フロンティア ビジネス 研究会

Ashida
Architect &
Associates

蘆田暢人建築設計事務所

DESIGN SOCIETY
ENERGY

ENERGY MEET

www.energymeet.org

SKY HARVEST

Space Elevator を利用した Space farm の提案

FONDATION JACQUES ROUGERIE Coup de Cœur Babel - Collectif 2013
‘Innovation et Architecture pour l’ Espace’ 賞 受賞

SKYHARVEST

CRISIS AD 2100

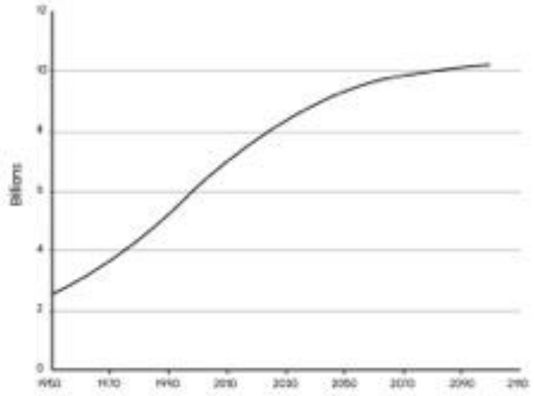
SKYHARVEST

SkyHarvest is a survival axis for the World, a bond between the sky and earth. It will be capable of generating the World's energy needs and producing all the population's nutritional requirements through zero gravity farming in 2100. It will help resolve the three greatest crises facing Humankind – Population, Food and Energy.

CRISIS 2100

POPULATION

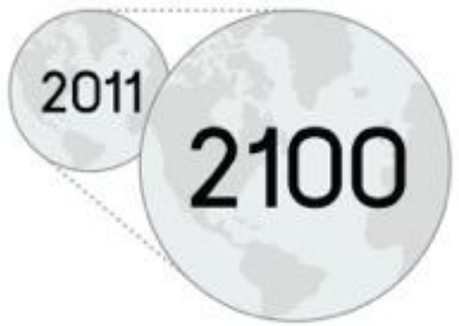
World population, 1950–2110



The World population is expected to reach 10 billion by 2100. Most growth will occur in regions that are now in their nascent stages of development. In Asia, Africa and India 'mega-cities' (10million+) and larger hyper-cities (20million+) will develop. By 2100, global life-expectancy too will increase from 75–82 years.

Overpopulation occurs when the number of people living on land exceed the surrounding resources to sustain them. By this standard, many nations are already overpopulated. The increasing World population is rapidly using up the Earth's resources and its ability to carry an ever-increasing amount of people. If we continue to consume our resources faster than they can be reproduced, Humankind will cease to exist.

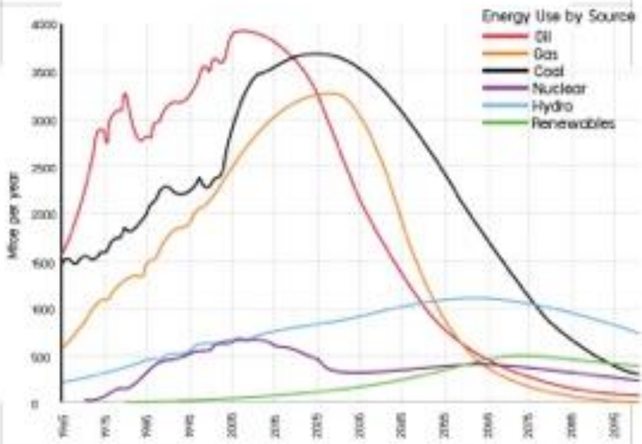
FOOD



To feed everyone, the world will need a 100% more food by 2100, when the world population is expected to hit 10 billion.

Is the earth running out of food? By 2100, the world will need to feed 10 billion people. Recent predictions claim that global food production will need to double in size to avoid catastrophic food-shortages. In 6 of the last 11 years, Humankind has consumed more food than it has produced. It is a small buffer from previous years that has helped avoid a hunger catastrophe. Several factors play their part in the crisis. Climate change is affecting where food can be grown. Unpredictable weather patterns are triggering floods and droughts. Land damaged through pollution is less productive reducing the amount of crops. Our fertile topsoil is slowly disappearing.

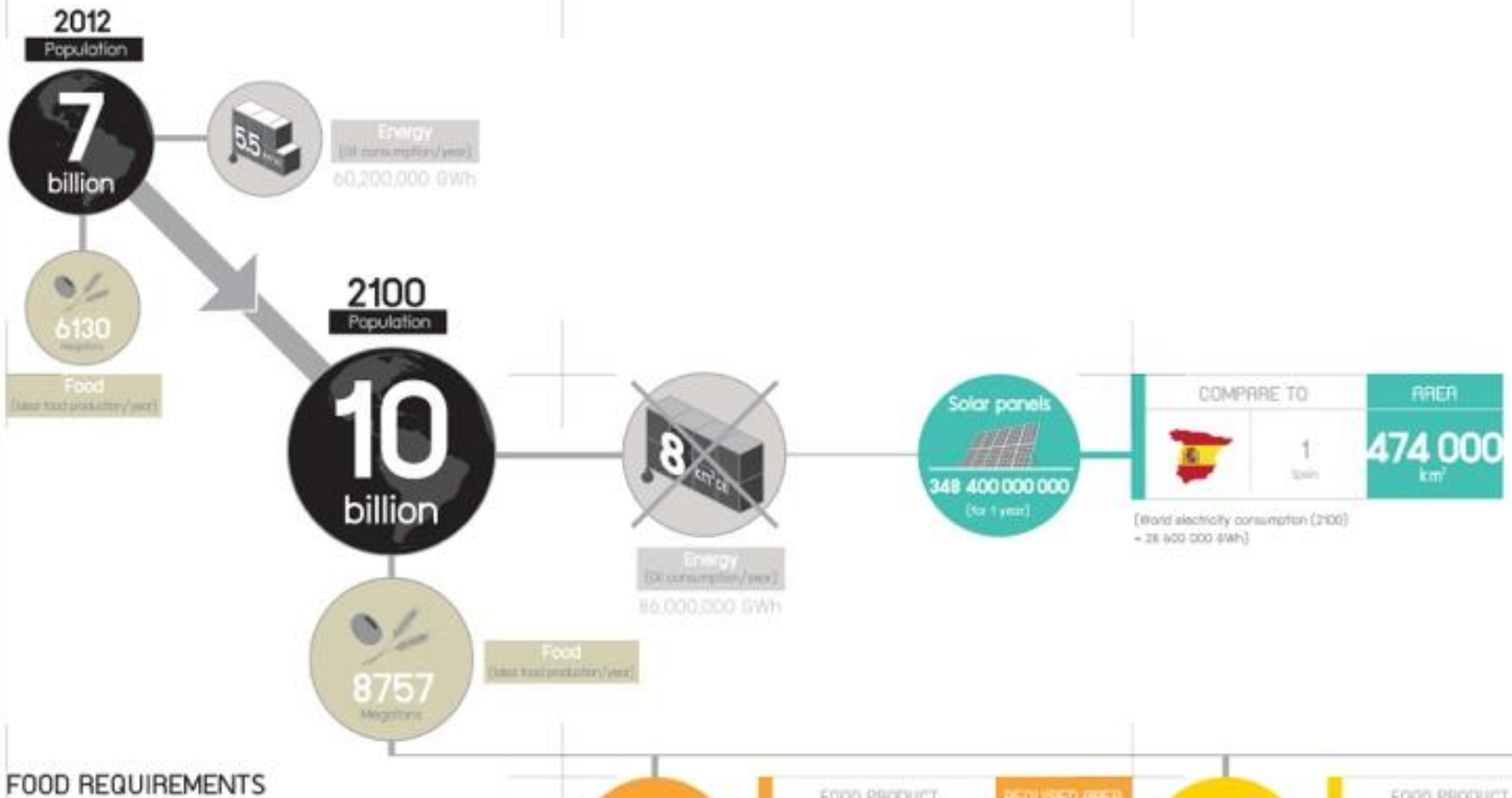
ENERGY



The World is without doubt running out of energy. Projections estimate most sources depleting by 2085. This remains the main source of conflict on the globe as each Nation tries to guarantee its future by securing an uninterrupted energy supply for continued technological progress. Without energy there is no progress, nothing moves. Soon after, we can expect the fall of our economies, mass unemployment, infrastructure breakdowns and ultimately famines and total system collapse.

