

ARSSDC

Space Mission Arial.

Northdonning Heedwell

SSDC RFPs have the following sections:

Our proposal should be justified under the following headings

1. Executive Summary
2. Structural Engineering
3. Operations and Infrastructure
4. Human Factors
5. Automation and Robotics
6. Schedule and Costs
7. Business Development
8. Special Studies / Operational Scenario



Past is History, Present is Past,
Future is Now

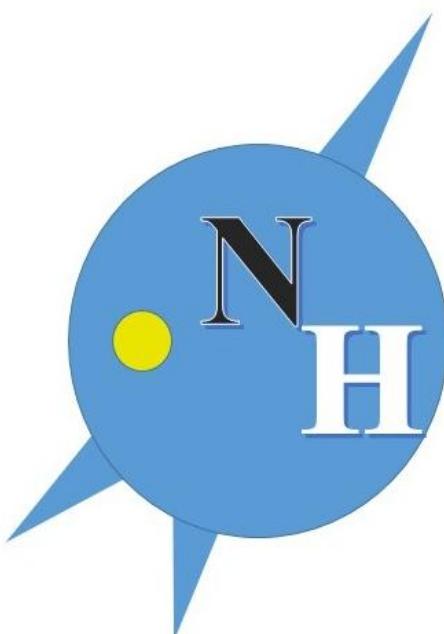


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1.0 EXECUTIVE SUMMARY

This proposal is prepared by Northdonning Heedwell and is being submitted to the Foundation Society in response to their RFP designing a city in space that will be a home for over 10,000 people. The overall objective of the RFP is to design, develop and implement a space settlement in the Earth-Luna L1 libration point.

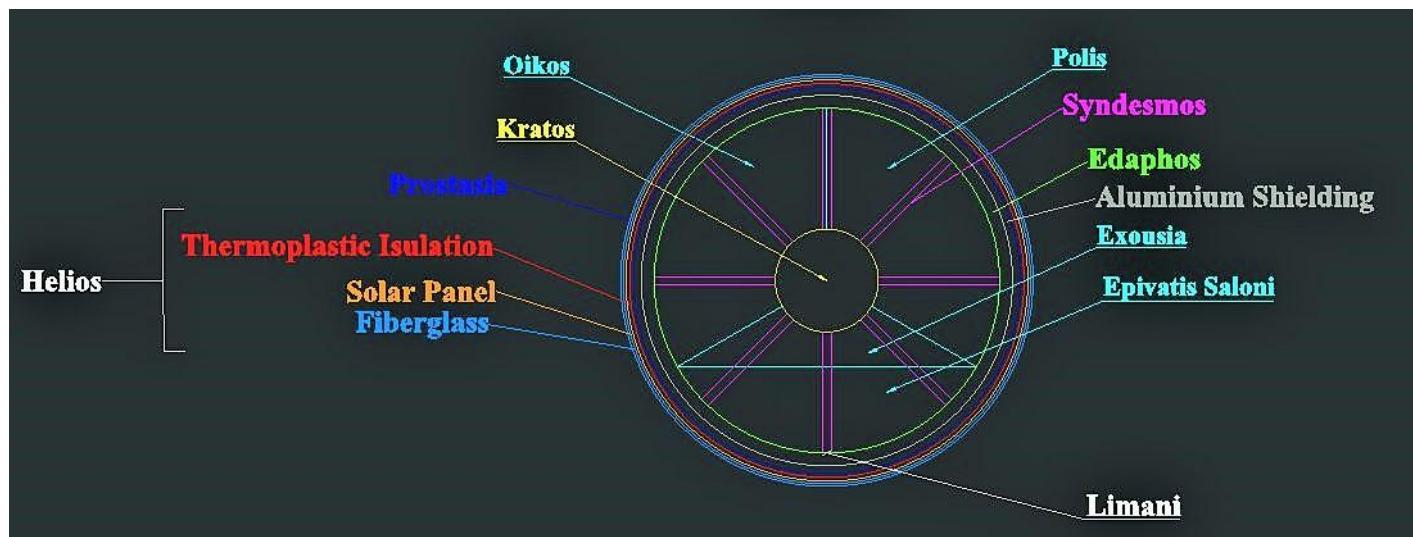
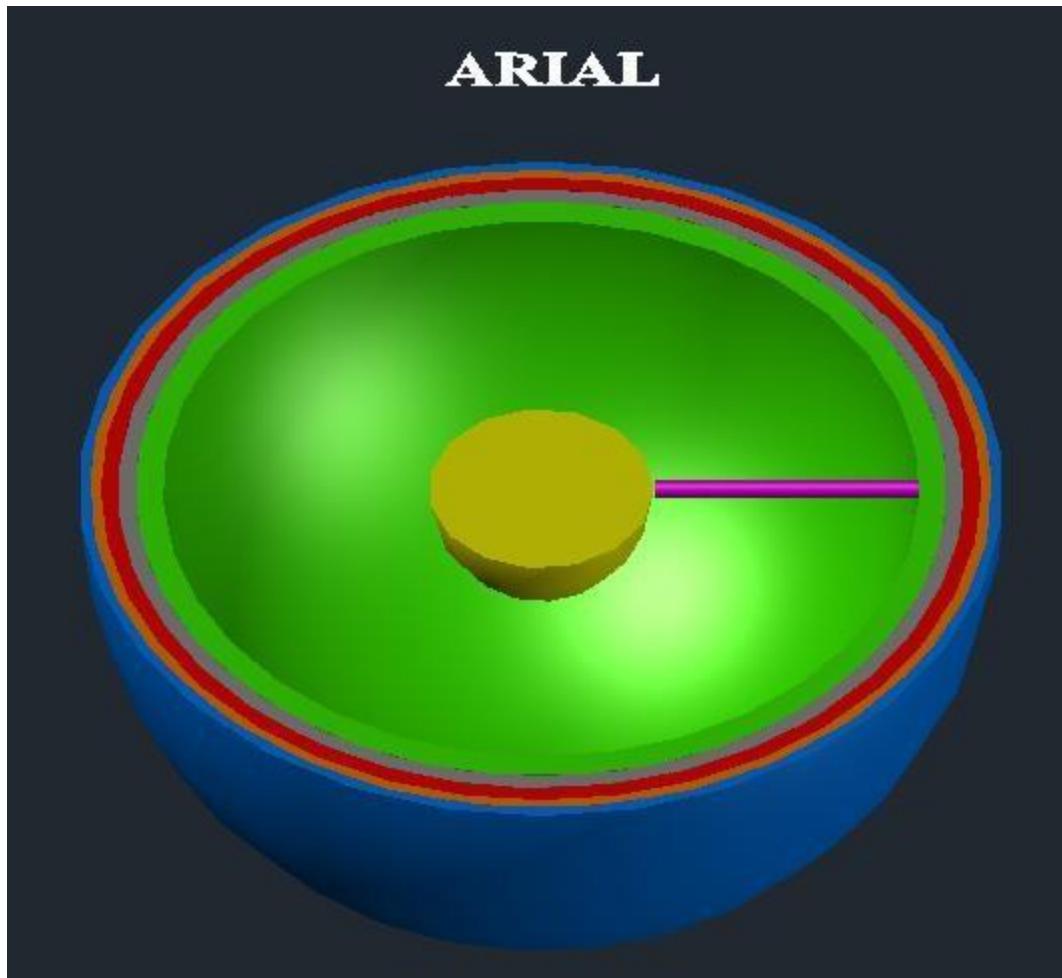
We are 38 years into the 21st century, an era inspired by countless breakthroughs in the field of science and astronomy. To name a few, there was the success of the LIGO labs in the discovery of gravitational waves, and the Hubble Space Telescope which has captured countless images giving us high resolution document of the Cosmos and the drastic expansion of the overall knowledge of the human population about the mysteries that inhabit space. Northdonning Heedwell, has gained prominence in this field and has now become one of the largest firms to offer the services of providing shelter to people in space ships at the L1 point. Mining resources from the moon and refining the lunar soil to obtain important substances such astitanium oxide, ferric oxide and manganese oxide, would be some of the major occupations of Arial. Based on this capability, the Foundation society intends to transform Arial into a profitable business venture. Northdonning Heedwell has fully understood this intent of the Foundation society and has prepared this proposal to fulfill the intent in its entirety. Northdonning Heedwell proposes to build and deploy Arial to enable it and commits to complete the entire project within the shortest and most efficient time possible.

Northdonning Heedwell's most notable examples of forward thinking and innovation within our designs appear within all disciplines:

1. Expansion plans of residential and commercial areas portraying the normal working of the Arial settlement.
2. Artificial sunlight in the residential and commercial areas with an effective day and night system to ensure minimum interference with body and sleep cycle.
3. An essential and powerful sewage system incorporated with a systematized and energy-saving atmosphere cleanser would aid the humanitarian lifestyles of the 'Arii'.
4. An effective network plan, advanced technology for food production along with effective transport system adds to the efficacious Arial settlement.
5. The sphere of the Arial is designed to shield against natural and harmful radiations to provide a comfortable environment to the inhabitants.
6. The sphere is divided into three sectors:-
 - a. Residential
 - i. The beautiful and extravagant houses coupled with recreation and occupational facilities seek to fulfill the desires of the 'Arii'.
 - ii. Community requirements and recreational activities are given an opportunity to flourish in the Arial.

- iii. Food requirements will be met with the use of technologically advanced techniques of hydroponics aeroponics.
- iv. It aims at Community development, but also keeping in mind and respecting the diversity of people.
- b. Commercial
 - i. Manufacture of industrial goods and products obtained from cosmological origins.
 - ii. Refining the lunar soil and other solar system resources that have the potential to be implemented in future.
 - iii. It includes major services like health and educational facilities although basic amenities are provided in each sector.
- c. Administrative
 - i. Administrative head is appointed and sent along with 'Arii', consisting of members in highly qualified posts to ensure the smooth flow of proceedings.
 - ii. Ensures the distribution of the resources to the different sectors in proportion to their need and availability.
 - iii. Manages the trade and production of goods between interorbital ships and lunar vehicles/capsules.
 - iv. Attempts to minimize lunar traffic by employing an LTC and a system of lunar capsules for easy interorbital travel.
 - v. Also has an advanced defense system to secure the Arii from any untoward incidents or in case of emergencies. Assures safety even in cases of collateral damage.
 - vi. Trade and exchange of information between allies in cases where it is necessary.
 - vii. There will be regular discussions with the stakeholders to ensure that all concerns are met.

Northdonning Heedwell has proposed a feasible, practical design with essential features to construct Arial using state-of-the-art technology and to make it operational. In addition to this, Northdonning Heedwell has also presented the commercial and the business perspective of Arial. In terms of policies to be employed so that the Foundation Society is able to start business. Subsequently, they can generate revenue and eventually generate profit however keeping in mind the larger picture of sustaining their designed line of business, with assortments, for a long stretch of time. In the view of the assured, sincere attempts to fulfil all the commitments made in the proposal, Northdonning Heedwell , herewith expresses its keen interest in working for Foundation Society on this illustrious life changing project.



