. (Clementine mission bistatic radar experiment)

EROS (near Earth, C-Type asteroid)	Low density regolith
Mathilde (near Earth, C-type asteroid)	May be carbon rich
Kleopatra (main belt M-type asteroid)	
Castalia (earth-crossing asteroid)	

Table 3.1.3.

Moon actually gives a crucial advantage in space construction, the costs for collecting, refining, and transportation throw space are evidentially lower than those of bringing them from earth. The materials, after Selena had extracted them, will be brought to Alexandriat with "Through Space Transporters", or "TST" (see chapter 5). After they've passed a series of chemical and physical changes, transforming them from a raw form, they're transported to Bellɛvistat, if needed, and for later concerns, to earth using one way transporters called "To Earth Transporters", or "TET", also detailed in chapter 5.



The storage of this materials will take place mostly on Alexandriat, but the already processed materials will be stored in the main cylinder of Belleεvistat, where there will be the 0-g factories.

3.2

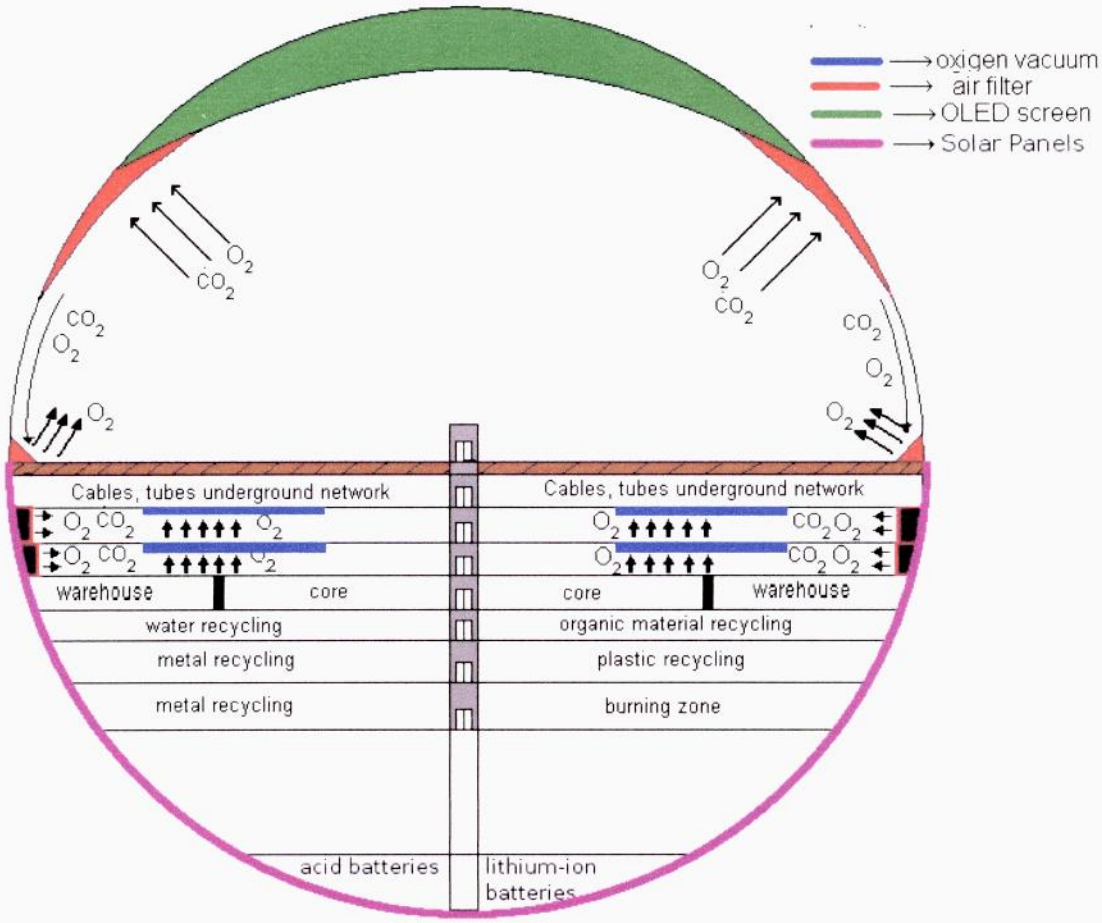


Fig 3.2.1

The life sustaining systems will provide the necessary and above of air, water, light, food, waste management , and day/night cycle. The production of food will be made under the built part of the city on 2 level. The distances between the upper floor and the agriculture part will consist of 10 meters. This part will be later discussed in a larger state in the human factors area. The depositing will take place in special chambers (freeze rooms) that will be place in the basement of the torus.

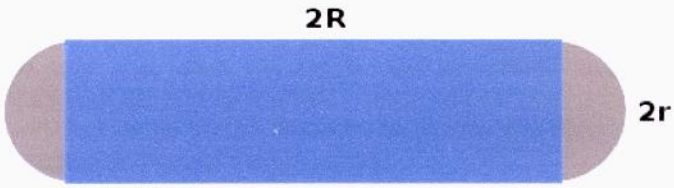
The packaging will be made inside the deposit zone where we will have a packaging facility. In this facility we have also a delivering and sorting station. The selling will be made in groceries and butcheries on the credits people earn by working.

Energy Production

The electrical power will be provided by solar cells placed on the outer part of the torus with the surface always facing the sun of 3 sq km that will obtain a power of 1242Mw/h. The amount of energy needed by 19000 people(18000 residents+1000visitors) is of 10Mw/h and the rest of 1232Mw/h is used by the life sustaining facilities and by the industry.

Only the exterior part of the torus will be covered in solar panels, it's surface will be of 14.79 km2. This solar panels will be photo-voltaic, compose of individual photo-voltaic cells. The panels will be

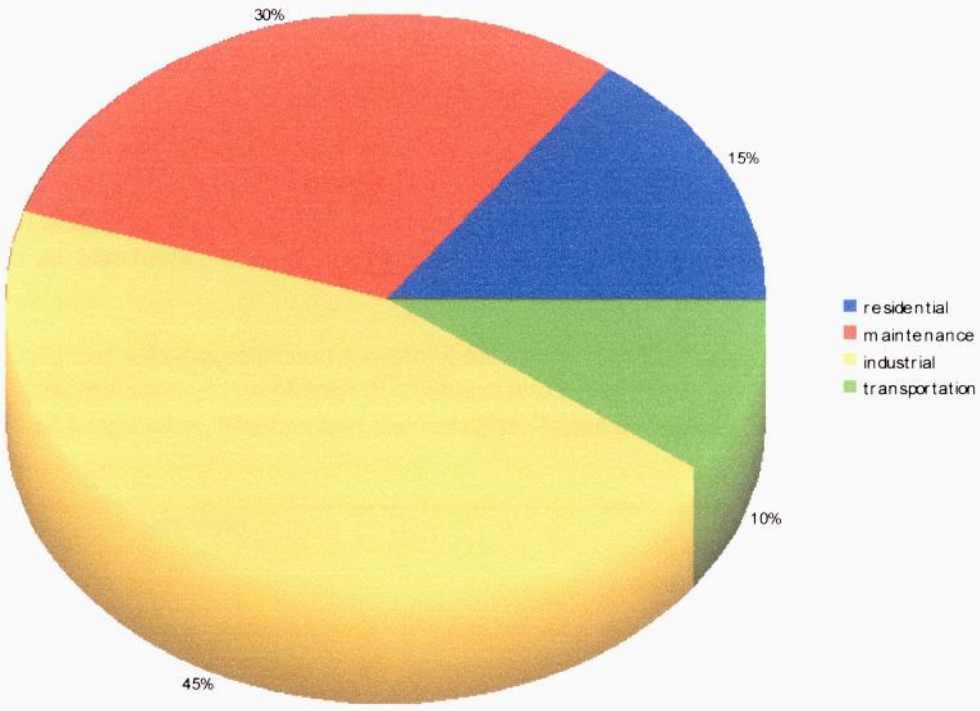
composed of crystalline-silicon modules with an aluminium frame and glass on the front. Image fig.200 show the surface that is oriented to Sun every time.