Almost all industrial output depends on oil. It is the key driver of the economy. Its production is declining and the Earth's topography is being brutally damaged in a search for additional resources. With the threat of nuclear energy on our environment, can we still take our use of energy for granted?

EARTH ENERGY FOOD



ENERGY REQUIREMENTS

The crossed-out figure of 8 cubic kilometres of oil is an estimate for the total energy requirements for a population of 10 billion for one year. The figure adjacent is the number of Gigawatt hours (GwH) that it is possible to obtain from this volume of oil. The final figure shows the total amount of surface area required to generate an equal amount of energy using current solar technology. Currently, the amount of surface area required to produce our future energy needs is 474,000km2.

FOOD REQUIREMENTS

The diagram at the top left shows the increase in population between 2012 and 2100. The figure of 8757 megatons is the total weight of food products required to feed a 10 billion world population for one year. Food has been divided into three major food groups, protein - carbohydrate - and vitamins (incl. fibre and minerals). The required quantity of each food group is then translated into a series of products and the amount of surface area required to grow them. The final figure shown is the total amount of required surface area in kilometres squared for all food groups combined. Currently, the required amount of surface area for total farming is 400,980km2.

Counterweight

Center of mass
for system
(above geostationary level)

Geostationary Orbit

Climber

Anchor at equator

Earth

North Pole

SPACE ELEVATOR

In escaping from gravity, Humankind has always created novel technologies. Our interest in leaving the surface of the Earth – freely and when we decide – has crystalised into the idea of the space elevator.

It was Arthur C. Clark who first popularized its use. The space elevator will give us access to 'space' and its resources daily. It will remain in geosynchronous orbit above Earth, anchored at the equator. A counterweight at its opposite end will use the planet's rotational movement to fight gravity, keeping the cables attaching it to the Earth in tension. Elevator cars will then travel along ribbon-like cables ferrying cargo and personnel back and forth from the planet's surface. The space elevator will make the cost of ferrying objects into space competitive. Currently, a 'jetliner' offers a trip of about $1/pound and rockets about $10,000/pound. The space elevator will aim for $10 per pound allowing a viable space-based economy.

FRONTIER

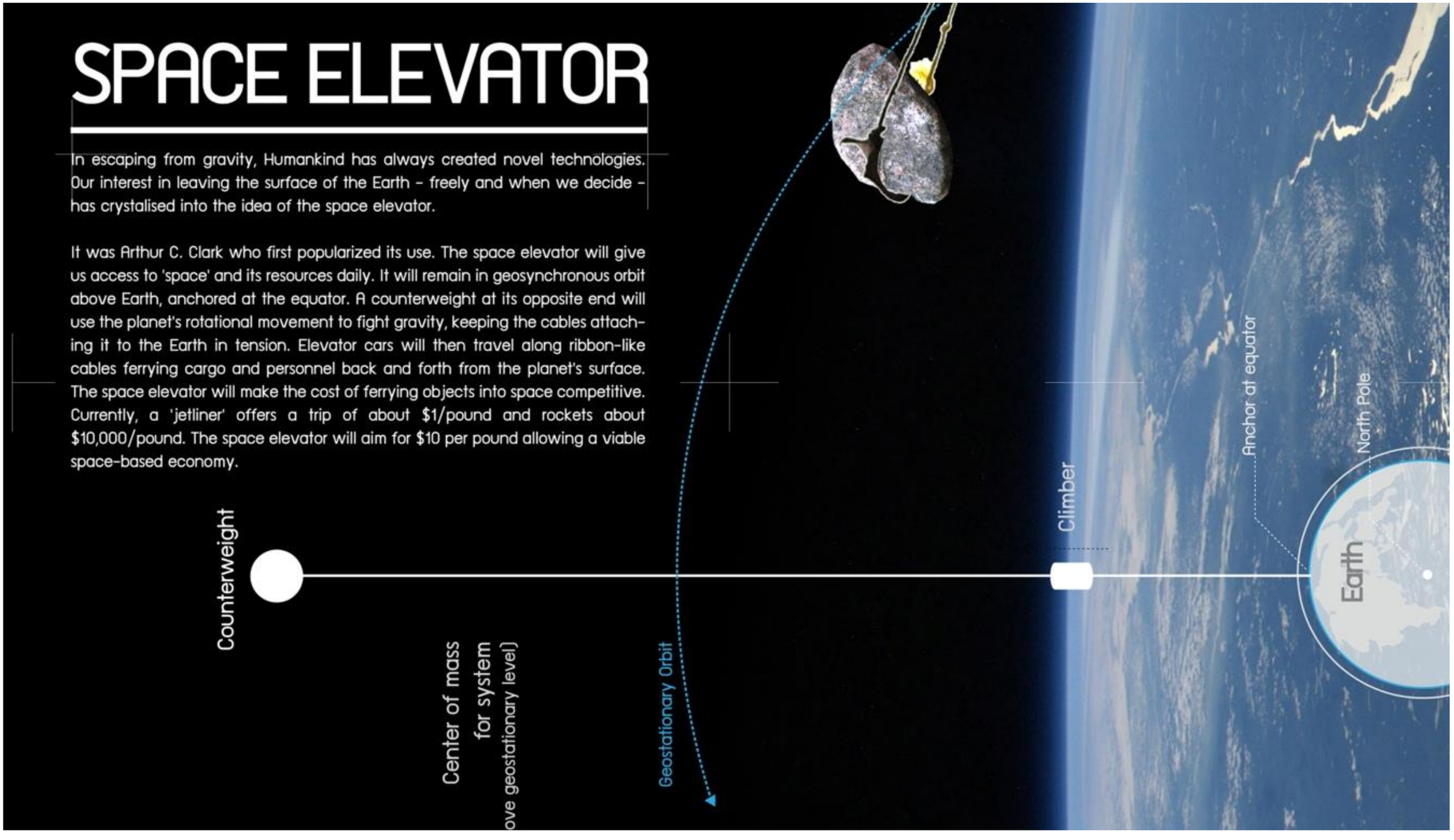
Humankind has an inbuilt urge to push boundaries. Vertical exploration into space remains the most epic adventure ever undertaken. Reaching beyond the Earth defines us. Since standing upright, we have always been interested in the heavens. Pushing beyond our limitations has always given us our greatest sense of achievement. It is with this attitude that we can explore the limits of our Earth and up into space.

Now when facing our greatest calamity Humankind must work with a constancy of purpose, surpassing independent ideas and resources and working together towards higher goals. By doing so, we will be able to achieve what no-one else has done before. We can then pass our successful knowledge on to future generations. They will take-up their new challenges building on our achievements. This is the impulse behind our evolution. With this attitude we will endure.

SPACE ELEVATOR

In escaping from gravity, Humankind has always created novel technologies. Our interest in leaving the surface of the Earth – freely and when we decide – has crystalised into the idea of the space elevator.

It was Arthur C. Clark who first popularized its use. The space elevator will give us access to 'space' and its resources daily. It will remain in geosynchronous orbit above Earth, anchored at the equator. A counterweight at its opposite end will use the planet's rotational movement to fight gravity, keeping the cables attaching it to the Earth in tension. Elevator cars will then travel along ribbon-like cables ferrying cargo and personnel back and forth from the planet's surface. The space elevator will make the cost of ferrying objects into space competitive. Currently, a 'jetliner' offers a trip of about $1/pound and rockets about $10,000/pound. The space elevator will aim for $10 per pound allowing a viable space-based economy.