2.0 Structural Engineering

a) External configuration:

Structural component	Usage and description
KRATOS (Central Battery)	(Kratos in Greek stands for the God of might, power and strength) Consists of 27,000 Li-ion battery cells (2170 battery cell). They will be stacked one above the other in battery packs to form the central storage hub for the power. It has a excellent capacity to store most of the generated solar energy. This stored power can be used for normal as well as emergency usage. Radius of the battery hub is 5 metres. The KRATOS will also be covered by CoeLux to provide artificial sunlight and an ACMS for weather monitoring.
OIKOS (Residential Areas)	(Oikos refers to three related but distinct concepts: the family, the family's property, and the house.) Consists of the main residential block with single or double bedroom luxurious houses of one or two stories. Oikos would provide an extremely comfortable environment for people to live in with great ease and comfort. It would also house commercial units like markets, shopping complexes, hospitals, police stations, entertainment facilities and various other amenities which would make lives of people in our settlement much easier.
POLIS (Commercial Area)	(Polis literally means city in Greek.) This area includes the manufacturing and processing plants for lunar materials and other raw materials obtained from the neighbouring universe as well as all the required amenities for a normal life. It will also consist of workspaces for business and trade purposes. It will include the main services that the Arii requires like a fully functional hospital and an educational institution.
EXOUSIA (Administration Area)	(Exousia in Greek stands for authority or power) It is the centre of management and control of the Arial. It consist of the administrative buildings who looking into the functioning of the Settlement. It consists of many offices handling different departments working towards the smooth operation in the Settlement. Controls all resources, manages trade and the functioning of the Arial orb.
ZOI (Provisions)	(Zoi is the Greek word for life.) Basic provisions required for the conventional system of life are provided in the Zoi. These include education institutions for primary, secondary as well as higher education. Also health care is provided in all the three sectors of Arial, however major hospitals and infirmaries are located in the Zoi. For other services like markets (for

	food, clothes and other requirements) and entertainment activity, provisions are incorporated in the residential sector.
LIMANI (Docking Bay)	<p>(Limani is the greek word for port or harbour)</p> <p>The docking bay will constitute 2 structures:-</p> <p>1.The International Berthing and Docking Mechanism along with a modified hollow arm for shuttles to be locked into. This allows for the docking of the shuttles to be fully automated. The probe and drogue system allows visiting space crafts using the probe docking interface such as soyuz, progress and atv space crafts to dock into our station which uses the drogue interface.</p> <p>2.The structure will also include an extendable arm, used for the melting of metals. It will be made of a substance with a high melting point, and low expansion rate, also being a good heat conductor, to melt the metal within but not vaporise itself. This also prevents other elements present in the gangue to not escape. These include oxygen, carbon and sulphur. All the space ships shall have a standardised plug into which a retractable 'claw' fits into. The claw consists of two space grade aluminium tubes divided longitudinally along the cortex of the arm. the y both attach to the incoming lunar capsules that will stack up or park themselves in the extendable capsipad just outside the docking bay. Standardised locks/plugs on the capsules enable the claw to attach onto them and once it attached, it rotates once clockwise. The longitudinal tubes, one of them is used to ferry metals(waste and usable), to melt and then carry them back to manufacturing plants. This tube is maintained at the same pressure as the atmosphere within the OIKOS, and is completely automated. Since it will be exposed to the solar radiation and is bound to get really hot, it will be coated with space grade insulators. The metals to be melted will carried through cartons on the outer surface of the tube and after melting, will empty the metals into a cartons present within the tube, that will then ferry them to the refining centre. The other tube, functions as an aero bridge to enable people to move into and out of the capsule. This tube is also maintained at the same pressure as the OIKOS. We believe this is an efficient way of processing and reusing metal waste and is a cost efficient way of ferrying new comers (tourists) and Arii.</p>
SYNDESMOS (Connectors)	<p>(Syndesmos is the Greek word for connection)</p> <p>Syndesmos include the connecting pillars between the central hub and the outermost layers of the solar panels and fiberglass shield. These will also contain electrical wires passing through them, from the photocells (that will convert the enormous amounts of solar energy to electrical energy) to the central hub, where the electrical energy will be saved.</p>
ANEMOS	(Anemos is the Greek god for wind and air)

(Air Purifier)	By using the oxygen collectors, which will be spread over the agricultural areas, and the distributors, we can ensure the layers of the atmosphere remain in the favorable percentages. The Carbon Dioxide Removal Assembly (CDRA) currently on board the ISS is the best functioning technology for manned spaceships.eSionic is developing a new electrochemical membrane technology using its patented innovations in electrolyte materials.
DEMETER (Agricultural Areas)	(Demeter is the Greek goddess of fertility, agriculture, grain, and harvest) Although there will be widespread flora throughout the sphere, the residential area will be concentrated largely in the residential areas. This enables easy food production and related activities like processing and transport. Agricultural production will be done completely through the technologically-advanced techniques of hydroponics.
KINESIS (Transport)	(Kinesis is the Greek word for movement) Transport will be done through pod like structures, we like to call Amastochia (after the greek term for train). An individual Amastochia can fit in a maximum of 4 people and 5-6 Amastochia will be connected to make a train, that transports the Arii from one place to another. Emergency exits will be present in every Amastochia, in case of untoward incidents. In case of a faster transport, there will be a individual express Amastochia that fits in maximum 2 people and is automated. The regular train is not automated but manually driven, like a modern day bus/train service.
EPIVATIS SALONI (Passenger Lounge)	As the name suggests, Epivatis Saloni will be the passenger lounge for the incoming and outgoing passengers from Arial. As the gemini docking system can transport only one lunar capsule at a time, inter settlement travel can be tedious. Hence the Epivatis Salon is equipped with lavish facilities and comfortable living spaces.
APOTHIQUE (Storage Facilities)	(Apothik is greek means warehouse/ storage rooms) With the food being produced continuously, we have stocks of food. This will be stored in the Apothique, with chemical preservatives that do not interfere with the taste or quality but increases the shelf life. It will hence include cool temperatures and air-tight chambers, with no exposure to sunlight.
KARAS (Garage)	(karaz in greek stands for garage) Lunar capsules and vehicles will dock in the Karas. Repairs will also be done in here. It will be stocked with sufficient supplies of fuel and other equipments for the preparations of future generations. There will also be maintenance capsules are situated on the lunar vehicles, that perform the dual role of automated maintenance as well as

	backup vehicles for transport.
HELIOS (Solar Shield)	(Helios in Greek stands for the sun) The outer surface of Arial will consist of a tough fibreglass (S glass, which has a high tensile strength) and a space grade Aluminium bi-concave a.k.a glass reinforced Aluminium shield that protects the internal structures from space debris and other astronomical bodies. It also serves as a preliminary shield from radiations. For cosmological radiations and space dust, which are very weak, sparse and are of a minute size, this is sufficient. However for solar radiations, solar panels (26.235 millions) are the secondary shield.
PROSTASIA (Radiation protection)	(Prostasia is the Greek term for protection) Any residual radiations are blocked by a water tube flowing between the aluminium metal and the solar panels. There will be a layer of aluminium shielding that will protect from highly penetrating radiations, along with keeping the pressure system of the Arial intact. A layer of thermosetting plastic will then meet the requirements of a heat as well as an electrical insulator. Hence the Arii are completely safe from radiations of any kind.
EDAPHOS (Ground and soil)	It will be made of a 5m layer of cement covered by non-poisonous rocks of space origin to limit the effect of the cons of cement. This cement will be manufactured on the moon settlement, during the construction. Once gravity is initiated in the L1 point, the cement along with the layer of rocks will be placed. Cement also helps in forming a base for the further buildings made of bucky structures.
DYNAMOS (Thrusters)	(Dynamics is the greek term for force or power) The Arial will use gyroscopes and thrusters to be launched into the L1 point and to maintain its spin respectively. The gyroscopes shall not use propellant but will use electricity to store momentum. As a result a desired spin and orientation of the launch towards the L1 point can be controlled by the ground stations.
SELENA AMAXA (Lunar capsules)	(Selena stands for lunar and Amaxa stands for vehicles) Lunar capsules will be used for the interorbital travel between spaceships and other vehicles. They will be shaped like a medicinal - capsule and attach to the Gemini Docking Arm. The people will be transported through the Arm (hence it is hollow) into the Epivatis Salon, and this will be a continuous process.
SKOUPIDIA (Sewage System)	The sewage will mostly be recycled. Arii will be encouraged to use recyclable materials, and thus dissuaded to use glass and ceramic materials. Materials will be separated in a centralised tank present on the outskirts of Oikos. From here the materials will go to their respective purification plants. Metals will be melted in the second arm present in the docking bay and further refined in the Polis.

	Biodegradable materials will be recycled in a biogas tank that will be in Oikos. It can be further used as a minor fuel. Water will be refined in the Central Plant by using the method magnetic water treatment.
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b) Structural Specifications:

Dimensions

Structural Component	Shape	Dimensions	Total Surface Area (in m ²)	Volume (in m ³)
KRATOS	Spherical	Radius = 4m	A = 201.06m ²	V = 268.08m ³
OIKOS	Sectoral	1/3 the Internal Area of the Arial	A= 1.65×10 ⁷ m ²	V=10,933,333,243.97m ³
POLIS	Sectoral	1/3 the Internal Area of the Arial	A= 1.65×10 ⁷ m ²	V=10,933,333,243.97m ³
EXOUSIA	Triangular	Length of Arms= 1981m Length of base = 2000m	A= 1.53x10 ⁷ m ²	V= 3.42×10 ⁹ m ³
LIMANI	1.Gemini docking system- Funnel shaped 2.Claw- Cylindrical	1.Docking Bay Height= 950m 2.Docking Claws	1. A= 4.75×10 ⁷ m ²	V=5,433,333,243.97m ³
SYNDESMOS	Cylindrical	Length = 1981 m Radius = 1 m	A = 12447m ²	V = 6223.5m ³
EPIVATIS SALONI	Segmantal	Length of Base= 2000m Height=1000m	A= 2.75×10 ⁶ m ²	V= 5.5×10 ⁹ m ³
APOTHIQUE	Cuboidal	Length = 200m Breadth =200m Height =50m	A=1.2x10 ⁶ m ²	V=2x10 ⁶ m ²
KARAS	Cuboidal	Length = 250m Breadth = 5m Height =55m	A=30550m ²	V = 68750m ³

HELIOS	1.Fiberglass layer-Spherical 2.Individual solar panels- Cuboidal 3.Solar panel layer- Icosidodecahedron (polygon with a certain number of regular pentagons and triangles)	1.Fiberglass Thickness =0.4m 2.Solar Panel Dimensions= 2m x 1m Thickness = 0.05m 3. Icosidodecahedron Dimensions = 20 regular triangular and 12 regular pentagonal faces.	1.Fiberglass $A=5.03\times10^7\text{m}^2$ 2.Solar Panel $A = 2\text{m}^2$ (Individual) 3. Polyhedron $A = 42.192\times10^6\text{m}^2$	1.Fiberglass $V=2.01\times10^7\text{m}^3$ 2.Solar Panel $V = 0.1\text{m}^3$ (Individual) 3. Polyhedron $V = 13.8\times10^7\text{a}^3\text{m}^3$
DYNAMOS	A Cylindrical head with a Conical nozzle	Radius = 1m Length = 3 to 4m	$A=13.08\text{m}^2$	$V = 3.14\text{m}^3$
SELENA AMAXA	Spherocylindrical	$a= 31.44\text{m}$ (For 100 passengers) $r= 7\text{m}$ (average height of humans + additional head space)	$A=1998.556\text{m}^2$	$V=6276.57\text{m}^3$
KINESIS	Spherocylindrical	$a= 2.5\text{m}$ (For 2 passengers back to back) $r= 5\text{m}$ (average height of humans while sitting + additional head space)	$A=392.7\text{m}^2$	$V=719.948\text{m}^3$

c) Construction materials:

Material	Location	Usage	Properties
Fiberglass	Outermost sphere of Helios	1.Protection the internal structures from space debris and other astronomical bodies	1. Low coefficient of thermal expansion 2.Relatively high thermal conductivity. 3.High tensile strength
Solar panels	Second layer of helios	Collecting sunlight to convert light energy into electrical energy	Photovoltaic effect on solar cells to convert light energy to electrical energy Specifications for solar cells.