$S=2Rh=3$ sq km
$E_0S=P$
$Pe=0.3E0S=0.3E_02Rh$
$E0=1380\ W/m^2$

Most of this energy will be firstly stored in huge lead-acid batteries and lithium-ion, stored in the underground side of the torus, to assure a liable source of energy in case of shadow or inevitable accidents. The energy will be stored in a combination of acid batteries because they maintain a relatively large power-to-weight ratio, and lithium-ion batteries, because of their best energy-to-weight ratio. It will assure a complete back-up for the station's energy needs, also creating a healthy environment, using only the energy of the Sun.

The energy will be transported through the station by the cables in the basement layer of the torus. Therefore it will not disturb people from the surface.



Energy distribution

Communications - The internal communication will be based on Push to talk technology and wireless network calls or chat. Also the external communication will be provided by the antennas put on the side of the torus orientated to other communication satellites used for searching and finding the destination of the receiver. The technology used will be holographic calls, video or audio calls and also internet with all its functions.

The internal transport of people will be made by a system of Maglev tracks and chairs stations. The chairs will have a harness to keep you in place and also will provide luggage depositing space around the seat. The chair will move from the station on to the first strip of track and will accelerate progressively till it will switch to the 2nd track where it will accelerate to a speed of 15 km/h. When it needs to stop it will decelerate on the first strip till it pulls to a stop in the station where the person will take of the restrainment and will get of the transport.

Atmosphere - Bellεvistat requires an artificial atmosphere of acceptable composition and pressure to assure a maximum comfort for its residents. The pressure on Earth of Oxygen, at sea level is around 22.7 k Pa, and so, on our space station it shouldn't be a deviation of more than 9 k Pa of this value. To prevent certain respiratory problems, Nitrogen is needed, preserved at 26.6 k Pa. These values are based on NASA-Space settlements, A design Study. The maintenance of this artificial atmosphere needs monitoring and controlling trace elements. The atmosphere in the station and all air and ventilation services will be managed by supercomputers that are specially built for this purpose.

The station's atmosphere will mimic the Mediterranean climate, composed of 80% nitrogen and 20% oxygen. The pressure will be the same as on Earth of 1 atm. The daily air necessity of the station is 820 000 liters

The air will be filtered by an air purifying respirator by the name Elektron oxygen generator, and also with the help activated carbon filters. Also this filtering will be done by green plants put around houses and also the air will be sent to the agriculture levels for further purification. The Elektron system is developed by the Russians that electrolyzes the water to obtain oxygen and hydrogen, and the oxygen will be mixed with nitrogen brought in liquid form from the Earth.

The light inside the station will be created by huge OLED screens, which will provide a realistic view, imitating Earth's sky. This will also assure a day/night cycle, crucial in every living being's life. The screen on the ceiling will be placed as shown in figure 3.2.1. It needs to be closely supervised, to prevent light pollution, also known as photo pollution. Bellεvistat's lighting systems will be controlled by the center core, using occupancy sensors or other controls to extinguish lighting when not needed.

Water management - Bellεvistat will have its own water cycle, not losing any of the water brought from Earth or from Selena's harvesting. (see 3.1.) The water will be totally restored from the residents waste, the agricultural usage (see 3.4) and industrial usage. The water will be stored in containers in the basement of the torus, where it will also have place water recycling. The system that accomplishes such a thing is explained in figure 3.2.1.

After water has been collected with the collection system, it passes a series of treatments. In the first one it will suffer sedimentation, the second one biological oxidation and disinfection, and the most advanced one, the third, chemical coagulation, filtration and disinfections. These processes are detailed in table 3.2.2. with they're uses.

Primary treatment	No uses recommended at this level
Secondary treatment	Surface irrigation Non-food crop irrigation Restricted landscape impoundments

	Industrial cooling processes
Third treatment	Landscape and sports field's irrigation Toilet flushing Vehicle washing Food crop irrigation Potable reuse: groundwater recharge of potable aquifer and water reservoir augmentation.

Table 3.2.2

The quality of the water will be closely supervised, being very important in disease control and general health.

3.3 The station will have permanent connection to satellites already existing on orbit around the earth but we will have special satellites for obtain a secure permanent contact between the Belleεvistat and the other settlements or space vehicles. We will have a special SatCom frequency that will be used only by the authorized personal.

Spacecraft and Transportation means	Description
Personal Transportation Shuttle	This shuttle will take the personal from the orbit around earth to the settlement
Raw Material Transportation Shuttle	The shuttle will consist of a docking platform were containers filled with raw material are locked in place and sent to the station
Space Probe	This robot will be a easy to build an cost effective robot that will gather information about unexplored space.
Excavating Shuttle	This will be a twin power temporary stationary robot that will extract ore or soil form the moon and other asteroids

3.4. Consumables.

Placed in the subsurface area, on two levels, agriculture is being well-taken care of. Being inspected very closely, this sector develops its activity under optimum temperatures, with sufficient light and in conditions of moderate humidity. The table presents some of the items.

Plant	Vegetation	Light	humidity
Pepper	22-28 days	Strong	60=70%
Potato	18-20	strong	65=70%
cucumber	25-28	Strong	High
onion	18-20	Strong	high

cauliflower			65-75%
pumpkin	25-28	Medium	65-75%
Carrot	18-22	Medium	70-75%
Parsnip	15-20		70-75%
parsley	17	Medium	70-75%
salad	16-22	Medium	
Beet	16-23	medium	65-70%
Celery	18-22	Medium	70-75%
Tomatoes	22-28	30-35 klx pt 14-16 ore	75-85%
Garlic		Strong	65-70%
Cabbage	15-20	Medium	

We will grow spirulin, considering its importance. Spirulin is used in healing anemia, hepatitis, gastritis, and other inflammatory processes, diabetes, malnutrition, etc.

Experimental, there have been proven the antistress effects of Ginseng. Thanks to its properties, it helps the organism to bear better the variety of temperatures and outside factors. Ginseng grows the physic efficiency and helps the cancer sick.

Also, a considerable space will be dedicated to growing algaes, because they are very fertiles.

The harvesting will be done automatized, with the (fig. 34)

Fig.34

Talking about growing animals, we thought about a species of animal that would be very useful in the industry, it is very small(so it can be transported to the space settlement), and could be used for scientific observation: rabbits. Their fur can be used, and their meat is very appreciated. Then, we would need eggs, because they have a lot of vitamins, and the animal that lays them doesn't require special attention: ducks and chicken.

Also, Belleεvistat will try to grow Caprinae and sheep for milk, and the finest cheese. Their hair and fur will be used for coats, like traditional Romanian clothing.

The consumables will be distributed to specialty institutions and then given to the habitants, on credits(example: medicines to the hospitals and pharmaceutics, clothing to the Mall, etc.).

Belleεvistat management cares a lot about habitants' comfort and turning the space settlement into a nice place to rest. Belleεvistat society will be dedicated to creating a paysagist architecture, for providing a pleasant and relaxing ambient.

IV. HUMAN FACTORS

"Man is the most perfect, the happiest and with the longest lifetime of all animals. Therefore, instead of wondering and complaining about life being too short, we should be wondering and enjoying our happiness and the time it lasts." Voltaire

Peopling Belleεvistat will be very difficult. Alienating the individuals from their family, the well-known space and especially moving to another "planet" are things very hard to handle, psychically speaking. That's why Belleεvistat has already established a set of rules, meaning that the individuals will be (before coming on the space settlement) verified for they have been suffering of any disease, or their relatives with 2 generations before did, if they have psychical problems.