HORIZONTAL to VERTICAL

HUNGER MAP 2011

The space elevator allows us to dream of almost infinite verticality. Each horizontal crisis located on Earth can find its vertical solution on the space elevator. The three crises shown here are all based on surface area. Population, Food-shortage and Energy need surface area, one to live, one to grow and one to generate. The global maps clearly pin-point where these World problems appear.

The first global diagram (top-left) is the world hunger map for 2011. It depicts Africa, India and Far East Asian regions as having the highest expected levels of hunger now and in the expected future. These areas will thus require the highest quantity of food for stabilization.

POPULATION DENSITY MAP 2011

The second global diagram (top-middle) depicts the world population density for the year 2011. It clearly shows that widespread increases should be expected to occur in Africa, India and the Far Eastern parts of Asia. This will be due to rapid urbanization patterns that will trigger the development in these continents of 'mega' and 'hyper' cities. Within the next 100 years, the capitals of these countries are expected to house populations in excess of 20million inhabitants.

ENERGY CONSUMPTION MAP 2010

The third global diagram (top-right) reveals the levels of energy consumption by country for the year 2010. With the exception of central South America, the strongest increases in energy consumption are visible in Africa, India and the Eastern regions of the world. The demand of energy in these developing regions is expected to greatly increase as all its nations make an attempt to reach their full physical and economic development.

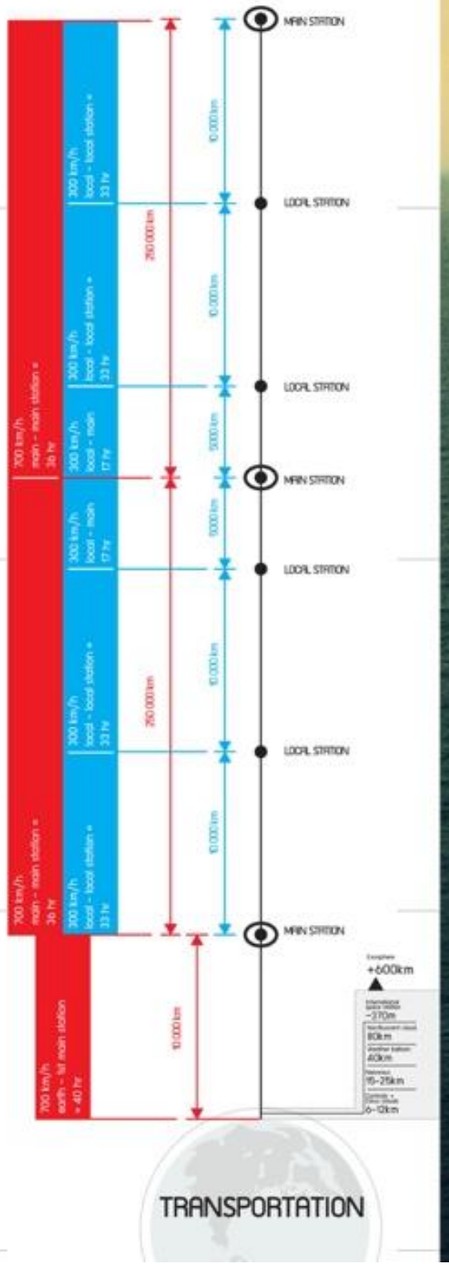
ATMOSPHERE AND GEOLOGY

The fourth diagram depicts atmospheric and geological concerns. The 'coriolis force' (zero at the equator and increasing towards the North and South poles) helps stabilise weather along the equator. A tectonic threat from plate movement can be avoided if construction occurs equidistant from fault-lines.

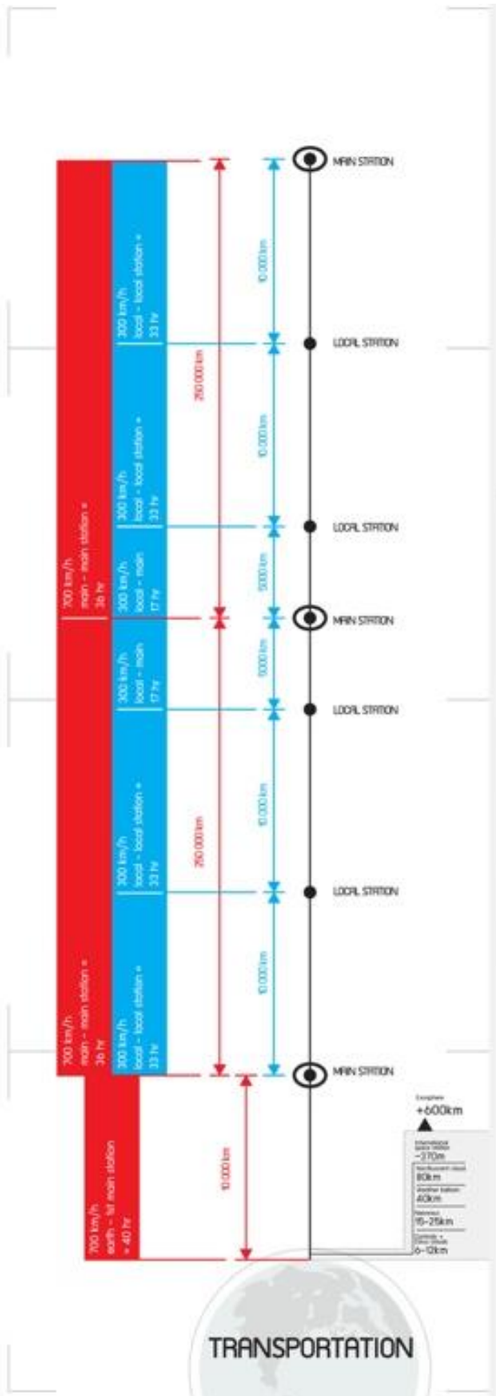
The main map is an overlay of Hunger, Population and Energy maps. Darkest colours show regions that would most benefit from a close proximity to SkyHarvest. The seas of South East Asia emerge as an ideal area for construction. In addition, the surrounding countries and their people have a strong history of trade and a good export mentality. When married, all these points provide a strong logic for an Asiatic location for the space elevator's anchoring islands.