			Specification Efficiency -40-46% Nominal Voltage -2.35 V Average Current -505 mA
Water	Third layer of helios	1.Preventing any residual radiations from entering into the Oikos. 2.Produces a cooling effect for the Arial.	A layer of water reduces the ionizing radiation transmitted through it by capturing or moderating it to non-ionizing radiation levels.
2219-T6 aluminum alloy	1.Prostasia 2.Central tank	1.Provides for a strong structure and foundation 2.Protects the Arial from any residual radiations. 3.To collect and store the metal wastes.	1.Belongs to wrought-aluminium copper family. 2.It has high tensile strength but low ductility.
Thermosetting plastic	Prostasia	Protects the Arial from any external electrical discharges.	Good electrical insulator
Magnetite slurry, Magnetic particles and Magnetic powder	Located in the sewage treatment plants.	To attract metal impurities and magnetic metals.	1.Highly magnetic in nature 2.Doesn't leave any residue.
CWR(Continuous Welded Rail)	Along the pathways connecting the different sectors of Human Settlement(including the docking station) and along the longitudinal extent of the sewage treatment plants, the houses and the docking claw.	It is a framework for the movement of pods that transport people from one end to another and in transport of cartons of metal wastes, impurities to melt and recycle.	1.It is based on modern railway system back on Earth. 2.It is a simple and inexpensive to replace old rails and replace with new ones.
Cement	Located above the prostasia.	Acts as a crust on which the city foundations will be laid.	1. Its durable and easy to maintain. 2.extremely versatile.
Bucky structures	On top of the cement crust	Is used for housing and work-pace buildings	1.It is superconductive and extremely resistant

		like industries.	to heat.
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d) Artificial Gravity:

Artificial gravity is being provided in Arial using centrifugal force. It is the apparent outward force that draws a rotating body away from the centre of rotation. It is caused by the inertia of the body as the body's path is continually redirected. In Newtonian mechanics, the term centrifugal force is used to refer to one of two distinct concepts: an inertial force observed in a non-inertial reference frame, and a reaction force corresponding to a centripetal force. The force will be applied when the settlement starts rotating.

e) Gravity Provision:

Structural Component	Magnitude of Gravity	Justification
KRATOS	0g	Since the hub will be the primary rotating body, it has to be in a continuous state of inertia. Hence 0g will help it. Also the centre of any large rotating body has a negligible gravity, close to 0g.
OIKOS	1g	Waste management requires 1g to prevent unwanted scattering of waste which may happen in 0g. Water management will be more efficient in 1g as floating of water will not take place. Conditions similar to that of Earth are required for agriculture. Residential provisions require gravity. Moreover, children need to spend at least 3 hours per earth day at 1g for proper development
POLIS	0.5g-0.8g	1. Most of the processes of manufacture, and occupations need a gravity of 0.5g-0.8g. 2. However different industries will be allocated different gravitational forces, depending on their nature and requirements. 3. It has also been found out that adults like working in an environment of 0.8g.
LIMANI	0g	To facilitate the various processes taking here easily like loading, disembarking etc.

EPIVATIS SALON	0.25g-0.5g	To favour temporary human inhabitancy.
KARAS	1g	For easy repairing of crafts and easy storage of the lunar vehicle.

The Arial will rotate continuously with a 1.7 rpm. This will ensure a 0.8 gravitational force throughout the spacecraft. As we go further from the central hub, gravitational force will increase marginally. However this will not affect the lives of the Arii much. However in particular areas, as mentioned above, gravity is specified, thus ensuring a smooth and continuous flow of life.

f) Construction and launching:

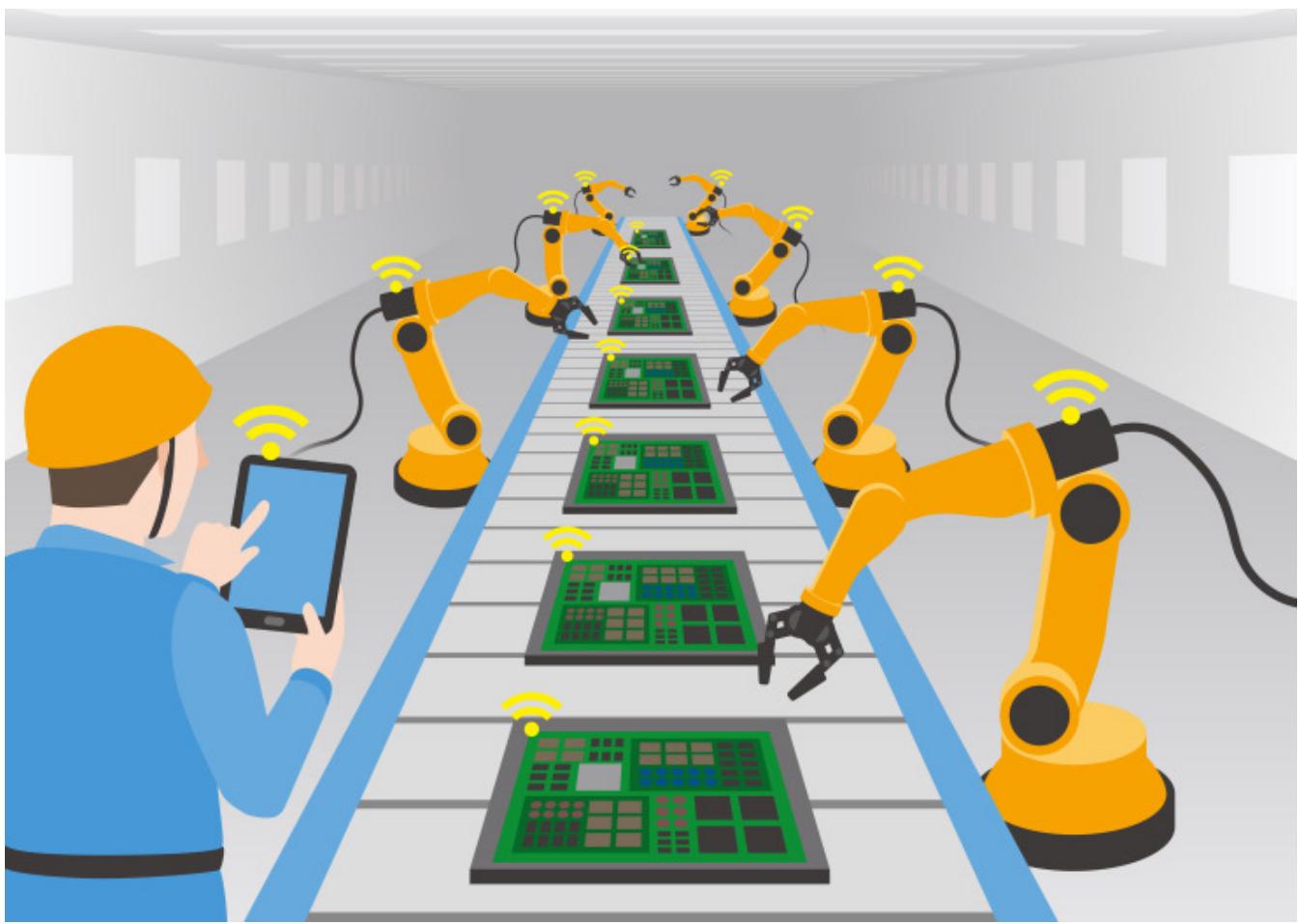
The Arial will be constructed layer by layer in the moon settlement and will thereafter be launched into the Earth-Luna L1 libration point. All of the required materials will be sent to the settlement and Arial will be assembled by the settlement. It will be assembled in 5 broad steps:

1. The outer covering of the KRATOS will first be assembled and the Li-ion batteries will be arranged in circular discs ,which shall serve as effective support systems to the outer covering, which will then be placed along the various diagonals of KRATOS.
2. The syndesmos will consequently be attached to the KRATOS which will then be lined with the CoeLux.
3. The outermost structures are then built thereafter, the solar panels and the fiberglass shield. Then the water tube is completed, however the flow of water is still not started.
4. Then the layers are subsequently built, from the outer layer to the inner layer. Once when layers are built, thrusters are attached and then launched..
5. Once when artificial gravity comes into existence, buildings and the other internal structures are built.

Arial will use propellants for launch but will not need the propellant for rotation. It shall use the gyroscope technology to rotate around its own axis to create artificial gravity. However a certain amount of propellant will be conserved to be used in case of any emergency.

The launch will take place in 3 steps:

1. Arial will be launched into a geostationary orbit. Also it will be made to start rotating around its own axis.
2. It will then be made to decelerate at its perigee to reduce its farthest point(the apogee) from the moon.
3. Once it enters into the Earth-Luna L1 libration point its rotation speed will be increased to attain required artificial gravity.



ROBOTICS AND AUTOMATION

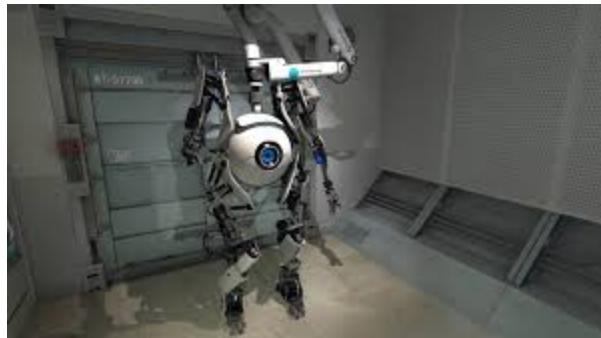
3.0 Automation and Robotics

Most of the systems on Arial will be automated. Starting from all the primary transport systems to the sewage systems, everything will be automated. This will include taxation systems, the docking bay and to a large extent, even agricultural facilities.

<u>Name of the System</u>	<u>Uses and Description</u>	<u>Quantity and Location</u>
Extendable Arm	1. For the melting of metals. It will be made of a substance with a high melting point, and low expansion rate, also being a good heat conductor, to melt the metal within but not vaporise itself. 2. This also prevents other elements present in the gangue to not escape. These include oxygen, carbon and sulphur.	Present in the Limani Quantity-1
Sewage System	Explained previously, the sewage system is completely mechanised and is taken care for the recycling and segregation for all types of used in Arial.	Skoupidia
Katharos	Automation for collection of waste materials for the residential area. Also is responsible for maintaining the Settlement clean.	Present in Oikos Quantity - 200
Lefta	The tax system will use artificial intelligence for an efficient and clean system, thus ensuring minimum interference of human politics and partiality.	Present in Oikos - 1. Central, large hub 2. Smaller units will be 5-10 depending upon the population density and the number of houses.
Mechanicos	Mechanicos is automation responsible for repairing the settlement. They are deployed in case of any fracture or damage in the structure of the settlement. They are deployed for both	Used whenever required. Quantity - 100 (explained later)

	internal and external repairs (Deploy through the docking bay.)	
Technitis	<p>1.These will be used in the Karas, for the repair and maintenance of the lunar capsules.</p> <p>2.Stocked with sufficient supplies of fuel and other equipments for the preparations of future generations.</p> <p>3. Also will serve as backup vehicles when the lunar vehicles or capsules are unable to operate.</p>	Used whenever required. Quantity - 100
Amyna	These will be the defence mechanisms of Arial. It will be equipped with sufficient supplies, starting from laser disintegrators (of small size - for protection from asteroids and other rocky bodies) to supersensitive microwave range finders.	Present throughout Arial-50
Oplitis	They are bots designed to ensure safety and security in the Arial. They will be deployed in all the area in the Arial. They will help in the smooth functioning in the oikos and help avoid any breach. They also help to maintain law and order in the settlement.	Present in the Oikos, Polis and Exousia. Quantity - 300
Eurus	A main server updated by sensors utilized for warning as well as checking the pollution control of the settlement. This will be done by checking the amounts of each of the contents of the artificial atmosphere and adjusting consequently to the optimum requirements for ordinary life.	Present throughout the living quarters and industrial areas, at a distance of 6-8m from each other. Quantity- 600-700
Metalleftis	This automation is used in excavating lunar materials and delivering them to the research and the industrial facilities. They are also used as cargo transporter in the mining sites to ease the process.	Present inside or outside Arial. Quantity - 70
Amastochia and the Conveyor Belts	Explained later on under transport in detail.	Amastochia: Tracks present interlinking oikos, polis and exousia.