Because it's really soliciting, Belleεvistat seeks to create o proper background, and similar facilities to the ones from Earth . We offer the possibility to the Terra's residents to visit the space settlement(see 4.5) and to communicate with the Belleεvistat habitants(specified in Section 5.3, Community Automation) so that none of them would lose contact.

Belleεvistat tries to amend or fill in the flaws of cities from Earth. Therefore it is absolutely necessary the presence of gardens, parks, greens spaces, boutiques, and a good assignation of the buildings from the industrial sector. There are Belleεvistat's priorities.

4.1 Community Design

Divided in 5, the torus will have, in each sector, public institutions, medical centers, and some other facilities. Housing – In different places there will be council estates, and some building districts(apartment houses= will have max. 2 floors, and the ground floor, so we won't be needing elevators, and so, we wouldn't confound energy). In Fig. 6 we can see the emplacement, housing families of a specific type.(example, apartment house or couples, or families with 3 members). Fig. 4 and 5 present a house and Fig. 6 an apartment house model.

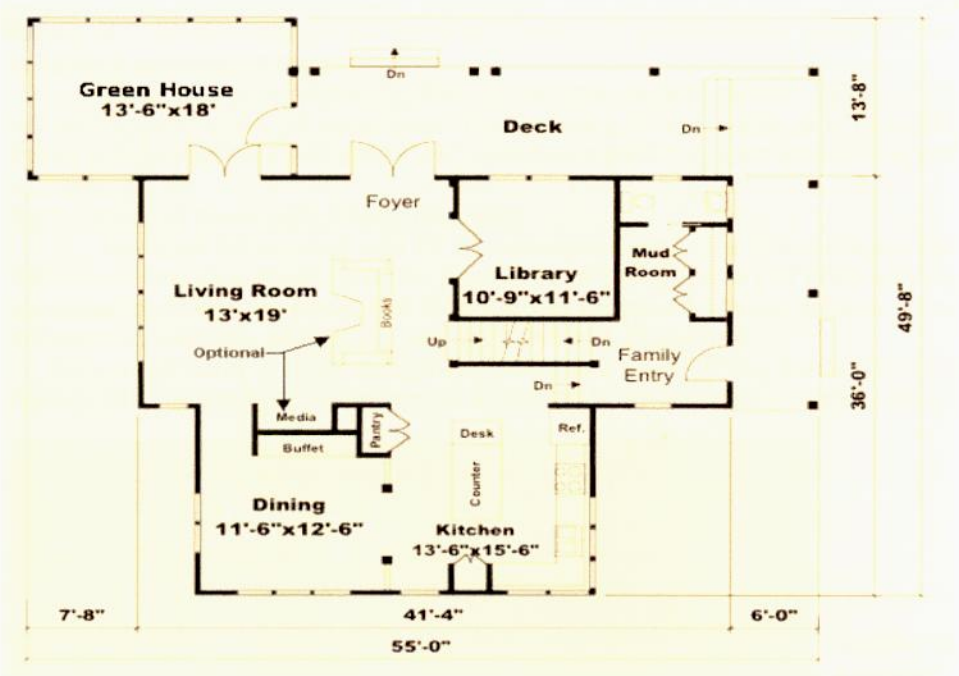


Fig. 4,House, Main floor

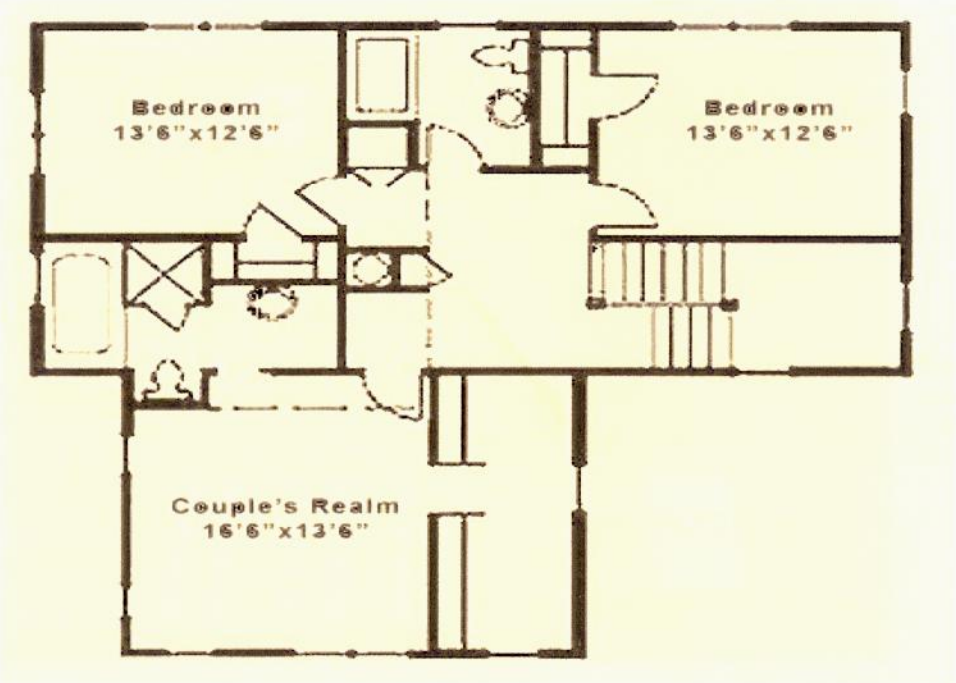


Fig. 4B
Upper floor

Entertainment Two floors Malls will be built, the superiors floor being dedicated to the entertainment: 3D games, libraries where the habitants could revel in with the last publishing, and special places for the entertainment of the children. Separate, in each sector gym clubs, with tennis courts, basketball and athletic fields, and for those who would like to practice yoga, or some other relaxing sports, we have different classes.

Education Campuses will be built so that the young generation could beneficiate of variate studies. In fig. 7 we can see the 4 institutions. And for thoroughgoing study the habitants can visit the House of Culture, where, under the direct leading of well-prepared masters, they could study or be initiated in some other topics.

Medical – Built diagonally, the two medical centers, heeled with the best and newest technology, will be disposed to the public, in case of emergency, or accidents, or in psychotherapy needs.
Parks and recreation: Each sector will have green parks, spaces where Bellεvistat habitants could recreate. (fig.6).
fig.6 : Sector of torus, with 2 neighborhoods

Because Belleεvistat acts for an individual society, the consumables sector is very diversified. Agriculture occupies about 1300 ha. Benefiting of s large variety of fruits and vegetables, and spices, the habitants won't feel any need, and they will feel spooned by these gamuts. All consumables will be delivered to specialty institutions, and from there, to the people.

Belleεvistat cares a lot for habitants comfort and transforming the space settlement in a great place for resting. So it dedicates to a landscape architecture, for assuring a restful, relaxing and pleasant ambient.

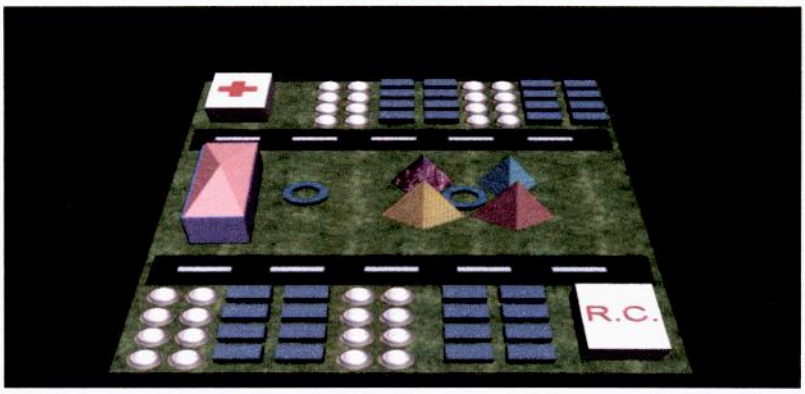


Fig. 6B,
another piece of a sector, with buildings, and Funland.