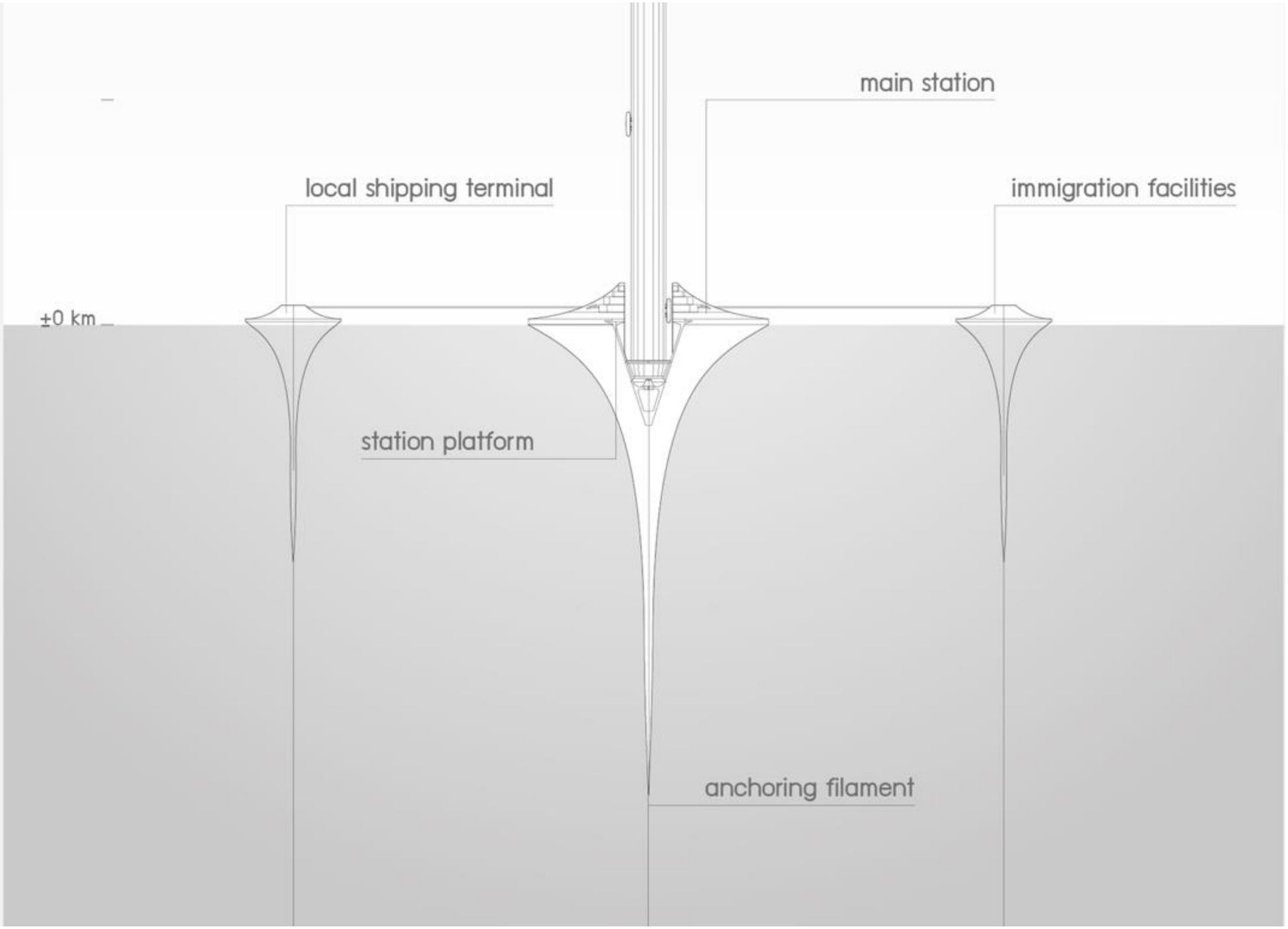
EQUATOR

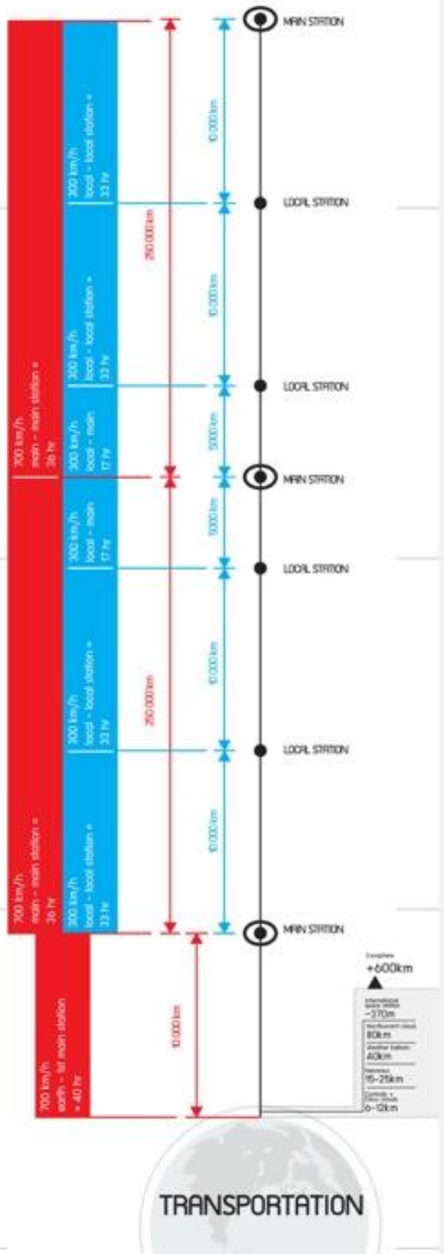
potential area



TRANSPORTATION


MAIN STATION
LOCAL STATION
LOCAL STATION
MAIN STATION
LOCAL STATION
MAIN STATION
10,000 km
250,000 km
10,000 km
5000 km
5000 km
10,000 km
250,000 km
10,000 km
10,000 km
+600km
TRANSPORTATION

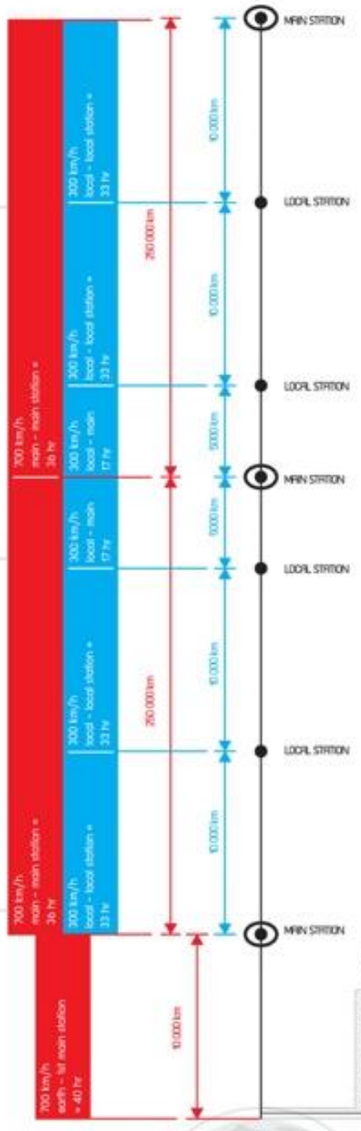

main station
local shipping terminal
immigration facilities
±0 km
station platform
anchoring filament