		<p>Quantity-</p> <ol style="list-style-type: none"> 1. Regular-50 (considering 10% travelling population at any given point of time) 2. Express-25 <p>Conveyor Belts: Interlinking Apothique and Zoi</p> <p>Quantity-20-25</p>
ALEXIS (<u>Another Legit EXtra Intelligent System</u>)	<p>It is an AI assistant to every Citizen of the Arial. Its is integrated into their living spaces to ease their life. It contains all the personal information and is extremely safe as it is has a unique identification system.</p>	<p>Present in the entire Arial.</p> <p>Quantity = 10,000</p>



KATHAROS

Dimensions = Length = 0.7m,
Breadth = 0.7m, Height = 0.9m

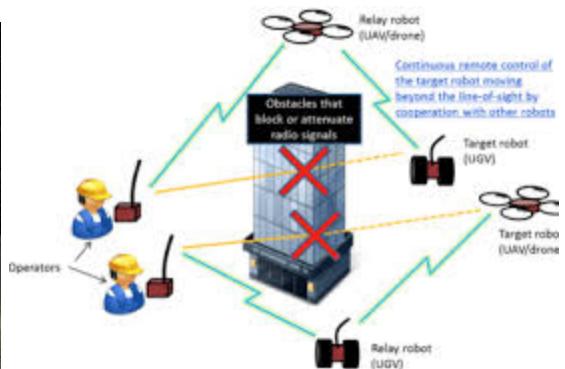


METALLEFTIS

Dimensions = Length =3m,
Breadth = 2m, Height =2.5m

TECHNITIS

Dimensions = Diameter = 100 cm,
height = 50 cm



EURUS

Dimensions = Length = 0.6m,
Breadth = 0.5m, Height =1m

a)ALEXIS:

One of the most primary automation features in Arial will be the ALEXIS. Each Resident of Arial will receive an ALEXIS which would feature a 4 inch foldable touch screen which would communicate with the user via gesture based controls through Smart Sensors present in it. This device would serve as primary communication medium in Arial and would be equipped with calling, emailing and other such pre-requisite facilities. The device comes in various configurations built specifically for each requirement. The standard edition features a 4 inch touch screen with haptic feedback, gesture and motion controls. 4" foldable touchscreen ALEXIS. The device can be used to locate availability of nearby facilities and amenities using the unique Settlement Positioning System. The ALEXIS also notifies the user about the Arial's present conditions and alarms the user in case of an emergency. The ALEXIS' software interface will be user specific and each ALEXIS device will have an operating system custom built to user requirements and will vary with respect to the age, business requisites etc and its OS will be updated to meet any new needs in the future.



b)Construction:

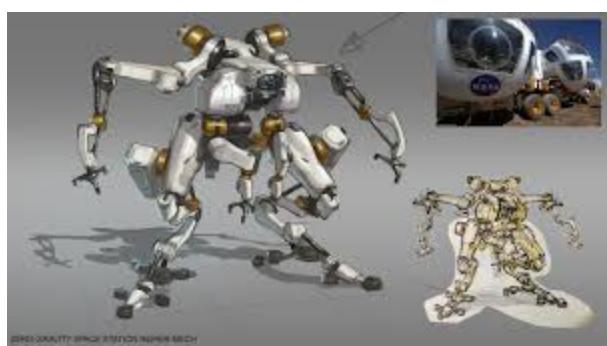
System	Description/Construction	Features
Mechanicos Major	External repairs will be taken care by this system. It is capable of repairing damage in the external structure of the Arial. These automation systems are coated with polyethene foam bonded with silicon Bucky structure via adhesive films for protection against Solar Flare	Parts like the fiberglass, solar panel, external docking arm and bay will be supervised by mechanicos major. Regular maintenance of these parts will be done with the help of mechanicos major to ensure minimal fault. This will be done by Artificial Intelligence, and thus be efficient and without human interference.

Mechanicos Minor	Internal repairs will be taken care by the mechanicos minor. This will include repairing the buildings, transport system or any other faulty or erroneous equipment.	Parts like the oikos, polis, and the limani will be taken care by this system. Also automated systems will be taken care by this. This will be done by Artificial Intelligence, and thus be efficient and without human interference. Like the mechanicos major, regular repairs will be done to all the systems to ensure minimal malfunction.
Ergolavos Major	External structural construction is handled by this system. It has an extremely high payload capacity to carry heavy construction material.	Its is AI integrated and hence it extremely efficient. It is deployed to assemble the solar panels, the wiring, the docking bay, the extendable arm as well as the Fiberglass. Quantity - 200.
Ergolavos Minor	Internal Buildings as well as aesthetics will be constructed using this system. It also has an extremely high payload capacity to carry heavy construction material.	Its is AI integrated and hence it extremely efficient. It is deployed to construct the houses, buildings, the sectoral aesthetics like gardens, parks,etc. Quantity - 250



OPILITIS

Dimensions = Height=1.6m,
Breadth= 0.8m



ERGOLAVOS MINOR

**Dimensions = Length=13m,
Breadth = 3m, Height = 2.5**

ERGOLAVOS MAJOR

**Dimensions = Length=0m,
Breadth = 4m, Height =5m**



MECHANICOS

MINOR

**Dimensions=Diameter= 50cm, Arm
Length= 60cm**

MECHANICOS

MAJOR

**Dimensions= Length=2m,
Breadth =1m, Height = 1.5m**



c) Automation System For Authorized Personnel Access:

All household appliances and machines will employ a highly sophisticated resident recognition detection program and artificial intelligence will be incorporated into the core of their systems which will help them process data and carry out user-specific programs. Apart from user specific systems, basics functions expected in a highly automated residential layout such as control of lighting, climate and such will be incorporated into the house's data processing system

<u>Security System</u>	<u>Specifications</u>
Fingerprint Scanner	<ul style="list-style-type: none"> Analyses the lines and curves in the finger of an individual. Analysed information is stored and retrieved whenever requested and then authorization is granted.
Iris Scanner	<ul style="list-style-type: none"> Analyses the iris of the eye, which is the coloured ring of tissue

	<p>that surrounds the pupil of the eye. Analysed data is stored in personal database of each individual.</p> <ul style="list-style-type: none"> • Widely regarded as the most safe, accurate biometrics technology and capable of performing the test at high speed without compromising accuracy.
Speech Recognition	<ul style="list-style-type: none"> • Examines a person's Speaking by analysing voice tone and modulation while speech. • Also uses on board camera to scan lip movement and analyse lip geometry. Lip elevations and depressions are unique to every individual and is one of the most accurate biometric test.
RFID	<ul style="list-style-type: none"> • Each individual is provided with an RFID. RFID codes are generated on the basis of personality and individual uniqueness. This RFID is provided through tags. The tags contain electronically stored information about that individual which forms his basic identity in Arial. • Its uses electromagnetic fields to automatically identify and track tags given to each individual.
Ear Recognition	<ul style="list-style-type: none"> • It uses infrared dot technology to trace the rim of your ear. The curves and ridges of the ear are unique to person. In a range of wavelengths over 10mm patch, several LED's send light into the ear rim and photodiodes read the scattered light. • It uses an algorithm that will identify a single individual out of the database with a 99.6 percent accuracy rate by analyzing how light reflects off the curves of the ears.
Facial Mapping	<ul style="list-style-type: none"> • It uses infrared dot technology and scatters dots onto your face to map its geometry. • It is a software-based system and analysis your face and its changes over time. • Its system is very accurate even in a dark environment. Its sufficient light is not available it will fire and LED to adequately illuminate your face and enable it the authorized.

d) Process of authorisation:

To provide for data and personal security, Aynah is broken down into the following 5 divisions. The Least Secure division is known as Level E, and it has no authorization requirement.

<u>Security Level</u>	<u>Method of Authentication</u>	<u>Places It is used</u>	<u>People Given Access</u>

Level 1	Speech recognition, RFID, Fingerprint, Facial recognition,Iris scan, Ear and Lip Recognition.	Exousia, Control Centre.	Authorized Personnel only.
Level 2	Speech recognition, RFID, Fingerprint, Facial recognition,Iris scan	Polis - Industrial and Agricultural area	Industrialists and other Authorized personnel
Level 4	Fingerprint, RFID	Houses and other places in Oikos.	Citizens and other tourists
Level E	No Authorization	Public Places such as parks and malls	Everyone

e) Administrative accounts:

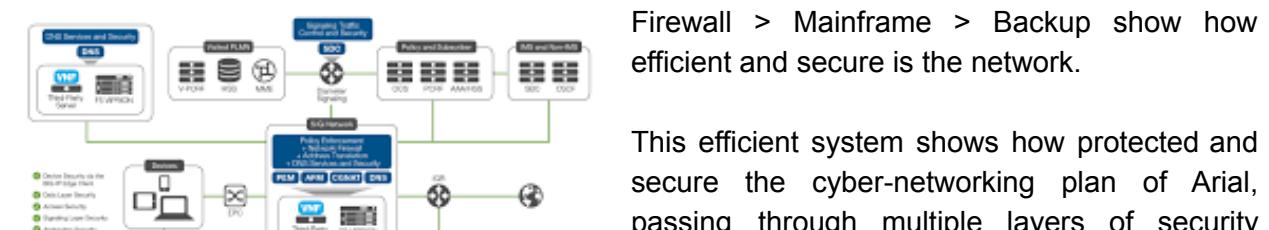
Administrative accounts is secured by a method known as Quantum Cryptography which is the most reliable method out of most known methods in terms of network security. Advantage of quantum cryptography lies in the fact that it allows the completion of various cryptographic tasks that are proven or conjectured to be impossible using only classical (i.e., non-quantum) communication . In particular, quantum mechanics guarantees that measuring quantum data disturbs that data; this can be used to detect an adversary's interference with a message. Personal Computers of residents and work accounts can also only be accessed by fingerprint and retina scans. All methods of verification of authorized use of the system are encrypted to prevent identity theft and exposure to sensitive information.