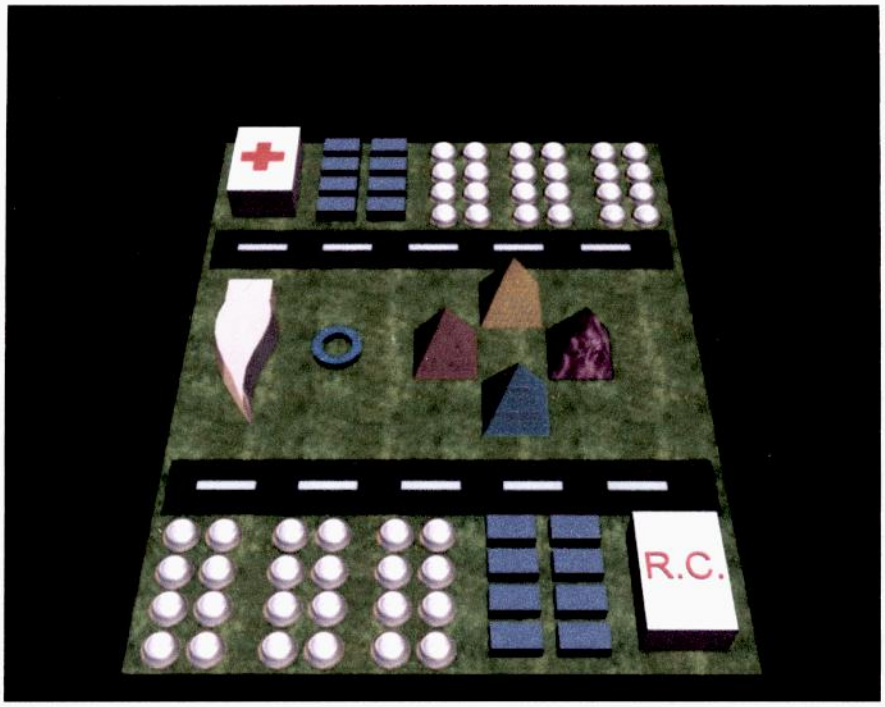


Fig.6A, A piece of sector with two different neighborhoods, a Mall and the Cultural center.

A house of a couple is about 120 m^2. For families with more than 3 members apartment houses will be arranged, and houses, of about 170 m^2.The buildings will be specially built for a specific type of family. The ones with children will be separated from the others with a park, in order not to disturb. Because socializing gives you the feeling of safeness, we'll try to encourage the creation of couples or families. That's why we will build apartment buildings for singles. Independently of the necessary surface, all houses will benefit with a greenhouse, so that habitants won't be isolated from culturing their own plants.

Subject	Percentage	Meaning	Kids	building/number		buildings	surface
Families	3%	540	1	apartment	240	20	6000
				house	300	300	51000
Couples	27%	4860		apartment		200	144000
				house	300	1260	151200
Single W	30%	5400		apartment	10ap/floor	180	12600
Single M	37%	6660		apartment	10ap/floor	222	15540
		17460					380340

Although apparently the houses will be standard, the originality comes from the taste of the habitant. Benefitting of standard packages(furniture, household appliances, etc), and with the help of housekeeping robots, the habitants will be able to arrange their houses in a very short time.(the housekeeping robot, fig.8, a house design, fig.9) All buildings will be made of glass/plastic, carbon with wall clamps.

Fig. 8, The housekeeping robot

Fig. 9, A house design(the roof is built for the greenhouse)

4.3

Because Belleεvistat wishes to be a productive community there have been worked out some systems for facilitating the operations. Housekeeping robots have been created to help the habitants to win some time. Following a well prepared plan, the industry is developing gradual, with a 100% capacity, because each sector will have a time lag in each sector of 4, 48 hours, and the space settlement will work full-time.

Each domain will have its own gadgets and occupations. For example, each will have its own robots, etc. For the vacuum space special suits will be used. Fig. 29 shows us a model. For a better mobility the suit will be cussed, with a weight of 18 kg. and will protect the body from extreme temperatures (-82 degrees Celsius). This will consist of a buckram case, and over it a nylon abb will be fixed, and then a spandex one and a polymer with the "shape memory".

Fig.29

MAJOR CATEGORIES OF WORK AND TOOLS NEEDED

Industry	electronic, electro technical	-electronic engineer	-robots -computers -measurement and control for electronic parameters machines
		-sistem engineer	-computers and IT substructure -softs -programs

		-metrologist	-measurement and control machines -robots
Chemical		-industrial chemist	-laboratories industrial ability of manufacturing chemical
		-assistant -biological expert	experimental devices and systems -standardized unites for biological experiments(specific parameters
food		-food processers	-installation in the technological process of making food -measure and control machines for testing the products quality
		-biochemist engineers	-proper machines for assimilation of food standards
		-expert engineers in	-processers -industrial robots
		food	production, packing, keeping food equipments
		-system engineers	-computer networks
light industry		-expert engineers low industry	-computers -industrial robots -measure of quality machines
		Designers, model makers	-computers Soft design
		-maker	-industrial robots -computers -control panels
		- maintenance equipment expert	-computers -industrial robots -control panels
Agriculture	-earth exploitation	-pedologist engineer	-bio-hidro-pedologic testing laboratories
	-production	-hidroameloration expert	-selection high biological performance species
	- arrangement	-horticulturist-biologist	-chemical nourishing substance -irrigation, machines, robots
		-chemist	tools for agricultural exploitation

Commerce	-exchanges	-economists -investors -analysis programmers	-offices -computers -device necessary for the production of credits on electronically supports -electronically distributors for payment -commercial spaces
Developing the substructure and transport		-dispatchers -programming engineer -pilots	-vehicles -material rulant -spatial capsule
Financial and Banking activities		-economic analysts for prognoses -economists -financial consulters -brokers	-soft prognoses programs -ATM(automated teller machine) -computers -banks
Public services	-lighting -heating -air/water cleaning -residues recycling	-energetically expert engineers in computers programming engineers, automation	-nuclear units -solar panels -energy distribution substructure -air/water cleaner -pools for stocking water -transforming and recycling residues machines
Health	-Hospital -Clinics - Laboratories	-researchers -doctors -assistant -auxiliary personal (electronic, IT)	-laboratories -high performance medical tools -high performance specific medical installing capacities -surgery blocks -intensive care units
Education	-elementary school -gymnasia school	-didactic staff on different degrees -specialized IT soft engineers	education substructure. energy distribution substructure

	-college -university	-auxiliary staff	-virtual library -multimedia spaces	
Culture	-virtual library -cinema -theatre	-expert researchers in history, culture and civilization, knowledge of space exploring, philosophy, psychology of human communities, media, and so on		-virtual library -documents -mass-media -cinema -theatre
Tourism Sport Relaxing activities		-tourism experts -relaxing activities managers -fitness trainers -nutritionists -food consulters		-hotels -agreement vehicles -physical training spaces -parks-resting places -cinemas
Space Safe and Defending Instit.		-pilots IT engineer		electronically safe systems, satellites Robots

4.4 Neighborhoods

Each neighborhood will have it's own design. The originality of these places are in the Cultural Center, shaped in pyramids (we focus on the pyramid effect) , and each such building will have, in the weight point, a little garden, with wild flowers. It would be a fascinating spectacle, and in the building arrangements.

4.5 Activities, Amusement

Space settlement Belleεvistat arranges for its residents a variety of activities, fun ways and recreation for improving habitants' physical condition and mental stimulation, as follows: cinemas, theatres, fun lands, Malls, casinos, hotels, stadiums and fun grounds. Also, Belleεvistat will have an Universal Entertainment Complex specially created for the resting of the habitants.