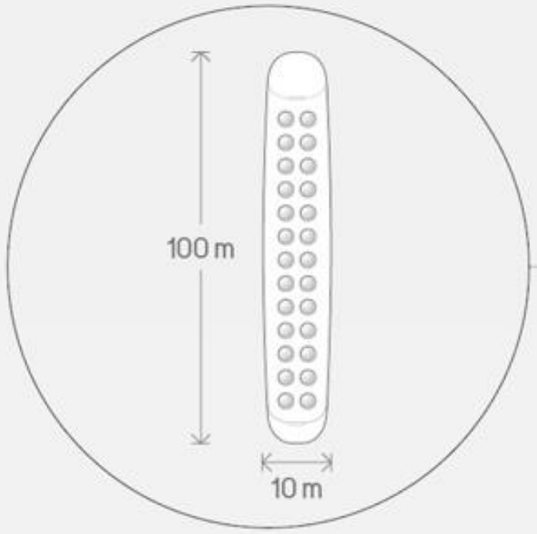
TRANSPORTATION

+5 km

carbon-nanotube ribbons



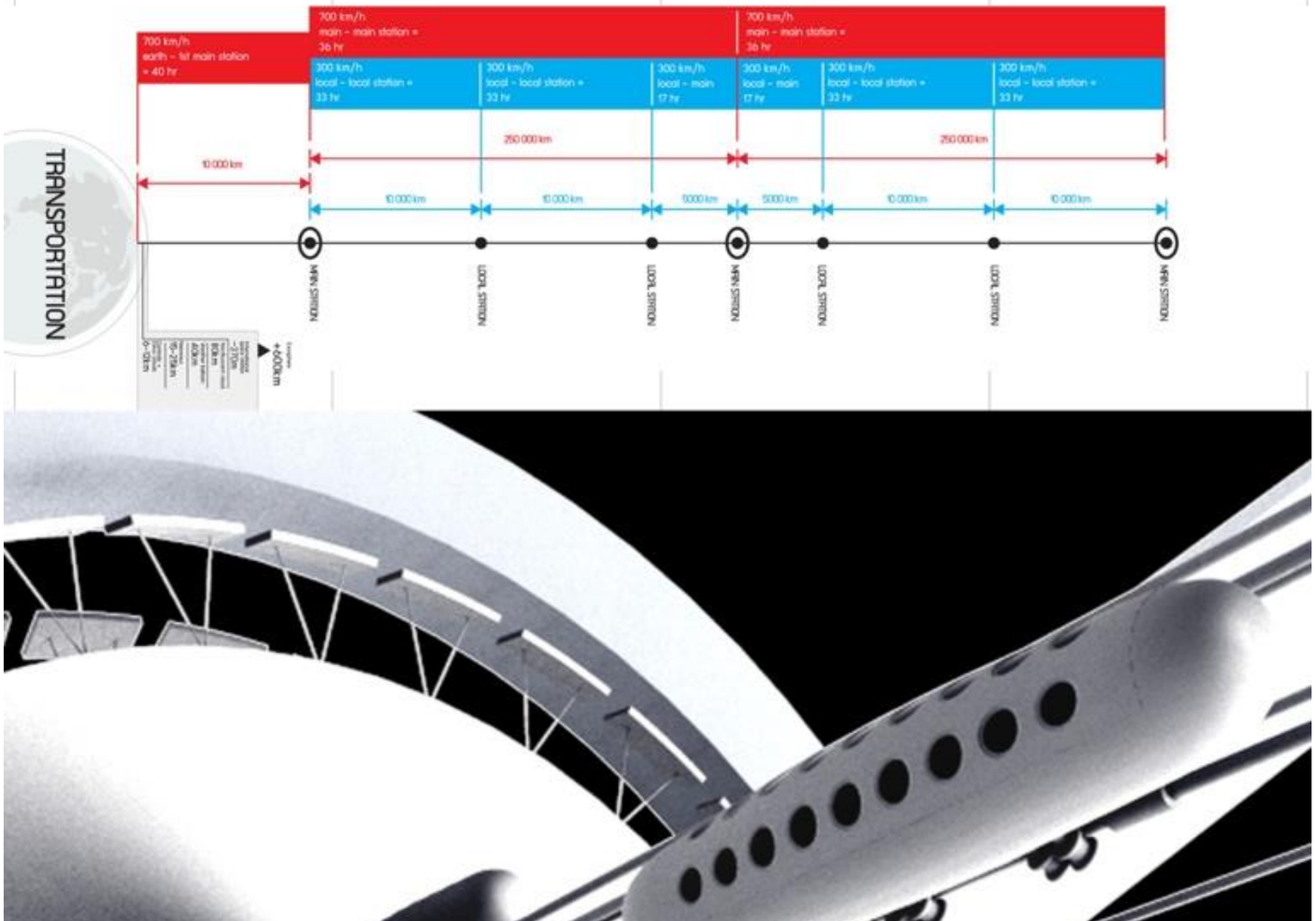
TRANSPORTATION



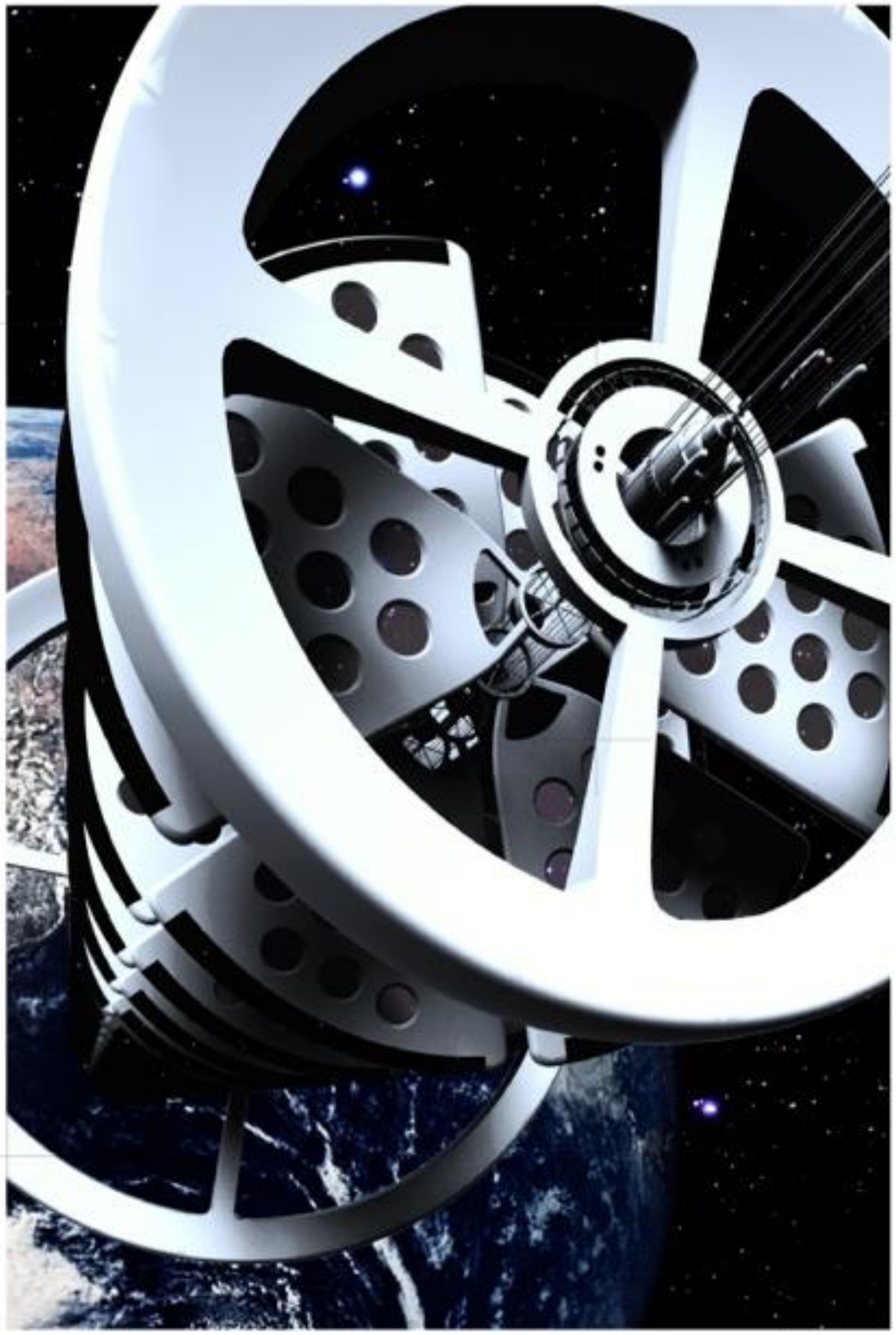
capacity :2,000 people
speed :max. 700 km/h