Communication within and outside the settlement will be through the ALEXIS. Information delivery and pod controls can be controlled by the ALEXIS and through this harmonious integration, residents will have a hassle free delivery of their specific personal data and controls to their personal ALEXIS efficiently.

f) Computer Networks:

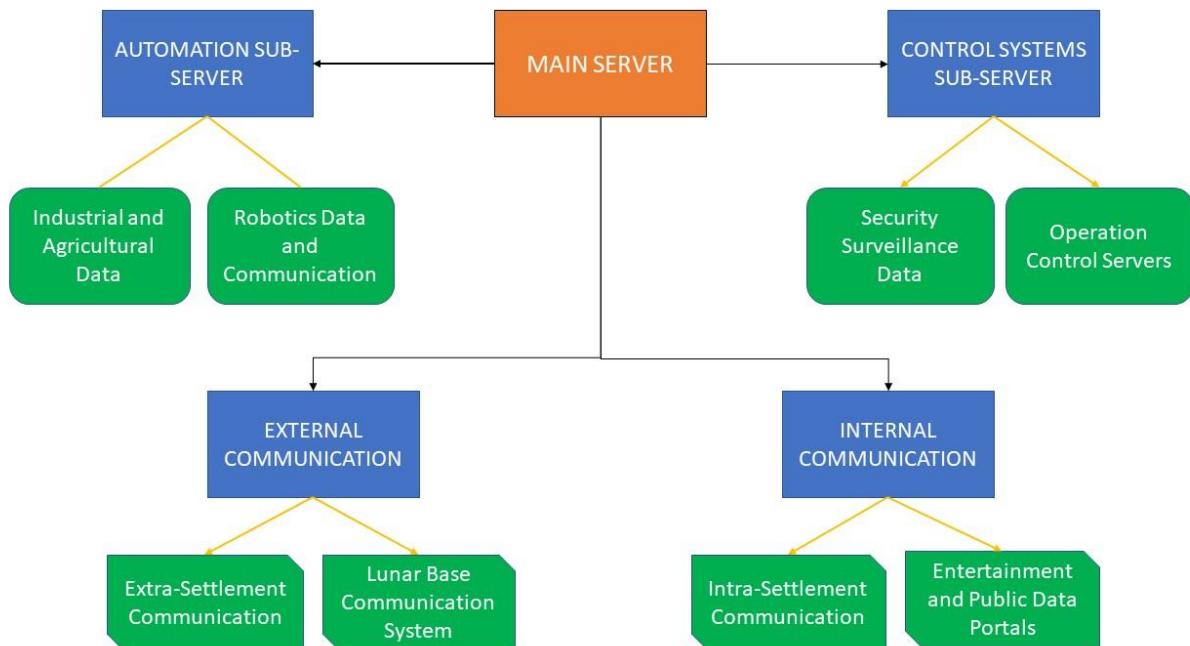
The Arial has an advanced system of computer networking and cyber-security. The arrangement

Firewall > Mainframe > Backup show how efficient and secure is the network.

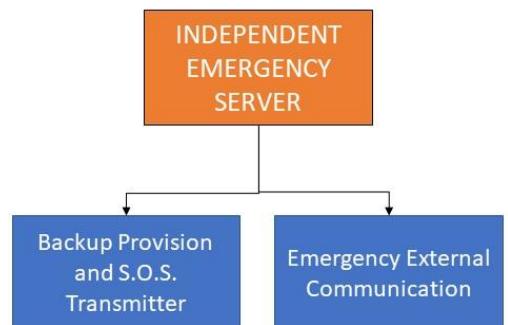


This efficient system shows how protected and secure the cyber-networking plan of Arial, passing through multiple layers of security

This includes Firewall, anti-malware software, Automated theorem proving, Intrusion Detection System, User account access controls and cryptography and 2-factor authentication. Communication within and outside the settlement will be through the ALEXIA. Information delivery and pod controls will be based in the ALEXIA and through this harmonious integration, residents will have a hassle free delivery of their specific personal data and controls to their personal robot resources.



Data Structures	
Orange	Central Main Server
Blue	Sub-Server
Green	Peripheral and System Servers
Connection Speeds	
Black arrows	3.5 TBps
Yellow arrows	2.0 TBps



g) Failures and Backups:

<u>Contingency</u>	<u>Vulnerable Areas</u>	<u>Detection</u>	<u>Problem Fixation</u>	<u>Time Taken</u>
Fire	House, Industries, Public Areas	Smoke Detector will be installed in the wall of the settlement.	In case of fire people will be evacuated from the affected area and the cause will be detected immediately. Based on that, respective fire extinguishers will be automatically sprinkled by the smoke detectors	<2 mins
Framework Breach	Prostasia	Sensors on the walls of settlement and reported to the Exousia.	The command centre will immediately deploy Mechanicos major, which will fix the breach in Minutes.	<1.5mins
Power Failure	Arial		In case of a power failure, power stored in Li-Ion batteries and ultracapacitors would be distributed through the power lines. The problem will be analyzed and rectified by engineers.	<30-45 secs
Data Storage Failure	Arial		Backup storage devices Will be started. Primary data storage will be replaced with new ones.	<45-60 secs
Food Failure	Arial		Back-up food is used until food is re-grown. This will be taken from Apothique.	<1-2 mins
Water Failure	Arial		Immediate	<3-5 mins

			supply of ice to get water for Arial. Although the chances of Water Failure is very less. Also approximately 65% water from the water tube will be redirected to the living drought affected regions.	
Failure in automation Systems	Expanded in table previously		They will be repaired by specialized engineers and mechanicos minor as soon as possible.	fluctuating
Computing network crash	Cyber Network of the Settlement	Highly developed cyber security systems will detect the problem	That line of the network is closed down temporarily and a new line is employed, until mechanicos minor fixes it.	<15 secs
Dock Failure	Limani	Sensors on the walls of Limani and the arms, and subsequently reported to the Exousia.	Damaged dock is are repaired by our engineers, along with the mechanicos minor and major.	<1-1.5 mins
Exterior damage	Prostasia	Sensors on the walls of settlement and reported to the Exousia.	Replacement and repair of the damaged parts by the Mechanicos major	<5-6 mins

Finance and Economics



4.0 Finances and Economics

a) Launching Procedure:

Launching the space ship, includes the launching it from the launch pad at a point close to the equator of the Moon and ejecting it from the Lunar atmosphere having acquired the orbital velocity of 110724 km/hr, firing of the navigational thrusters and separation of the launch vehicle and the space ship (deployment of the IGS and the radar, to beam its location to the Central tower which is a dedicated Northdonning Heedwell station on the Moon to monitor the functioning of the spaceship from launch to the day to day functioning). Considering the Moon has less gravity than the Earth and its own orbital speed around the Earth removes some of the velocity required to leave the Earth-Moon space, the cost of launching an average satellite costs lesser than launching it from Earth.

b) Taxation

The citizens will be taxed as a percentage of their income, as well as General tax for purchasing commodities, rendering services, land and water and electricity by a Central Body just like how it is done on Earth, to ensure the progress of the Colony. The tax system, Lefta, is fully-automated with a state of the art AI system to make it convenient for the Arii. There will be a Central Bank which will monitor the expenditure and provision of funds of the various other banks. The currency will be called Ariali and will be worth around 12 USD initially, which will vary based on the rate of development. The most probable inflations will be handled by the AI to ensure smooth transaction.

Loans will be available to Arii who require them. The interest rate of loans will increase with the amount required for the loan.

95% of all the taxes collected will be spent on improving the technology present in the Arial. The remainder will be used to develop the ground stations.

Since, one Amastochia will be provided per house, the Arii will be taxed about 3% more than the declared tax for the first 2 years, in order to recover the expenses of the provision of the pods. If the citizens opt not to take the pod services, they will be omitted from the list of the additional taxpayers.

In the Colony, we take taxation as a serious matter, as we would expect it to be everywhere else. Tax paying is a way to enable the government to administer and better the lives of the Arii. E-mails will be sent by the central body 21 days prior to the tax filing deadline, after which a reminder will be sent 4 days prior. Arii who file it prior to 30 days of the deadline, will receive rewards, whereas the Arii who don't file it before the deadline will incur severe punishments.

c)Cost and Schedule:

Cost:

<u>Structure:</u>			
<u>Unit</u>	<u>Quantity</u>	<u>Cost per Unit</u>	<u>Total Cost</u>
Fibre-glass layer	$5.03 \times 10^7 \text{m}^2$	40 per m^2	2000000000
Solar panels	25.2 million	500 per kW	12500000
Thermosetting plastic	$42.192 \times 10^6 \text{m}^2$	0.5 per m^2	21096000
2219-T6 aluminum alloy	$42.192 \times 10^6 \text{m}^2$	3.2 per m^2	13501440
Cement	$2 \times 10^7 \text{m}^3$	75 per m^3	266666.67
TOTAL			2047364106

<u>Operations and infrastructure</u>			
<u>Unit</u>	<u>Quantity</u>	<u>Cost per Unit</u>	<u>Total Cost</u>
Weather control System	1	N/A	1,000,000
Water-Treatment Plant	1	N/A	100,000
Waste-Treatment Plant	1	N/A	100,000
Hydroponics	N/A	Depends on the type of food grown (on average 3.30\$ per gram)	2,094,510
Amastochia	Regular-50 Express-25	Regular-3000 Express-4000	Regular-150,000 Express-100,000
Podilatou	3000	150	450,000
Conveyor Belts	N/A	N/A	100,000
Electromagnetic shafts	25	4000	100,000

Li ion batteries	27000	500	13,500,000
Ultracapacitors	8000	2400	19,200,000
Selena Amaxa	10 (considering a 10% travelling population between spaceships)	20,000	200,000
Total			37094510

Human Factors			
<u>Unit</u>	<u>Quantity</u>	<u>Cost per Unit</u>	<u>Total Cost</u>
Shops	150	10,000	1,500,000
Malls	3	200,000	600,000
Police stations	15	30000	450,000
Fire stations	15	50,000	750,000
Schools and universities	3 (2+1)	Schools-125,000 University-1,000,000	1,250,000
Public Restrooms	100	1000	100,000
Hospitals	10	1,200,000	12,000,000
Hotels and Resorts	5	130,000	650,000
Restaurants	15	20,000	300,000
Offices	50	40,000	2,000,000
Clinics	20	100,000	2,000,000
Theaters	10	20000	200,000
Administrative buildings	10	30000	300,000
Library	10	10000	100,000
Research observatories	50	30000	1,500,000
Museums	3	100000	300,000

Parks	15	10000	150,000
Banks	10	10000	100,000
Community Centre	40	15000	600,000
Religious outlets	20	15000	300,000
Houses	4000 2BHK-2500 3BHK-1500	Depends on the size 2BHK-60,000 3BHK-80,000	270,000,000
Space Suits	12000	2000	24,000,000
Air Locks	35	10000	350,000
Total			319,500,000

Automation			
Unit	Quantity	Cost per Unit	Total Cost
Extendable Arm	1	20,000,000	20,000,000
Katharos	20	100,000	2,000,000
Lefta	10	500,000	5,000,000
Mechanicos	Mechanicos Major-50 Mechanicos Minor-50	Mechanicos Major-2,000,000 Mechanicos Minor-1,500,000	3,500,000
Ergolavos	Ergolavos Major-200 Ergolavos Minor-250	Ergolavos Major-20,000 Ergolavos Minor-15,000	7,750,000
Technitis	100	10,000	1,000,000
Amyna	50	10,000	500,000
Oplitis	300	5,000	1,500,000
Eurus	600	10,000	6,000,000
Metalleftis	70	20,000	1,400,000

ALEXIS	10,000	10,000	100,000,000
<u>TOTAL</u>			<u>148,650,000</u>

<u>Employee Directory</u>				
<u>Category</u>	<u>Subcategory</u>	<u>Personnel</u>	<u>Annual Salary</u>	<u>Total salary</u>
Engineers	Computer	500	120,000	60,000,000
	Civil	500	108,000	54,000,000
	Mechanical	500	120,000	60,000,000
	Electrical	300	108,000	32,400,000
	Aeronautical	225	132,000	29,700,000
	Robotic	550	120,000	66,000,000
	Metallurgical	625	108,000	67,500,000
	Communication	100	114,000	11,400,000
		3300		370,740,000
Medical	General Physicians	300	110,000	33,000,000
	Specialist Surgeons	150	125,000	18,750,000
	Specialist Doctors	225	120,000	27,000,000
	Nursing Personnel	100	90,000	9,000,000
		775		87,750,000
Industry	Managers	75	90,000	6,750,000
	Technicians	45	75,000	3,375,000
		120		10,125,000
Corporate	Bankers	250	120,000	30,000,000
	Brokers	150	95,000	14,250,000
	Analysts	250	95,000	23,750,000

	Accountants	350	90,000	33,250,000
	Managers	100	100,000	10,000,000
		1100		111,250,000
Others	Officials	2000	90,000	180,000,000
	Research Scientists	750	150,000	107,500,000
	Civil Servants	350	95,000	33,250,000
	Law Enforcement	500	95,000	47,500,000
	Lawyers	500	100,000	50,000,000
	Professors	400	90,000	36,000,000
	Diplomats	400	120,000	48,000,000
		2150		214,750,000
<u>TOTAL</u>		7445		794,615,000