Bellevistat Universal Entertainment will have shops, boutiques, 3D cinemas, and a playground. As another way of having fun, the residents, or visitors will be able to enjoy views from space from the passenger ports', visitors' area. These special rooms will have heavy glassed windows(special glass with plumb ions, or yenna glass). The special disposal of the space settlement will offer spectacular pictures, uniqueness.

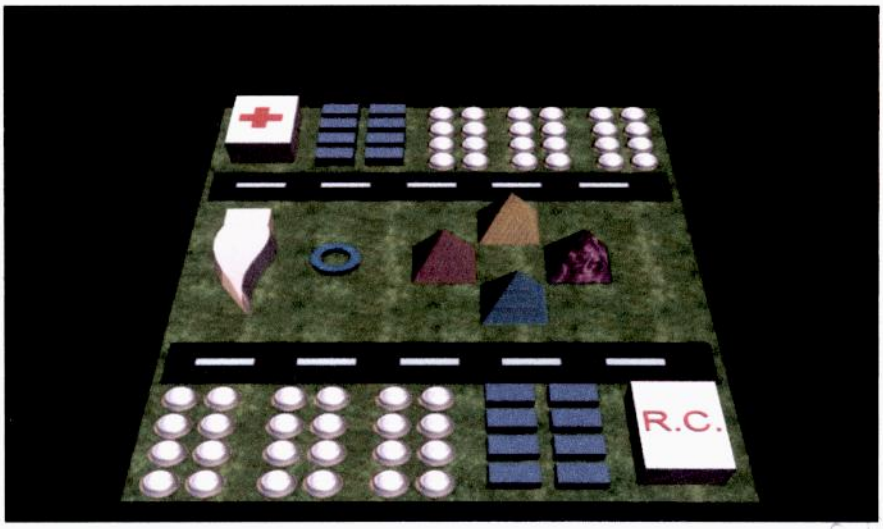


Fig.6A, A piece of sector with two different neighborhoods, a Mall and the Cultural center.

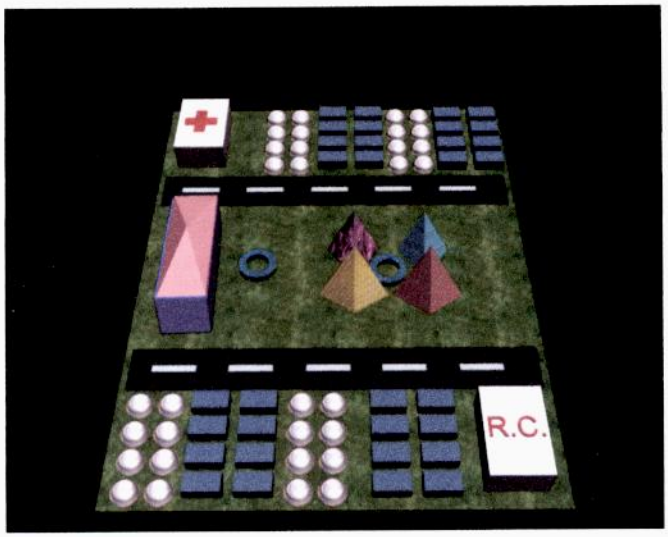


Fig. 6B, another piece of a sector, with buildings, and Funland.

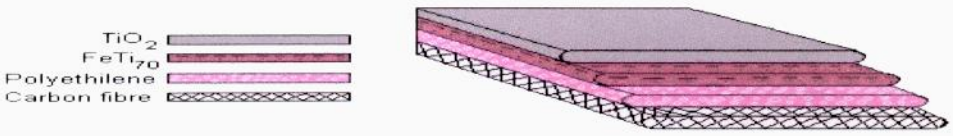
V. AUTOMATION DESIGNS AND SERVICES

Bellevistat space settlement will work with the help of some automation systems controlled by supercomputers which have the purpose to avoid the human error that may appear in some processes. These systems will ensure all population needs (food, hygiene maintenance, air and water purification, humidity adjustment etc.); also they will play an important role for the health supervision and safety on the station. All these automation processes will be coordinate on each sector by a series of supercomputers, on all of them being installed specific software for that branch that have to coordinate. All these supercomputers at their turn will receive commands from a main core. This way this main core will know anytime what is happening on Bellevistat and everything it will be saved in a journal which will write all the information on quartz. One safety measure will be that each computer form main core to supercomputers will have at least one backup computer in case of damaging his function being replaced quickly by another computer. From the moment of their arrival on Bellevistat each of the residents will have to make an implant with a nanochip which will have the responsibility to verify the vital signs and send them to the population database. This information will be analysed by main core, this way all the people will be supervised, besides this implant people should receive a pair of virtual glasses which have various purposes from communications, map for guiding in case of losing (this one shouldn't be a problem but we took this precaution just in case), and the possibility to open documents and read on a virtual screen on the lens. These glasses will be voice commanded.

5.1Automation of construction processes

Name	Purpose
Crane robots	pull and push objects(materials)
Building probes	it fixes materials on place
Transport machine	transport of material
Interior creator	creates the interior and finishes
Assembler robo	assemblies the parts

First robots will be specialized on mining and will be made on Earth and then sent to the moon to begin the mining process. Next stage is to make and bring again robots but this time in L4 (the place where Bellevistat will be placed). Here they will begin the construction by making the cylinder skeleton which will be covered with $FeTi_{70,}$ carbon fibre, polyethylene and TiO_2, as follows:



Materials	Thickness	Description
$FeTi_{70}$	5 cm	Network made by small bars
carbon fibre	0,5 cm	Multilayer
polyethylene	3 cm	Multilayer of foils
TiO_2	1 cm	A small layer

Next phase is the construction of the 5 tubes (spikes) which will be placed at 72° one form each other. Once finished, at the end these tubes will start the symmetrical construction of the 5 segments that will form the torus.
The materials which will be used for building the station will be obtained from the Moon's extracted ore and processed on moon and Alexandriat until Bellevistat industry will be functional.