+5 km

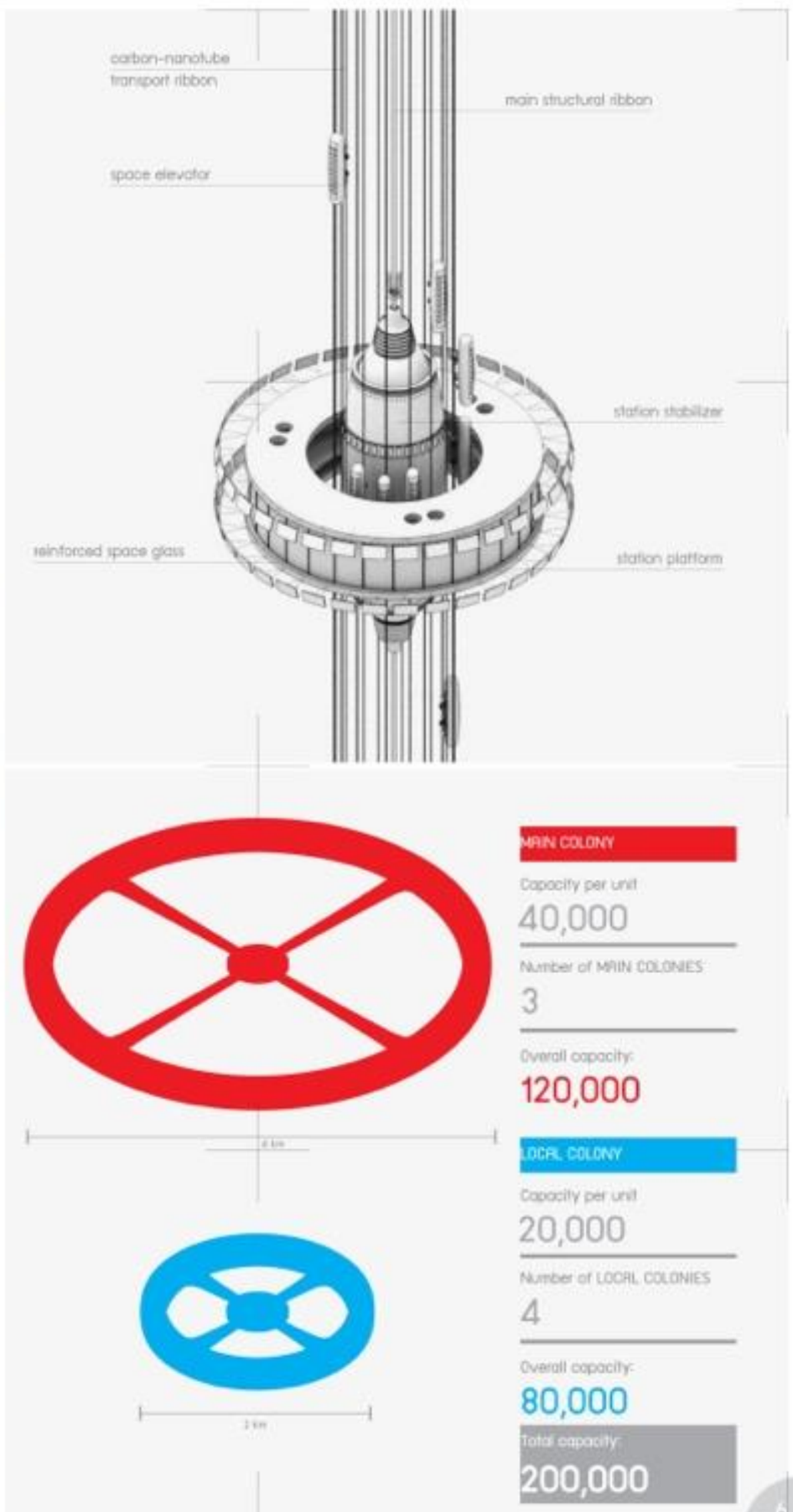
carbon-nanotube ribbons


TRANSPORTATION
700 km/h
earth – 1st main station
= 40 hr
700 km/h
main – main station =
36 hr
700 km/h
main – main station =
36 hr
300 km/h
local – local station =
33 hr
300 km/h
local – main
17 hr
300 km/h
local – main
17 hr
300 km/h
local – local station =
33 hr
300 km/h
local – local station =
33 hr
10 000 km
250 000 km
250 000 km
10 000 km
10 000 km
5000 km
5000 km
10 000 km
10 000 km
MAIN STATION
LOCAL STATION
LOCAL STATION
MAIN STATION
LOCAL STATION
LOCAL STATION
MAIN STATION
+600km

SPACE STATION AND COLONY



All SkyHarvest colonies are equipped for long-term settlement. There are 'main' and 'sub' colonies 4km and 2km in diameter. Nested in each colony is a space station that acts as transport hub for vertical movement. Their platforms allows interchange of personnel, cargo and crops, to and from all destinations along the space elevator and back to Earth. 4km wide colonies sit at 10,000km, 35,000km and 60,000km and contain 40,000 inhabitants. The 2km colonies are spaced every 10,000 km and hold 20,000 inhabitants. Journey time between larger colonies takes 50 hours (2days) to complete. Journeys between local space stations also take 50hours (2days) to complete. The SkyHarvest total population is 200,000.