<u>Annual Costs</u>	
Power	12,000,000
Water	5,000,000
Aerponics and Hydroponics maintenance	2,000,000
Communication	7,500,000
Day-night cycles	20,000
Weather Systems	50,000
Maintenance of automated systems	10,000,000
<u>TOTAL</u>	36,570,000

Thus for Arial to be operational, the total cost is **3,383,343,620**

Schedule:

<u>Plan</u>	<u>Estimated time(in years)</u>	<u>Time for delays(in years)</u>
Construction of KRATOS	0.5	0
Construction of SYNDESMOS	0.5	0
Connecting of SYNDESMOS and KRATOS	0.25	0
Construction of HELIOS	3(1+1+1)	1
Construction of LIMANI	1	0
Construction of OIKOS, POLIS and EXOUSIA	4.5(1.5+1.5+1.5)	0
Establishing ANEMOS and CDRA	0.5	0
Construction of EDAPHOS and PROSTASIA	1	0
Construction of ZOI and DEMETER	0.5	0
Construction of SKOUPIDIA	1	0.25
Construction of KINESIS	1	0
Construction of SELENA AMAXA	0.25	0
DYNAMOS	0.25	0
Final modifications	0.25	0
Approval of Foundation Society	0.25	0
Quality Checks	0.25	0.5
Correction of Glitches	0.25	0.5

Time = 15.25 years
Time delays=2.25 years
Total time=17.5 years



5.0 Power and settlement

a) Solar panels and KRATOS:

The solar panels form a layer on the outside which will be connected to multiple inverters which will change the DC(direct current) to AC(alternating current). This electricity is then fed into the main power grid(KRATOS) via the SYNDESMOS. The KRATOS which consists of many Li-ion batteries grouped together, will then distribute the current as required.

As the energy consumption in the Arial will be really high, 26.235 million solar panels will be required. These panels will produce 6.3 GW which will be put to various uses.

KRATOS will consist of 27000 cells arranged in circular rings stretching across its diameter.

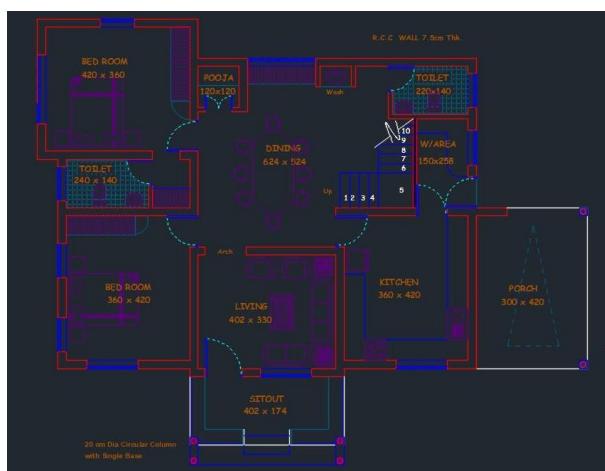
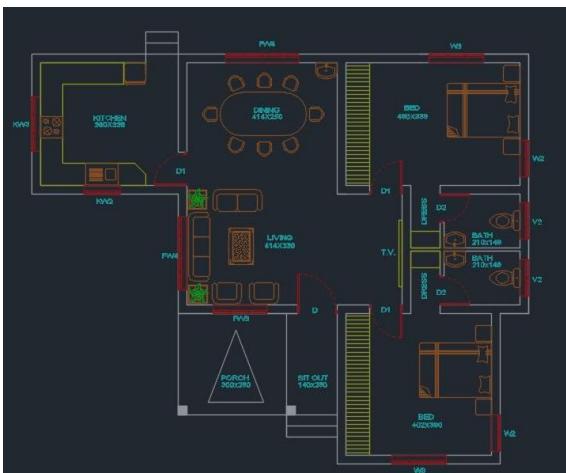


The energy brought to the KRATOS via the SYNDESMOS can be stored and later used. The batteries will have to be changed every 5 years as the batteries will lose 5% of their original capacity. Each house will be provided with a collector and a storage tank, as well as a generator to ensure provision of electricity to it.

b) Housing and Infrastructure:

Northdonning Heedwell realises the need to provide adequate housing for the people and doesn't believe in compromise. Hence, it has taken measures to implement posh and luxurious ready-to-move-in quarters, with CCTV cameras and fire alarm and fighting system for the Arii, with a great view of the space around them. The houses will be adequately spaced and of different sizes based on the members, varying from 2BHK to 3BHK. There will be provided an attached balcony to admire the surroundings and plant saplings, according to the choices of the Arii. There will be 24/7 supply of water and electricity(including back up electricity) which shall not be restricted under any circumstances. The sanitation and water lines of the houses will be inter-connected and finally drain into a central tank, which will process the wastes. Each house will be equipped with a facial recognition scanner and a Touch ID which as a log of up to 10 members, to enable security and prevent burglary. All houses will be provided with burglar

alarms, and emergency buttons which will be password protected. Fitted with several room height grilled windows, it enables a generous amount of light to enter the house, boosting morale and brightness of the house.





Type	Area			No of Member s	No of houses	Total Area Accommodated
	Plinth Area(sq.km)	Salable Area(sq.km)	UDS(sq.km)			
1 BHK Condo	840	990	618.75	2	900	1800
2 BHK Condo	1050	1200	890.75	3	750	2250
2 BHK Villa	1250	1400	990.75	4	650	2600
3 BHK Villa	1900	2050	1750.75	5	700	3500

All the houses come with an attached bathroom to each room. It is also completely furnished and has the following amenities:

1. 24/7 supply of Electricity and Water
2. 35 litre capacity geysers in each bathroom
3. Air conditioners in each room and the living room, along with a fan each.
4. Porch of area 40-100 sq.m.
5. Attached Balcony of area 50 - 120 sq.m, to any one of the rooms.

Category	Number
Shops	150
Malls	3
Police stations	15
Fire stations	15
Schools and universities	3 (2+1)
Public Restrooms	100
Hospitals	10
Hotels and Resorts	5
Restaurants	15
Offices	50
Clinics	20
Theaters	10
Administrative buildings	10
Library	10
Research observatories	50
Museums	3
Parks	15
Banks	10
Community Centre	40
Religious outlets	20

Keeping in mind the increase in population Arial has space for future expansion. Some of the future expansion area is used for growing plants using Hydroponics. The area will be used according to the requirement of time and will be used for residential and commercial areas. Especially 400 sq. ft of area is provided in all houses so that the houses can be expanded in case of increase of population.

- Library: - A very special library it contains a floor where the tables are fitted with EBook Readers and people can browse through the innumerable collection of books .People can sign in to save their favorite books and bookmark them. For those who get the pleasure of reading in physical books, two floors with racks full of books have been provided.
- Central Hospital:- Bhumitahachandramat contains a hospital right at its centre so that it is reachable from all parts of the settlement. It has cure for all types of diseases and along with it is also a research centre where parallel research work goes on for better treatment of diseases.
- Shopping Mall:- The settlement will have 3 shopping malls. Apart from shops, the mall will also have a food court, gaming arena, children's area and a movie theatre.
- School:- Arial High School will be a unique educational institution, its aim will be to impart learning that blends the traditional with the modern, the aesthetic with the scientific. This vision of the institution will be to usher in a new order in the sphere of education.

FURNITURE DESIGNS

- Karekla:- This is a very flexible chair has been designed in a special way such that it helps the person to concentrate in his or her work. This is done by its relaxing structure and the chair has the capability to modify itself according to the person's body temperature, heart rate, mood etc. This chair has been designed keeping the fact that people usually tend to lack concentration in space due to the non comfortable environment.
- AquaBed: - It is a very relaxing bed and allows people to sleep in very peaceful state. It modifies itself according the temperature of room. It also creates various illusions to relax the person if he is in stress and creates as an environment like that on earth. This bed has reading light and ventilation facility to avoid suffocation. It has a layer of water on which the mattress made up of Aero-gel floats. This gives a person a feeling that he is floating.

c) Jobs and Entertainment:

The people living in the Arial will continue to perform their jobs which they did on earth. Apart from this there will always be a medical crew and few basic services which shall be provided to every resident. Industries will be set up for the manufacture of bucky structures.

Every house will be provided with a pod each for their transport and commuting. The rail lines will extend into each house in order for them to park their pod in the designated area and to prevent overcrowding. At junctions, Traffic signals will be operational, on the lines of those on Earth, in order to prevent jams and ensure smooth sailing of traffic. A central shopping complex will be constructed, along with several stores at a distance of about 1 km from each other, in

order to supply the essential commodities to the citizens. Movie theatres, Arcades, Sports Arenas will be built to provide leisure to the Arii.

The sewage system is completely mechanised from collecting the wastes to refining and recycling.

d) Health and Wellness

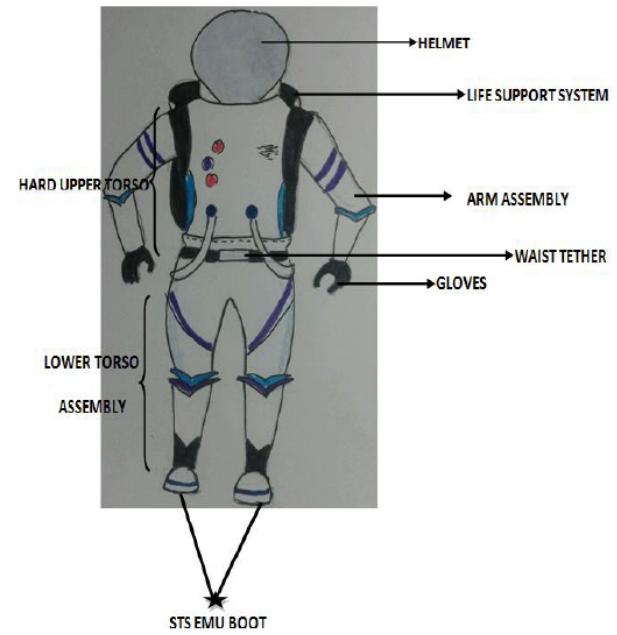
Hospitals, both general and specialized will be set up to ensure health and wellbeing of the Arii. Pediatricians, Gynecologists, Gastroenterologists, Neurologists etc, will provide services to patients who are suffering from any disease and illness.

e) Spacesuits:

Arial has a requirement of 1200 Hard Shell Spacesuits which are required when humans go out into space. These are mainly required for extra vehicular activity. It provides shielding against UV radiations and protection against micrometeoroids. It can also operate at higher pressures which would eliminate the need for an astronaut to pre-breathe oxygen to use a 4.9 psi space suit before an EVA from the 14.6 psi space shuttle as astronauts currently do. It also provides stable internal pressure, communication system, a liquid cooling system and protection against dust impacts etc.

Features of the Spacesuits:-

- 1) Custom fit to everyone using laser body scanning technique
- 2) Contains minicomputer to sensor data, such as suit pressure and heart rate etc.
- 3) Visors to protect astronaut eyes from sunlight.
- 4) Contains Simplified Aid for extravehicular activity rescue.



f) Airlocks:-

The airlock is located inside the Spoke between the Limani and Epivatis Salon . It has an inside diameter of 63 inches, is 83 inches long and has two 40-inch- diameter D-shaped openings that are 36 inches across. It also has two pressure-sealing hatches and a complement of airlock support systems. The airlock's volume is 150 cubic feet. The airlock is sized to accommodate two fully suited flight crew members simultaneously.