5.2 Facility automation

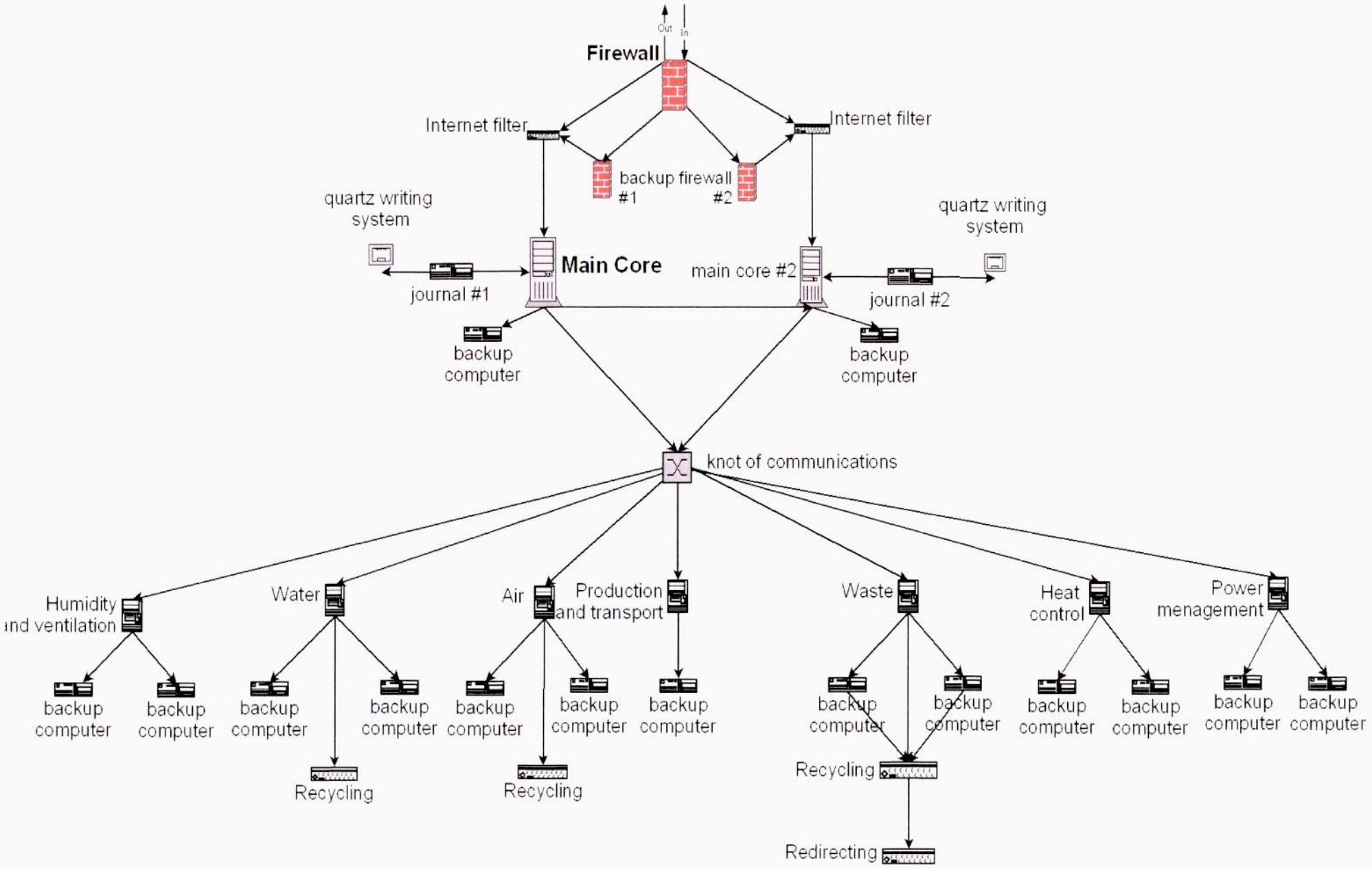
For security reasons we have divided the torus in 5 sectors separated by some vacuum tight locks with high resistance to pressure difference. This way in case of any danger like contamination, depressurization, fire, irradiation, even explosion that zone can be isolated by closing those locks until will be fixed or replaced. In case of low risk danger the residence of the problem sector can move temporary in other sector till they can come back.

Vacuum tight locks: their design will be same o one of a concave gate, with the centre of the sphere outward; will be closed toward the isolated segment and open to the interior of the torus, this lock insure the sealing of every level of the torus.
Regarding the leakage of information from the data circuit that will have place in administrative system and supervision (for a good station activity) system we have firstly a firewall for external data access, secondly firewall on station important data against the residents access that are now allowed to access them.

Another problem is than anytime one of the computers that control the life sustaining systems to be damaged or overloaded, in that moment is equipped with a backup system. Every supercomputer and core will have obligatory at least one backup system.

5.3 Habitability and community automation

For a better and safer flood of data between computer networks we will use mesh topology, thus in case on damaging of one network knot the flood of data will find another way to reach his destination. The possibility of Bellevistat's residents to communicate with the Earth will be made in real time, internet connexion being made using the satellites that are surrounding the Earth. The whole internet connexion will be filtered and have to pass the firewall, this way the leaking of data won't be a problem, and the traffic will be controlled permanently. On the surface of each of the 5 sectors exists wireless zones (like the parks), also in their residence even if they will have optical fibre connexion standard they have the possibility to get and use a wireless router.
Security problems of personal computer have been solved by using password and eye-scanning protection. All the sent data will pass through some filters but will be kept secret; the only person that will have access to this information will be the owner.
The sum of processes on the station will be controlled by a central core in this way we have next diagram:


Out
In
Firewall
Internet filter
Internet filter
backup firewall
#1
#2
quartz writing
system
quartz writing
system
Main Core
main core #2
journal #1
journal #2
backup
computer
backup
computer
knot of communications
Humidity
and ventilation
Water
Air
Production
and transport
Waste
Heat
control
Power
menagement
backup
computer
backup
computer
backup
computer
backup
computer
backup
computer
backup
computer
backup
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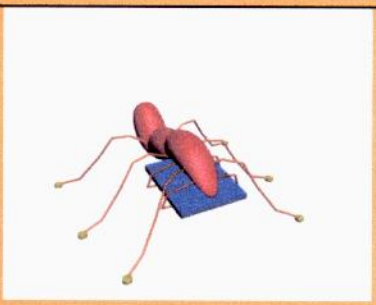
backup
computer
backup
computer
backup
computer
backup
computer
backup
computer
Recycling
Recycling
Recycling
Redirecting

For each computer that have a vital role on the station will be at least 2 backup computers this way in case of damaging in very short time the computer with problems can be shutted-down and the back up computer can take over his responsibilities.

Concerning the healthiness the residents will have an implant with one nanochip which has the responsibility to watch their vital signs this way if any disorder of normal estate nearest hospital is announced and a doctor with a medical team will be sent to find that person and give him medical care.

To make the life easier the humans will need robots in their daily life, one never-failing will be housekeeper robot. This robot have the responsibilities to monitories the house, will be foreseen with humidity and temperature sensors, will scan the residence making an inventory of every object this way if any object will be missing the owner will be informed immediately. Another ability of this robot will be to keep the hygiene in the house, thus he will clean-up the dust, will be also equipped with a vacuum cleaner and will collect the garbage and distribute in: organic material, plastic, glass, metal all of this following to be recycled.

Other robots that we will meet on the station will be:

Name	Purpose	Description	Picture
The brush	Salubrity robot		
Collector robot	Is used in agriculture and also to clean up the trash.		
Solar ant	Have the responsibility to replace damaged solar panels		

5.4 Automated systems for finishing interiors

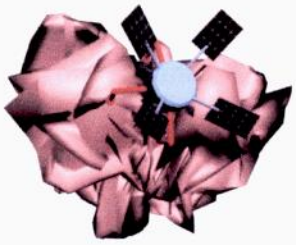
For the houses inside there will exist systems of plates of carbon fibre and plastic material prefabricated only for assembling and furniture packages for each type of room (day room, bathroom and kitchen). On each construction site there will be a grid assembled around the house for the robot arms to

assemble the house. The robots will have long retractable arms to move and position the plates. They will construct the house from the ground up. On each floor before putting the ceiling on each floor the interior is put and arranged inside by other robots. There will be Painting robot that will paint the walls, robots that will position the furniture, robots that will install the plumbing and robots for wiring and for installing the fuse boxes and plugs, and switches, lights. The floor will be built from carbon fibre honey comb structure. The plumbing will be prefabricated and will be installed by the affiliated robots.

The worker is the robot who has the responsibility to finish the interior of houses. This one is equipped with paint brush, hydraulic arms that permits a better mobility.

5.5 Automated system for mining and harvesting

The extraction will be in priory made from the moon but also from asteroids. For this we have specially designed robots for extraction and for transportation. These robots will extract the ore with the help of a vat and will be unloaded in a transporting ship. The ship will transport the ore to the station and will unload in the material dock by detaching the vat and sending it inside. It will be power by a hybrid engine both hydrogen oxygen rocket engine and also an electric motor powered by solar panels. Also the moon will be harvested by SELENA a group of extracting robots produced by The Foundation used for extracting lunar soil.



The Spatial Digger has as we can see from his name the ability to dig for ore. Land on the meteorite's surface and fix on it with some claws for a better steadiness.

VI. SCHEDULE AND COSTS

A. Schedule

Sequence	Approximated duration
Start date	10 May 2028
I	4 months
II	2 months
III	1 year 4 months
IV	1 month
V	1 year 6 months
VI	1 month
VII	3 months
VIII	1 months
IX	5 months
X	4 months
Total	4 years 7 months
End date	December 2032

Although the first and the third step do not represent nearly as much building as the fifth, their high required time is caused by the fact that all components are manufactured on Alexandriat and transported to the station to be assembled.
The constructed area over time ratio increases exponentially as the project progresses because either construction capabilities (sequences III to V) or available personnel and their workforce (sequences VII to IX) increase.

The buildings and the institutions will be built with the help of professional robots, that, working by sensors, will minimize the time of providing shelters.
Assuming that :
= a house will be built in 4 days
=an apartment building will be built in 10 days
=an institution will be built in 6 days,
=a park will be fit out in half a day. Knowing the fact that each sector is separated from the other by locks, the housing and instituting will be built by the time a sector is finished. So the end date would be December 2033.
The basement contains 8 layers. Each one will be built just like the houses, by the time a sector is finished. The schedule is included in the first table.

B. Costs

Construction Stage	
Research and Development	$9 000 000 000
Shield Construction	$1 000 000 000
Construction of Primary Conduits	$7 500 000 000
Construction of Residential Ring	$35 000 000 000
Construction of Agriculture Area	$6 800 000 000
Construction of underground levels	$35 000 000 000

Sources of Revenues	
Ore Sales	$7 000 000 000
Tourism	$1 000 000 000
Manufacturing	$400 000 000
Dry dock repair services	$2 300 000
Business	$1 700 000

Structure	
Silicon Glass	$7 000 000 000
Nickel	$10 000 000 000
Fire proofing	$50 000 000
Research and Tests	$5 600 000 000

Titanium	$50 000 000 000

Research and Development	$2 000 500 000
Docking	$2 000 000 000
Agriculture Infrastructure	$5 700 000 000
Fiber Optic	$100 000
Water Pumps	$450 000
Plant Seeds	$1 700 000
Atmosphere	$150 000 000
Manufacturing Facilities	$34 000 000 000

Family Houses	
Couple House	$435 000 000
Funland	$700 000 000
Apartment	$1 200 000
Learning System	$10 000
Hotels	$270 000 000
Casino	$500 000 000
Theatre	$27 000 000
Restaurants	$370 000 000
Parks	$4 000 000
Schools	$2 500 000
Museums	$1 800 000

Research and Development	$800 000 000
Transportation	$1 300 000 000
Machines	$30 000 000
Robots	$750 000
Household robots	$1 000 000 000

Business Development	
Radio Telescope	$27 000 000
Optical Telescope	$100 000 000
Rescue Ship	$6 000 000 000
Maintenance and Facilities	$70 000 000
Lab Equipment	$45 000 000
Dust Removal System	$8 000 000
Gas storage	$2 500 000

Every person will be paid considering his level of briefing. We approximate that the Human Factors salaries will not be outrun by $30 000 000, the Operations and Infrastructure sector = 90 000 000 $, Automations for about 100 000 000 and Business approximately 70 000 000 $.
Total Cost of the Space Settlement = $ 236 837 210 000.
We approximate that this sum will be regained in about 50 years, winning each year about 50 000 000 $

VII. Business development

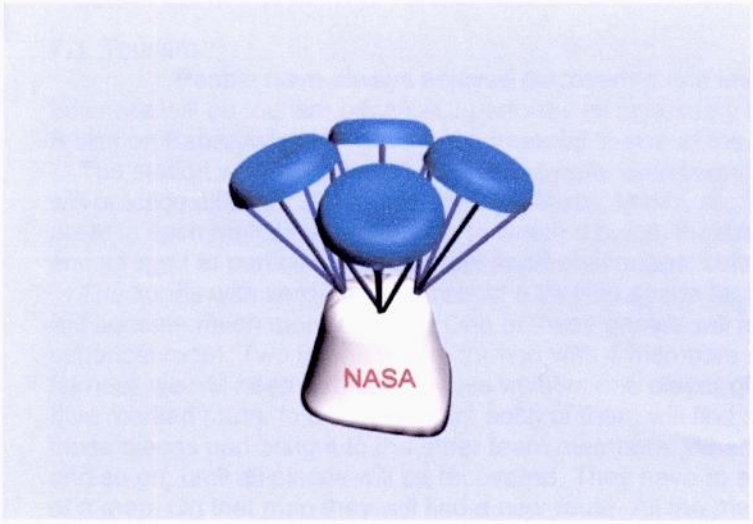
Belleεvistat represents an favorable environment for commercial and industrial business. The three major business pursuits are: extraterrestrial materials harvesting and refining, space manufacturing and tourism.

7.1. Extraterrestrial materials harvesting and refining

Asteroids, also called minor planets and planetoids, are an important source in obtaining the necessary materials (raw resources, minerals etc.) for the future space constructions. These materials can also be sold on Earth. The list containing the materials is found in chapter 3.1.

The obtaining process is: Selena station will collect the materials from the asteroids, using "space transporters", they will be taken to Alexandriat where they will be processed and finally will be transported on Belleεvistat. (Fig. 44)

A part of these materials will be used for buildings on Belleεvistat and the other part will be sold on Earth. Special "one way " re-entry vehicles "Terratrans" (Fig. 45) made of recyclable materials, will transport the manufactured products and raw materials to Earth's surface. These vehicles will be launched from Belleεvistat.



Fig, 45 A

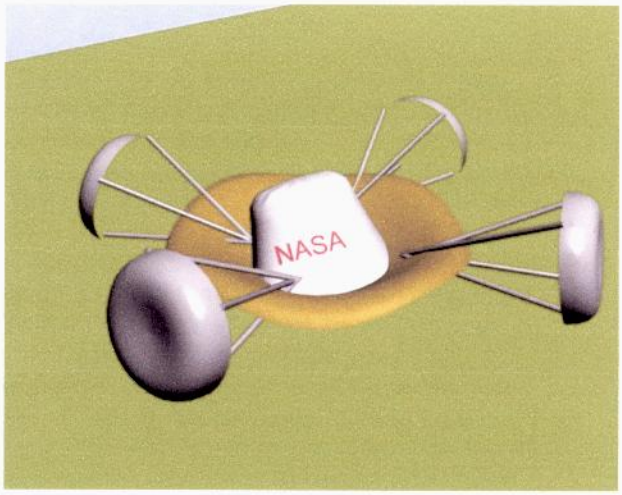


Fig 45 B.

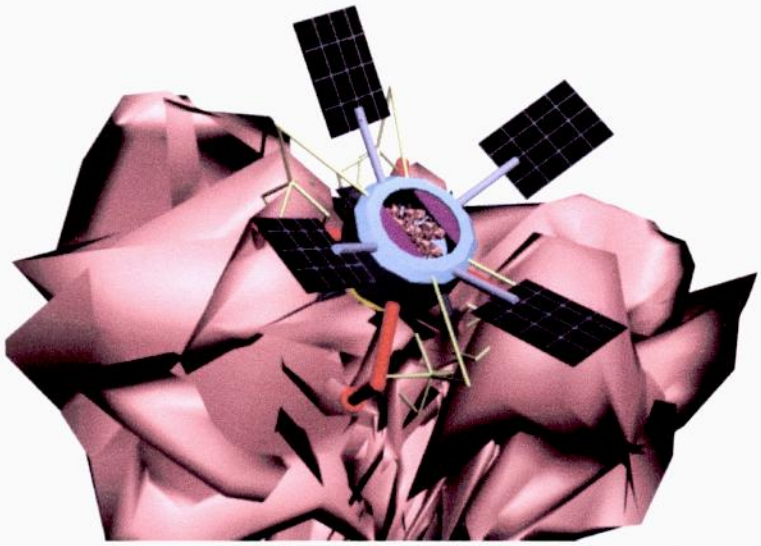


Fig. 44

7,2. Space manufacturing

Space manufacturing is the production of manufactured goods in an environment outside a planetary atmosphere.