Support functions include airlock depressurization and repressurization, extravehicular activity equipment recharge, liquid-cooled garment water cooling, EVA equipment checkout. Each airlock hatch has dual pressure seals to maintain pressure integrity. One seal is mounted on the airlock hatch and the other on the airlock structure. A leak check quick disconnect is installed

between the hatch and the airlock pressure seals to verify hatch pressure integrity before flight. The airlock air circulation system provides conditioned air to the airlock during non-EVA periods.

The airlock revitalization system duct is attached to the outside airlock wall. To assist the people before and after EVA operations, the airlock incorporates handrails and foot restraints. Handrails are located along the sides each handrail has a clearance of 2.25 inches between the airlock wall and the handrail to allow the astronauts to grip it while wearing a pressurized glove. Foot restraints are installed on the airlock floor. There are four lights in the airlock. Before opening either door, the air pressure of the airlock—the space between the doors—is equalized with that of the environment beyond the next door to open.

A gradual pressure transition minimizes air temperature fluctuations, which helps reduce fogging and condensation, decreases stresses on air seals and allows safe verification of pressure suit and space suit operation. Where a person who is not in a pressure suit moves between environments of greatly different pressures, an airlock changes the pressure slowly to help with internal air cavity equalization and to prevent decompression sickness.

1) Presence of hazard detection systems in public areas and crossroads and present in individual houses.

2) Presence of Oplitis at crossroads.

3) Audio warnings for humans in their lockets. Their lockets contain a chip which contains all information about the identity of the human containing it.

4) The hazard detection system would activate the Oplitis.

5) Warning System Mitigation

6) Relocation of Oplitis. The humans are sent to the isolation chamber where all the facilities have been provided. Mitigation

7) Areas which will be under impact; in less than 15 minutes in off limits and all humans and robot activities have been rescheduled.

Studies of human behavior in isolated environments have shown a tendency for permanent residents to regard visitors and temporary residents as outsiders or intruders.

In Arial we have physical and social community feature intended to involve non-permanent residents in social structures of the settlement. We have buildings in the shape of social networking sites where the permanent residents and the temporary ones come to socialize. It's just like socializing on any network site like on earth but the only difference is you get to meet people face to face.

People come here to meet different types of people with a different thoughts and different culture. Here different types of games and activities are also provided so people can compete with each other in various types of games such as poker, pool, bowling etc.

Quarterly, Arial will observe the Aria Festival where the permanent and the temporary shall compete and co-ordinate in the field of sports, dance, debates and other art forms.



The residents would be divided into 8 teams in order of the 8 planets. Sports and games have caused integration in the society since years now. BhumitahaChandramat looks forward for getting similar positive outputs.

d) Food:

As the conventional method of growing plants and animals for the food requirements of people requires lots of land, water and labour, the Arial will use Hydroponics which is a method of growing plants in vats of nutritive solutions without soil. Hydroponics will be done in the DEMETER along with aeroponics to increase the number of plants which can be grown in a small area. Also cultured meat, meat grown in cell culture instead of animals, will be used for the non-vegetarian Arii.

Any excess food will be stored in the Apothique which can be used later. Any exportable surplus created can be sent to the earth or moon settlements and can be traded for a source of income.

Food item	Consumption per person per year
Fish	70.5 kg
Beef	30.6 kg
Chicken	72.6 kg
Wheat	80.7 kg
Rice	80.25 kg
Sugar	36.5 kg
Tea	1.5 kg
Coffee	1.3 kg
Peas	54.75 kg
Potatoes	55.5 kg
Tomatoes	65.5 kg
Onions	48.5 kg
Lettuce	36.5 kg
TOTAL	634.7 kg

e) Administration:

A improvised legal document extending to private ventures, on the lines of the United Nations' Outer Space Treaty will be followed. The treaty has several major points to it. Some of the principal ones are:

- Space is free for all nations to explore, and sovereign claims cannot be made. Space activities must be for the benefit of all nations and humans. (So, nobody owns the moon.)
- Nuclear weapons and other weapons of mass destruction are not allowed in Earth orbit, on celestial bodies or in other outer-space locations. (In other words, peace is the only acceptable use of outer-space locations).
- Individual nations (states) are responsible for any damage their space objects cause. Individual nations are also responsible for all governmental and nongovernmental activities conducted by their citizens. These states must also "avoid harmful contamination" due to space activities.

Northdonning Heedwell strives to strictly adhere to these provisions and assures the United Nations that it will not violate any of these terms and conditions.

Within the colony, a central body will be established to administer and organize the day-to-day functioning of the spacecraft. All the Arii will be treated equally, and all fundamental human rights will be upheld. Being only 10,000 people the company believes that a government will be only be wastage of resources. There will be a legal body to settle disputes and discuss matters.

Back on the moon, there will be a government body, that is elected by the Arii on the moon, that will discuss and formulate laws for all the colonies in orbit and Northdonning Heedwell will abide by the instructions given to it by that body. For the welfare of the Arii, Northdonning Heedwell will go to any extent.

f) Study of Heavenly bodies:

Launching a telescope or satellite from Earth, is much more expensive than launching it from our space colony for the main reason being that they would have to penetrate the earth's atmosphere and attain the escape velocity. For that they would need, highly reinforced materials to withstand the force. For example, the effort to launch the Hubble Space telescope cost \$1.5 billion in 1990, plus there would be ongoing costs. But launching it from our satellite would be less expensive. So, if Northdonning Heedwell is permitted to do so, it will take active part in the study of heavenly bodies. It will also accept groups of researchers who want to join and study the Cosmos, as it is for the welfare of humanity at large. We see the bigger perspective and hence will set aside funds, and dedicate and encourage people who want to take part in this. We believe that everything from sending nano crafts to asteroids to capturing terabytes of information in pictures of heavenly objects helps and hence will work towards it.

g)Communication:

Communication is a very important part and parcel of the colony. It consists of both the internal and external components. Exchange of information between Arii, Arii and the outer space and between the colony and ground station is essential for the sustenance of life on it. We assume that every adult will be equipped with a mobile phone and hence makes it easier to provide services for the transmission.

The space between Arial and the ground station, is treated like a 3-dimensional grid(with x and y coordinates) and each cell is denoted by a different latitude and longitude coordinates. The position of the Arial will be relayed on the lines of this terminology. Any thrusters or boosters to be used to alter the location will be broadcast and controlled based on these co-ordinates. The Arial is pre-programmed to input, process and communicate in this way. A dedicated space traffic controller will be present on the Moon and Earth stations to locate other space ships and to relay locations to be at a safe distance from them in order to prevent a collision.

Communications will be broadly classified into internal and external communications. The types are:-

- Internal communications -
 - WiMax - Wireless high speed transmission standard with services such as, IPTV(internet protocol television) and VoIP(voice over IP). Many host servers would be placed at different locations to provide optimum speed for all users.
 - Speed:-Up to 1 Gbps.
 - Range:- Up to 48.2 kms.
 - Equipment Required:- Host servers and routers.
 - Fibre Optics -Transfers data with nearly 100% efficiency through wires made of SiO₂. This method is based upon total internal reflection and photovoltaic effect.
 - Free Wi-fi spots using this technology will be set up near major landmarks, and will be marked by a Wi-fi symbol on the flooring, to enable Arii to communicate with one another, as mobile networks will not be functioning up in space.
 - Speed:- 20 parallel wires each transferring at 10GBps. Cumulative speed achieved is 200 Gbps. Materials Required:-Fibre optic wires.
- External communications-
 - Radio Waves - Communication with Earth and all other space settlements would be done through X-band radio waves.
 - Frequency range - 8-12 GHz.
 - Transfer Speed - Up to 5 Gbps.
 - Equipment Required - Four parabolic antennas with Lotus Effect coatings.

- Advantages:-Less vulnerable to rain, snow and dust. Smaller antennas can be used as beams are more focused.
- Antennas - Transmit and receive radio signals - Transmit and receive radio signals.
 - Speed - 100Mbps
 - Frequency -
 - Transmission - 18-27 GHz
 - Receiving - 26.5-40 GHz
 - Band - K-Band and Ka-Band
 - Number required-4
- Traveling wave tube amplifiers - Amplify the waves to higher frequency within the band.
 - Speed - Helps in achieving 100Mbps
 - Frequency - Amplify the signal to desired frequencies.
 - Number required - 8
- Transponders - Receive, amplify and resend data over different frequencies within the Band.

h)Transport:

- ❖ Transport will be done through pod like structures, that we would like to call Amastochia (the Greek term for trains). An individual Amastochia can fit in a maximum of 4 people and 5-6 Amastochia will be connected to make a train, that transports the Arii from one place to another.
 - ❖ Every house will be provided with a pod initially, and can purchase more based on their needs and requirements. However, the quantity of pods per house will be restricted to 2 per house as it occupies too much area and is unnecessary considering the biggest house can provide shelter to only 5 people.*
 - ❖ Emergency exits will be present in every Amastochia, in case of untoward incidents. In case of a faster transport, there will be a individual, express Amastochia that fits in maximum 2 people and is automated. The regular train is not automated but manually driven, like a modern day bus/train service.
 - ❖ Conveyor Belts are used for transport of unpacked food products to the Apothique and Zoi from where packed products are taken to the warehouses for storage. This will be used as its a cheap and efficient way of transporting food material.
 - ❖ Electromagnetic shafts are responsible for the transport of heavy cargo, raw materials and other products. It will be totally controlled by electromagnets. Has high speed. And creates negligible friction.
 - ❖ Podilatou (Greek term for cycles/bikes) will be used for short distance travels, similar to the present system. This ensures a environment-friendly and efficient mode of transport.
 - ❖ Rails will be used as a platform for ferrying the pods instead of conventional roads, as it is more efficient and requires lesser space, enabling the Arii to move around freely.
- Every house will be provided with a extension of a rail into their driveway where they will



park their Amastochia.

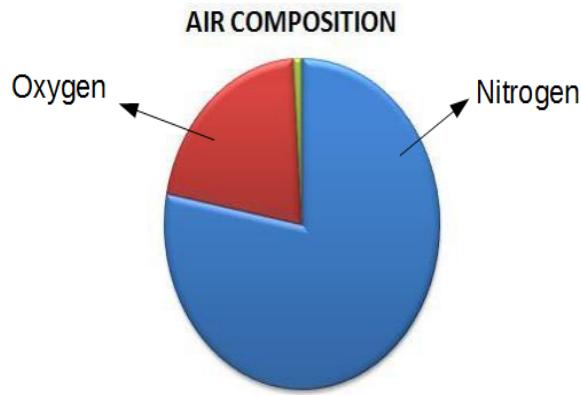
*Refer to taxation segment for scheme on Amastochia.



i) Atmospheric Composition:

The Arii will enjoy the same seasons they experienced on earth with moderate temperatures and an adequate nitrogen to oxygen ratio. It has also been found out that the seasonal requirements have to be met, owing to the agricultural and even the human needs, providing variety for the likes and choices of our inhabitants.

Efforts will be made to make Earth-like atmospheric conditions, as it has been found out that the atmosphere of Earth has the optimum conditions and necessities required for peaceful and effortless existence of human life and other organisms in a ecosystem.



<i>Season</i>	<i>Temperature</i>
Winter	27-37 F
Autumn	53-63 F
Summer	71-83 F
Spring	57-67 F

Air Composition Maintenance System (ACMS) and Back up :

- 1) Chemical Based carbon dioxide filters, aeroponics
- 2) Operates for 12 hour absorption, 1 hour release
- 3) CO₂ is absorbed and released as required
- 4) Maintained by computer supervision
- 5) Automation: A main server updated by sensors utilized for warning as well as checking the pollution control of the settlement.
- 6) Sensors activate if composition is disrupted.
- 7) "Airflow pipes" alter concentrations after filtration
- 8) Gases are stored in contingency cylinders for emergency balance
- 9) Alternative : HEPA filters.
- 10) Lunar Dust Busters using Styrofoam peanuts for second stage dust removal. They remove up to 99.83% of 0.293 micrometer particles, with greater efficiency for larger particles.
- 11) Settlement stays cosmic dust-free using Van de Graaff generators (electrostatics) to repel dust particles which are usually charged positively.