Belleεvistat will provide space manufacturing and assembly facilities which will be useful for future projects or future space settlements, solar power satellites, antennas.

As Belleεvistat will be built in orbit around the Earth, telecheric devices can be used for large-scale space and lunar construction projects. Solar power provides a readily available power source for thermal processing. Even with heat alone, simple thermally-fused materials can be used for basic construction of stable structures. The solar energy can be concentrated in the manufacturing area using an array of steerable mirrors.

Heating can be performed using sunlight combined with electrical heaters. Various metal-working techniques can be used to shape the metal into the desired form. The standard methods are casting, drawing, forging, machining, rolling and welding, but the electron beam welding has already been demonstrated and will probably the method of choice. Other space manufacturing technologies include coatings that can be sprayed on surfaces in space using a combination of heat and kinetic energy, and free-form fabrication of parts. A notable output of space manufacturing is solar panels, and also large scale manufacturing plants will be developed. This equipment will perform tasks similar to Earth-based cranes, trucks, bulldozers or mining equipment.

7,3. Tourism

People have always enjoyed discovering and investigating new territories. A prosperous new business will be tourism because it performs all necessary characteristics for complying tourist's curiosity. A visit on Belleεvistat can never be compared to one at the mountains or at the sea.

The station will have many hotels with single, double and triple rooms or apartments (Fig. H). Tourists will practice different sports (swimming, fitness, tennis, etc.). The hotels will be placed in the residential area, In each mall they will be able to watch movies, theatre plays and buy souvenirs. Visitors will be encouraged to participate at different sport challenges, cultural activities etc.

The zones with zero-g will represent a thrilling space for tourists and residents. Here sports and games will become much more exciting. One of these games will be called "The puzzle" . It will be played in a spherical room. Two teams will be formed with 4 members each. To keep the competitive spirit and fairness we will need a referee. At his whistle, one player of each team will depart on a green respective blue marked route. In a certain point each of them will find a pair of puzzle pieces. They have to take those pieces and bring it to the other team members. When the first players arrive the next one will depart and so on, until all pieces will be recovered. They have to assemble the puzzle and will obtain the image of a map. On that map they will find a new route. All the members of the team will depart on this new route. They will enter in a new spherical room where they will have to climb an artificial mountain. During this new test, competitors will improve their empathy spirit because they must help each other mental and physical. In the top of the mountain they will find a statue representing the torus. The first team to arrive back, in the first room with the statue is declared the winner. The purpose of this game is mainly the amusement of the players and the improvement of team spirit and their skills in low-g areas.

Habitants and visitor will be able to communicate with the help of special glasses(fig.46). Each person will have a Bluetooth implant in their hands, This implant will monitor a person's health, mood, and location. In case if a person is not feeling well, the emergency system will announce the Medical Institute and they will interfere. This is a special system. Besides that, each person will be able to communicate with whom they want to , Made in titanium, the glasses have a very well developed connection system.

They can be used even underground, while visiting the industry's institutions(every factory allows everyone to visit the institution, so they wouldn't be casted out from this branch of life).

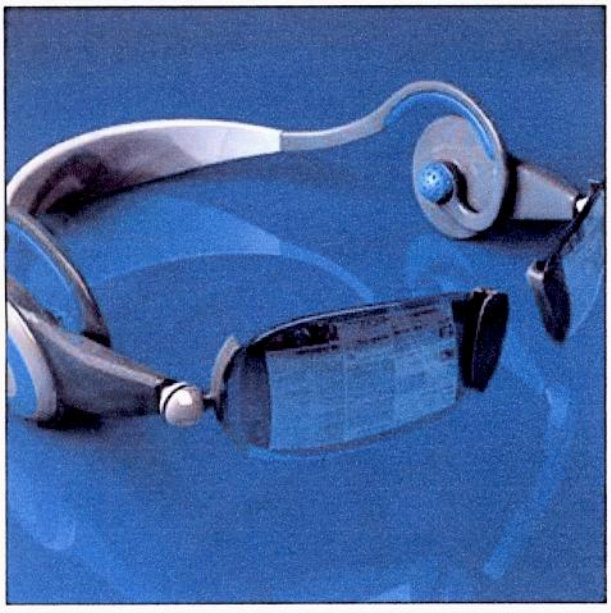


Fig.46

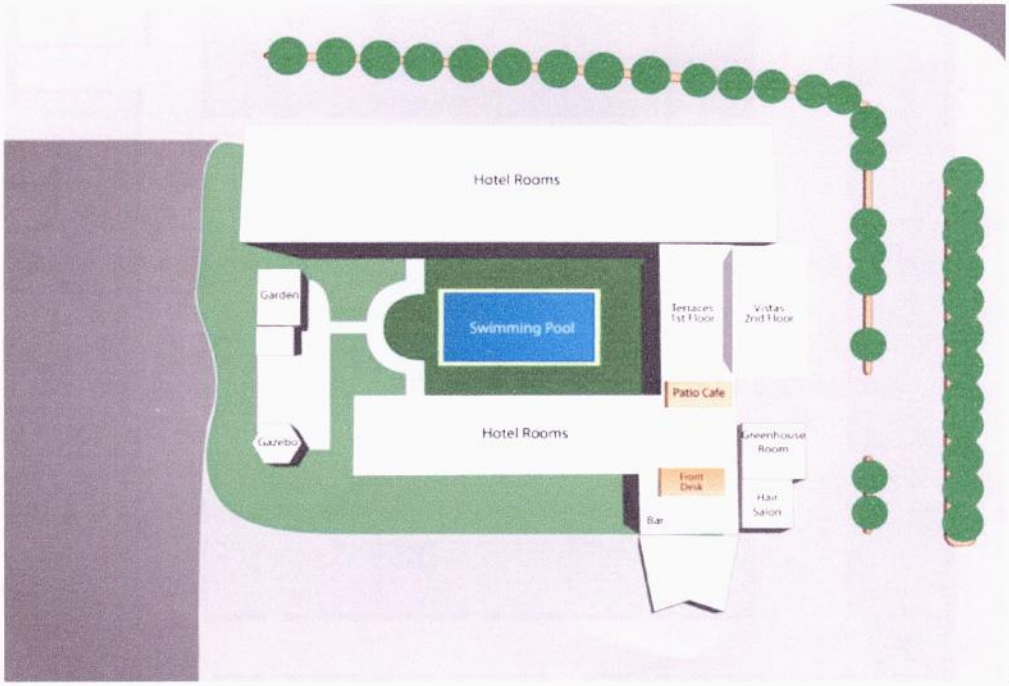

Hotel Rooms
Garden
Swimming Pool
Terraces
1st Floor
Vistas
2nd Floor
Patio Cafe
Gazebo
Hotel Rooms
Greenhouse
Room
Front
Desk
Hair
Salon
Bar

Fig. H.1


RECEIVING
DRY GOODS
LAUNDRY
REFRIGERATION
KITCHEN
(1978 SF)
HOTEL
OFFICES
(367 SF)
JAN
RR
RR
HOTEL
OFFICES
(332 SF)
MECHANICAL
MEN
WOMEN
STORAGE
COFFEE SHOP / BOUTIQUE
(1114 SF)
BAR
(1160 SF)
RESTAURANT
(3863 SF)
175 SEATS
FRONT DESK
HISTORIC LOBBY
(1413 SF)

Fig. H.2

Fig. H.3

COMPLIANCE MATRIX

Chapter	Section	Description	Page
1. Basic Requirements		Design	1
		Development	1
		Construction	1
2. Structural Design	1. External Configuration	Gravity	1
		Radiation	22
	2. Interior Arrangement	Overall maps of interior land areas,	1, 2, 15,16
		showing their usage	
	3. Construction Sequence	Settlement construction	2, 3, 4, 5, 6
	4. Shield Details	Shielding and system repair	3, 22, 33
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