By using the above mentioned steps, a perfect air composition is maintained. The ACMS will have to be changed once in every 10 years which can be done by changing the outer lining of the KRATOS which will contain artificial lighting system (CoeLux) and the ACMS.

Other Parameters		
Condition	Level	Method
Humidity	30-50%	Controlled by humidifiers and dehumidifiers installed all over the settlement
Temperature	Varies with seasons	<ul style="list-style-type: none"> Temperature control through HVAC (Heating Ventilation Air Conditioning) systems which supply air through ducts to meet required temperature Constant, non fluctuating temperature of 15-25°C to facilitate growth of crops 20-30°C in Industrial areas to provide comfortable work environment
Wind	0-25km/hr	Maintained by wind turbines installed all over the settlement to regulate wind speed
Sky	Clear, Snow, Windy	Depends on weather display through holographic screens and computer templates
Snow	Light (visibility of 1 km)	Dry ice, absorption by ACMS
Rain	Light showers; (150-200mm per year)	Controlled by sprinklers attached to the ACMS. Artificial rain will give residents a feeling of rainfall on Earth.

i) Waste Management:

The sewage will mostly be recycled. Arii will be encouraged to use recyclable materials, and thus dissuaded to use glass and ceramic materials. Materials will be separated in a centralised tank present on the outskirts of Oikos. From here the materials will go to their respective purification plants. Metals will be melted in the second arm present in the docking bay and further refined in the Polis. Biodegradable materials will be recycled in a biogas tank that will be in Oikos. It can be further used as a minor fuel. Water will be refined in the Central Plant by using the method magnetic water treatment.

Using ALEXIS, the Arii will be educated to take further action based on the type of waste they have. If found using unwanted/banned materials, the Arii will be given a preliminary warning, followed by a heavy fine, finally leading to a probable imprisonment. ALEXIS will aid them to make decisions on the go and will also inform the inhabitants if anything unlawful or illegal is being done.

Waste management will be done based on the type of waste produced:

Types of Waste	Purification
1.Organic Waste	<ul style="list-style-type: none"> • water will be extracted by heating the waste products. • urea will be extracted from human excreta for O₂ and N₂.
2.Inorganic Waste	<ul style="list-style-type: none"> • Recyclable wastes will be sent to the Recycling plant. • metals will be sent to the LIMANI where it will be melted and gangue will be collected.
3.Hazardous Waste	<ul style="list-style-type: none"> • They will be collected and will timely be launched into space towards the sun which will melt the waste.
4.Water treatment	<ul style="list-style-type: none"> • Water will be purified from metal impurities by using neodymium magnets to prevent or reduce scale formation with hard water. • It contains the two magnets on either side of a pipe which will ferry the hard water. • The water passes through whereas the impurities remain suspended.



6.0 Defence System

Although, movies such as Star Wars and Star Trek portray inter-galactic battles, we at Northdonning Heedwell are not inspired and do not wish for such battles. But, it realises potential threats in asteroids and other such heavenly bodies which can cause damage to the colony and hence it will maintain a defence system, consisting of space probes, and missiles to intercept if deflection of asteroid is not possible. In addition, the asteroids in close vicinity (400 kilometres) will be closely monitored by high-speed cameras and laser interferometers. It will also work with other companies in order to ensure safety and security of its citizens.

Due to the huge amount of space debris revolving around the moon due to previous missions, a need to clean up this debris arises. Northdonning Heedwell hence proposes to clean up the debris in the L1 point of Arial through controlled explosions.

a) Possible threats:

The possible threats may include:

1. Gravity fluctuations when satellite passes over certain areas over the moon or gets too close to the Earth.
2. Presence of a huge amount of space debris.
3. Fluctuations in radiation levels can partially affect the Arial.
4. Presence of low or no friction.
5. Meteorites constantly get pulled in towards the moon. These meteorites are a problem to the Arial.

b) Internal Conflicts

Nortdonning Heedwell hope that there are no cases of these. But, in situations where these arise, there will be a High Court to settle the disputes. The police which is a workforce of men and automated machines, will be at the disposal of the Arii. The helpline number for the police is : 900, and for the ambulance is : 901. The cameras surveying the perimeter of the Aria will be dually equipped with wi-fi to lodge a complaint in cases where there are conflicts in the range of the cameras.

Summary of Helpline Numbers :

POLICE : 900

AMBULANCE : 901

EMERGENCY DISASTER MANAGEMENT : 902

WOMEN IN DISTRESS : 903

MISSING ARII : 904

CENTRAL ACCIDENT AND TRAUMA SERVICES : 905

CHILDREN EMERGENCY/ISSUE: 906

FIRE:907

c) Defence Mechanisms:

1. Supersensitive microwave range finders will be used to keep close track of Arial in order to make sure that its trajectory doesn't change by even one micron due to the presence of the gravitational field of any other bodies.
2. A net, a harpoon and a drag sail set up will be used to get rid of cubesats, meteorites and other space debris.
3. Also the L1 point in which the Arial will be located will be cleaned before the launch of the Arial through controlled explosions.
4. The LIMANI will also have an automated system which will monitor the docking bay activity for any threats. All of the Arial will have customary ID tags to verify their residence in the Arial.
5. The LIMANI will also have a security force comprising of men and robots in case of an attack. The most advanced internal security force will ensure maximum safety to all the Arial.
6. Also every house will be equipped with an emergency button and an emergency exit in case the house is hijacked which will be responded to by the LIMANI security force.

As safety is one of the major concerns, the automated system will be monitored by our ground stations on Earth and Moon.





BUSINESS VENTURES

7.0 Business Ventures

Northdonning Heedwell is a self - sufficient firm, and promises to fulfill all the milestones set out for it. From launching it into orbit to ensuring that the Arii are content and happy, this company dedicates all its personnel and workforce to ensure that all of these are taken care of. The company is already present on the Swedish Stock Market (Stockholm Stock Exchange). For the construction of houses and infrastructure, we do need some funding however, and will be looking forward to investors. We will be able to boost our economy and the size of the company much faster with the financial aide. We promise to do anything and everything possible to profitably grow our business in a moral and ethical way. I promise to treat our employees and customers correctly, to be transparent with any and all stakeholders, and to do what we believe is best for the whole. We strive for empowerment of the employees. Many benefits such as insurance, paid holidays, job security will be ensured. The income of the employees in the ground stations, on the colony will vary based on their position in the hierarchy. Any employee, stakeholder and investor can request and question the procedures that we follow, and we will provide adequate and honest answers to those. We will also be looking forward to hire people for roles on the colony such as Architects, Mechanical, Electrical and Software engineers, Developers, Aeronautical engineers, Scientists in the field of Physics, Biology and Chemistry and so on. So there are many jobs up for grabs. Students who also wish to pursue their articles on the covered topic in our study and those who want to complete their Phd are welcome to join us too.

Port for receiving lunar and asteroid materials

1. Our settlement provides adequate facilities for safe and comfortable transit of goods, lunar and other raw materials. Since, the goods after delivery to the settlement, need to be stored, therefore we have provided in our settlement, Apothique, which is lavishly stored and equipped for this purpose.
2. The Apothique is connected to the Epivatis Salon and Limani by 2 connectors, interlinking them. From this storage unit,Apothique, the cargo is dispatched to various industries in the Polis (which provides different levels of gravity for different industries). Transportation takes place using electromagnetic shafts as the medium of transportation.
3. Separate facilities in Epivatis Salon for passengers and cargo, other than raw materials have been provided. This facility has been provided so as to prevent hazardous accidents from taking place, which could have happened if there were any kind of interaction between humans and lunar raw materials. The same applies for repair docks (since lunar materials could easily damage repair machinery) as well as other cargo .

Production of goods manufactured from extraterrestrial materials

- Ores are sent to refining industry for refinement. Refining and further production from the ores and raw materials are done in the Polis, which has different gravitational provisions for the different processes.
- After this the processed materials are packed and sent to storage area via electromagnetic shafts or consumed if required. They can also be transferred to the Limani for shipment to other destinations.
- These will products will include
 - ◆ Silicon oxide (SiO_2)
 - ◆ Aluminium oxide (Al_2O_3)
 - ◆ Titanium oxide (TiO_2)
 - ◆ Ferrous oxide (FeO)
 - ◆ Manganese oxide (MnO)
 - ◆ Calcium Oxide (CaO)

Repair and restoration of ships and other space infrastructure elements

- ❖ The docking system that we are following is very unique and not many alterations are required to accommodate different types and sizes of ships. The runway that we are using is wide enough so that big aircrafts can land.
- ❖ Different types of aircrafts can also easily use our facilities as we are using mating or berthing processes which require special types of organs. In case there is a demand for increase in area for docking of crafts, a cylindrical connector can be built between in the Limani where the crafts can dock. Widening of the runway will also take place if it is required.
- ❖ In the event a visiting aircraft develops a hazardous situation, the elevator will enter the emergency mode. In this mode, the platform on which the damaged aircraft is will exit the Limani so that the crafts inside will not be damaged.

Other Business Ventures

- ❖ Besides providing ambient living conditions, Arial space settlement would also have an economic base. Like any other human settlement (cities, countries, etc.) it will also follow trade practices.
- ❖ The business model of Arial will revolve primarily around the manufacturing, sale and research of Silicon Bucky Structures and the lunar materials. However, Arial will host a variety of other business ventures.

Research

- ★ Arial provides an apt place to conduct research activities. It provides unique research opportunities on Lunar and Bucky Structure metallurgy.
- ★ Inter-spaceship research is encouraged as each spaceship is exposed to different kind of environment and materials.
- ★ Our scientists will be encouraged to develop more products and utilise the materials to their maximum effect. Hence even incoming asteroids, comets and other heavenly bodies in the solar system will be studied minutely.
- ★ Not only astronomy and chemistry, but also in several other fields will research be encouraged. This will largely include medical sciences, computer technology, telecommunication, even literature and social science

Medical Nanotechnology

- Nanorobots are essentially an adapted machine version of bacteria. They are designed to function on the same scale as both bacteria and common viruses in order to interact with and repel them from the human system.
- These bots will then be used in Medics once Arial is operational. Today, many critical illnesses do not have cures and thus are life threatening. This has resulted in loss of precious lives. Chemotherapy wreaks havoc on humans and nearly kills them in the quest to kill off their malignant cancer cells.
- Nanobots could be deployed in the body to “turn off” cancer-causing cells in tumors giving the same results as chemotherapy, but without the debilitating side effects. Large amounts of the bots are injected directly into the bloodstream, where they then float through the circulatory system in order to locate and fix problem areas of your body. The method used by the tiny bots is called RNA interference.
- The robots, which are smaller than most viruses, find the cells responsible for out-of-control growth and cut off their communication system, rendering them harmless and effectively turning off the cancer.

Recreation, Tourism and Entertainment:

- The community layout plan of Arial provides space for future expansion, where it already has a series of commercial ventures like shops, restaurants, malls, theatres etc. These spaces will be leased out to interested companies.
- The established familiarity of these chains will instill a feeling of home in the residents, provide a variety and thereby increase sale. Holiday packages will also be developed for the residents and tourists on Arial.
- These will include trips to the surface of Moon, observation of Silicon Bucky Structure manufacturing processes, entertainment packages for the virtual reality facilities.
- The entertainment facilities also will consist of movies and theatres, sports facilities and gaming arenas for the Arii. There will be live concerts and performances by artists for the free-flowing and smooth functioning of the government.

8.0 Appendix

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