MAIN COLONY

Capacity per unit
40,000

Number of MAIN COLONIES
3

Overall capacity:
120,000

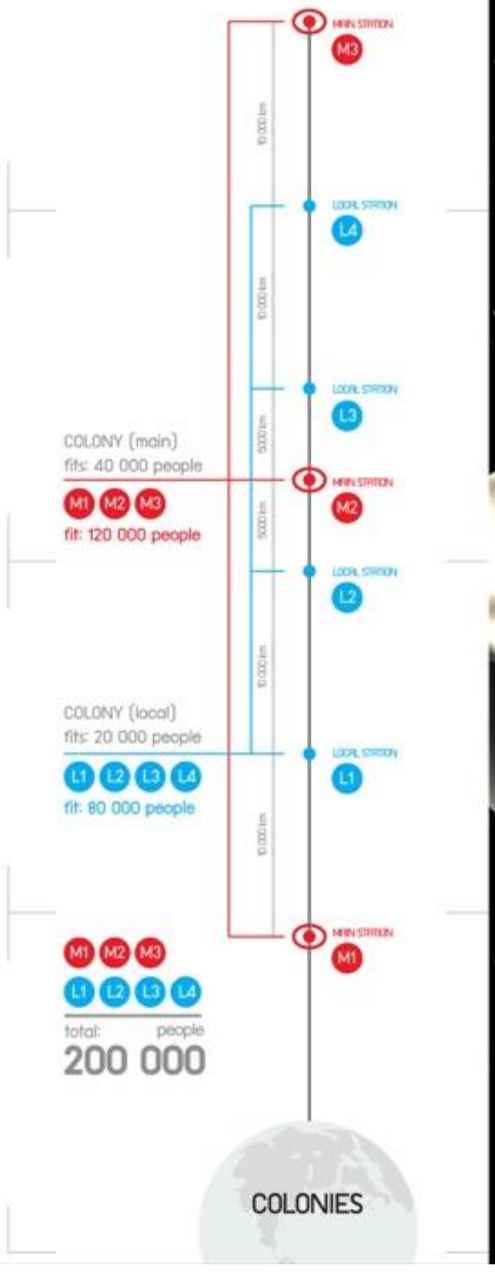
LOCAL COLONY

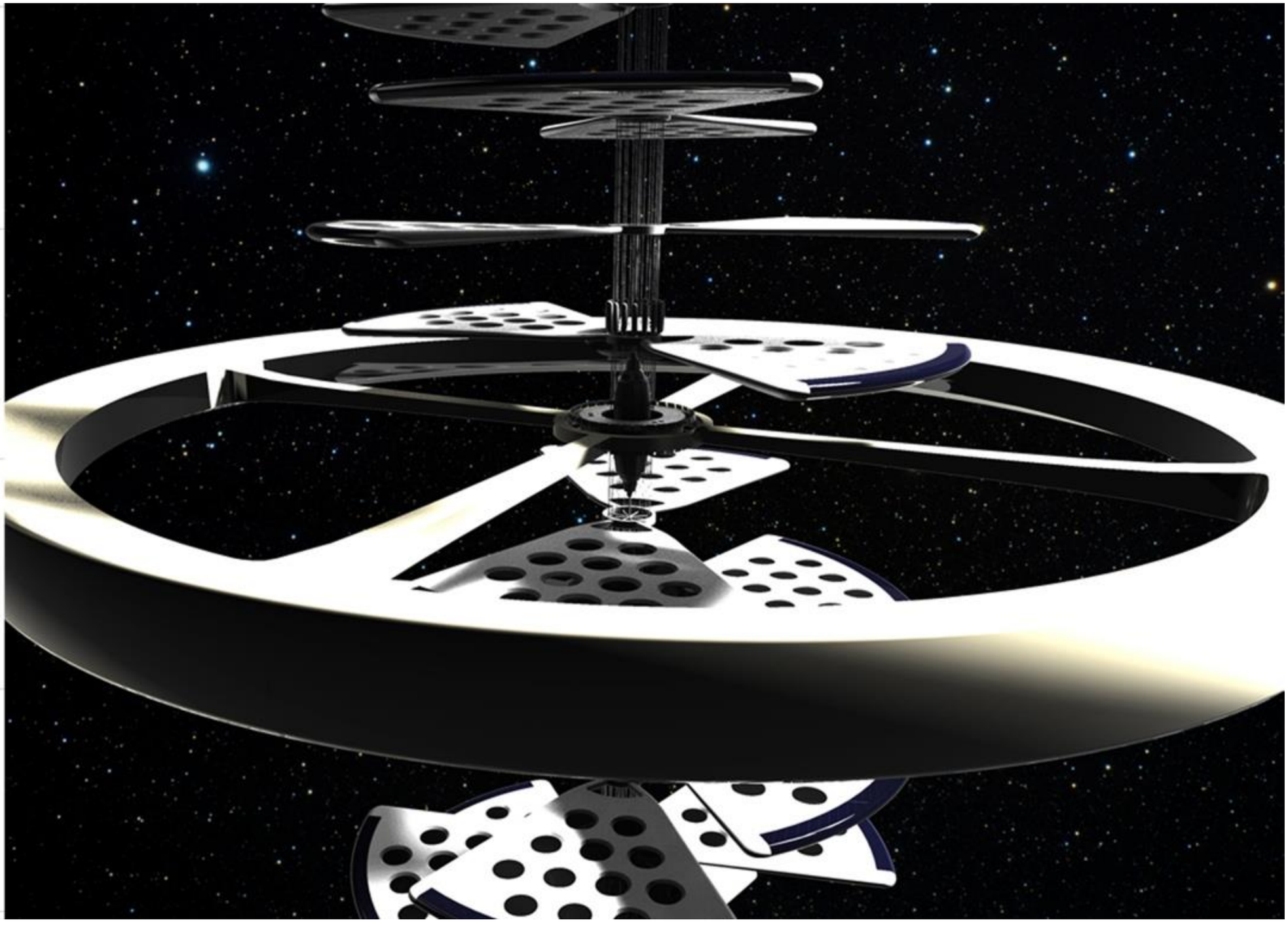
Capacity per unit
20,000

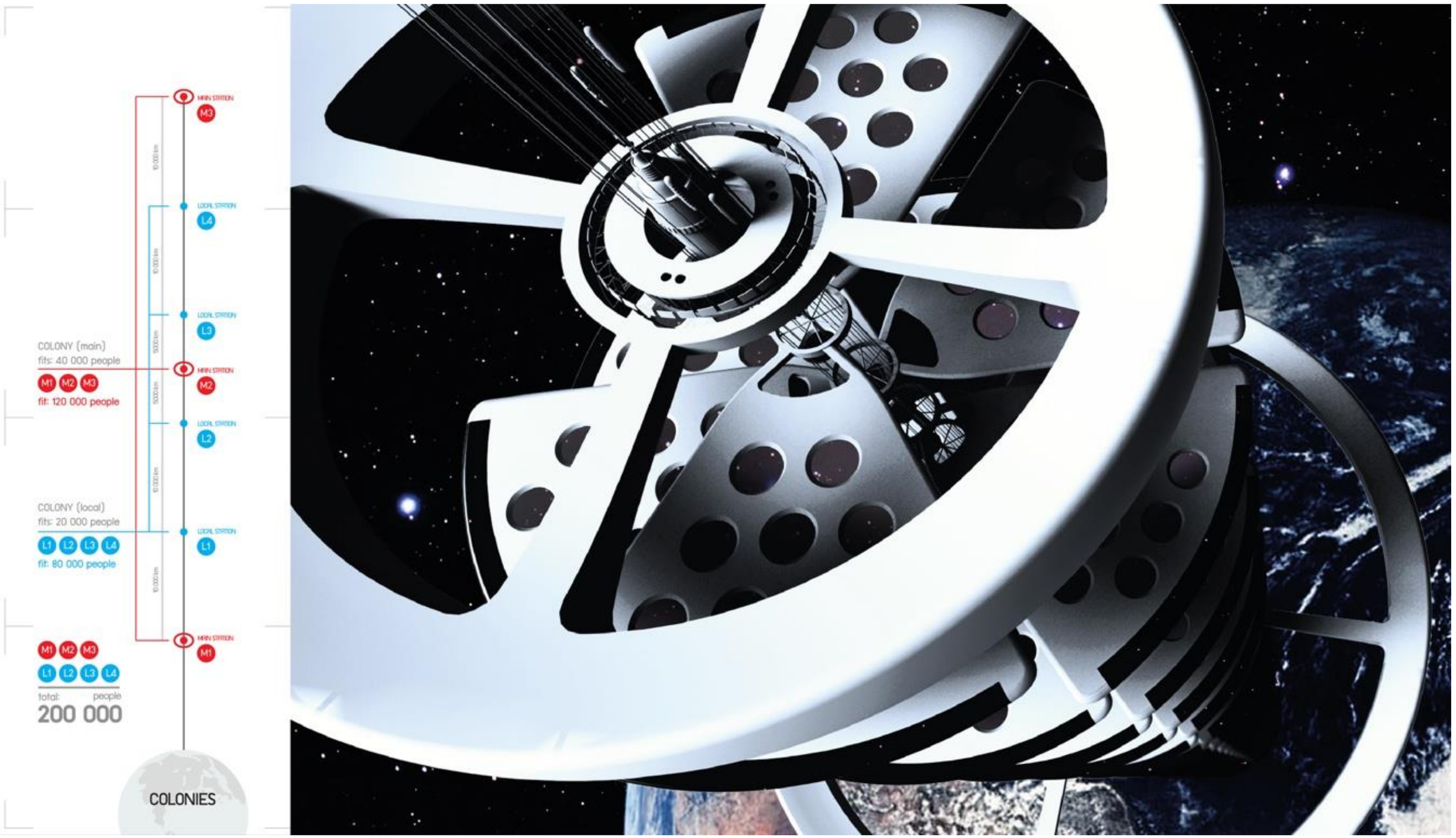
Number of LOCAL COLONIES
4

Overall capacity:
80,000

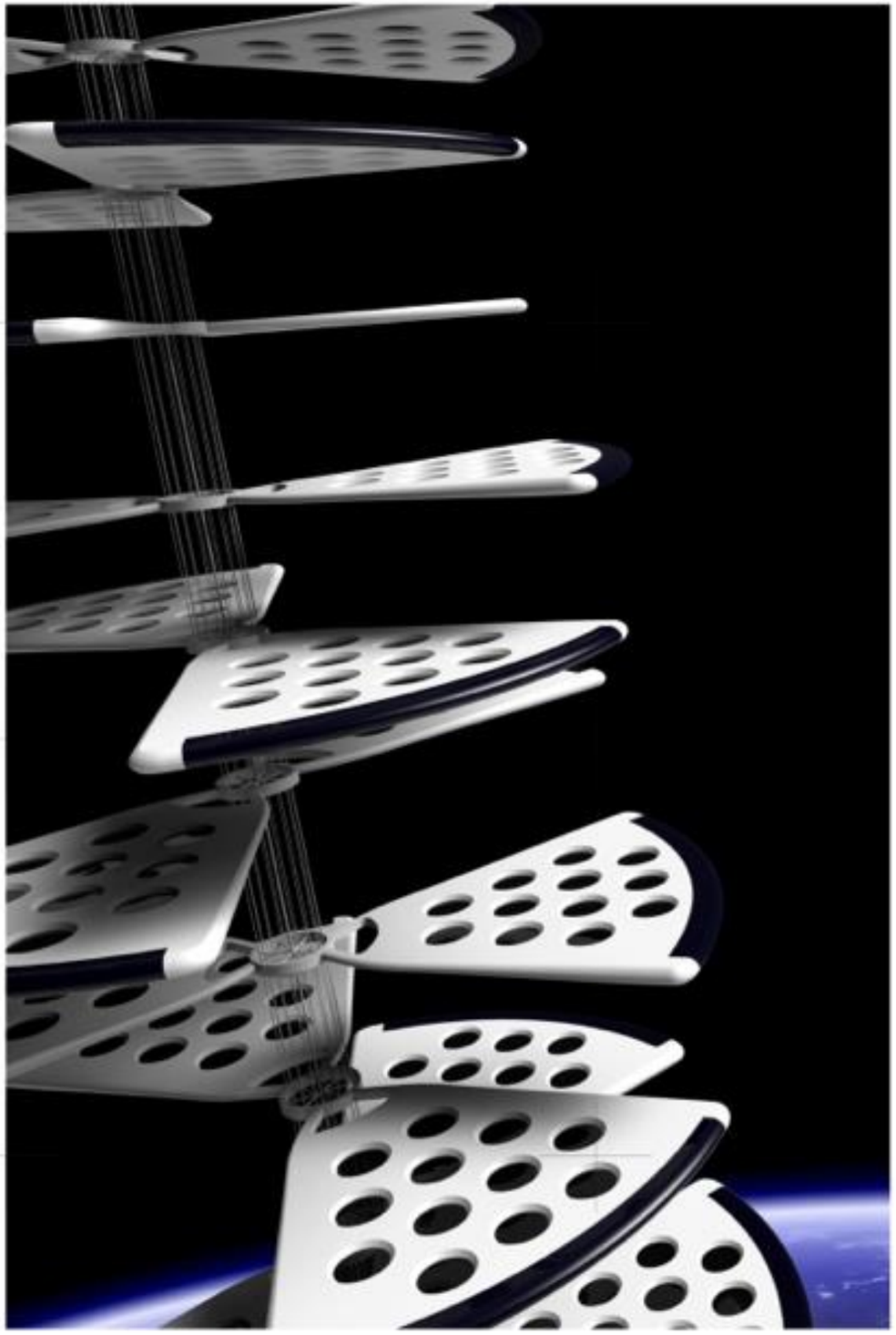
Total capacity:
200,000


MAIN STATION
M3
10 000 km
LOCAL STATION
L4
5000 km
LOCAL STATION
L3
COLONY (main)
fits: 40 000 people
M1 M2 M3
MAIN STATION
M2
fit: 120 000 people
5000 km
LOCAL STATION
L2
10 000 km
COLONY (local)
fits: 20 000 people
L1 L2 L3 L4
LOCAL STATION
L1
fit: 80 000 people
10 000 km
MAIN STATION
M1
M1 M2 M3
L1 L2 L3 L4
total: people
200 000
COLONIES

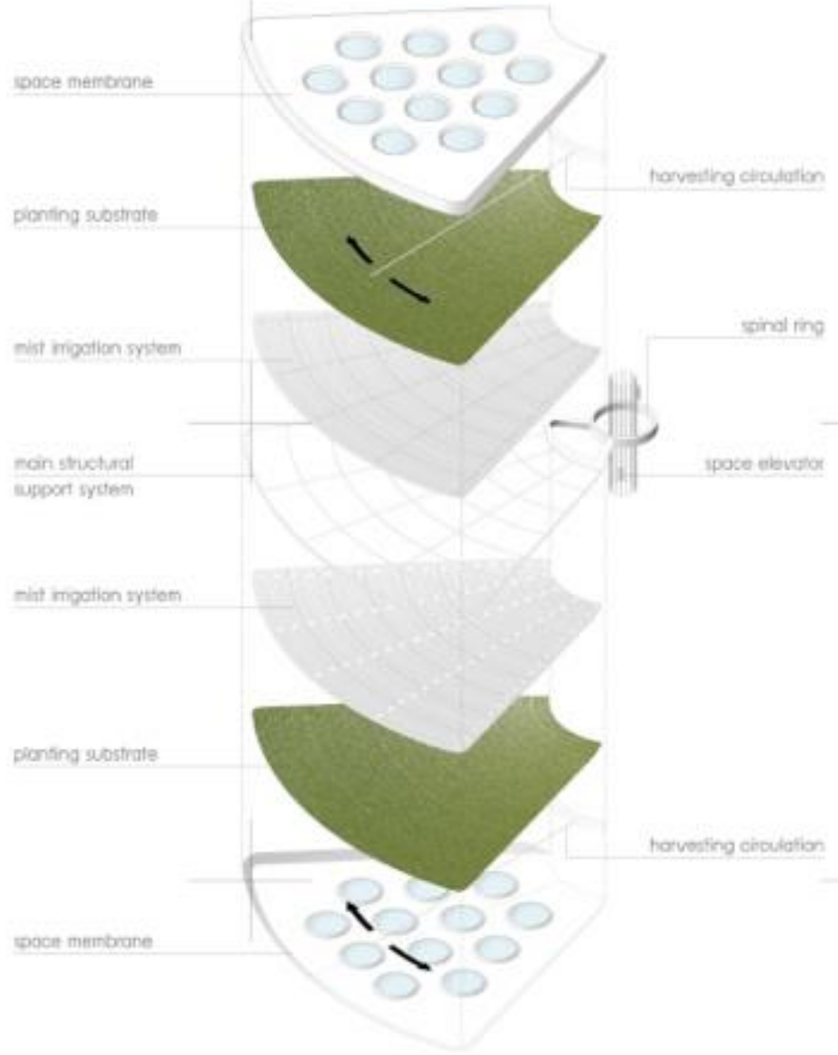


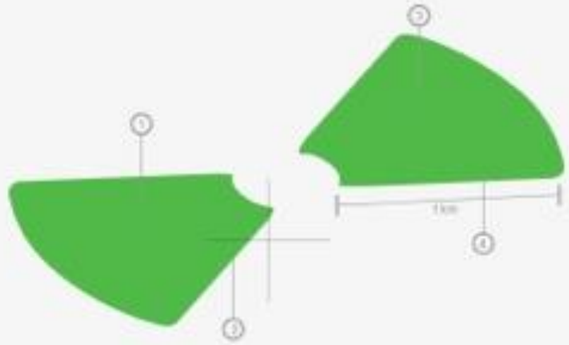

MAIN STATION
M3
LOCAL STATION
L4
LOCAL STATION
L3
COLONY (main)
fits: 40 000 people
M1 M2 M3
MAIN STATION
M2
fit: 120 000 people
LOCAL STATION
L2
COLONY (local)
fits: 20 000 people
LOCAL STATION
L1
L1 L2 L3 L4
fit: 80 000 people
M1 M2 M3
L1 L2 L3 L4
total: people
200 000
COLONIES

SPACE FARM



The SkyHarvest space farm takes agriculture 'off-Earth'. Each space farm is a dedicated environment for the optimized growth of crops. Each fan-shaped space farm has a mirrored twin and together they sit inside a diameter of 2 kilometres. Their location - in zero-gravity - allows all their surfaces to be freed for farming. Their farmable surface area is 3km2. Feeding an estimated 10 billion population requires a total surface area of 400,980km2. This surface area will satisfy basic nutritional needs for a future World population. Additional surface area can easily be made available for luxury food production until the maximum surface-area figure for farming is reached. This figure is 1,875,000km2 approximately four times 2100 requirements.





Area per face:
0.785 km²

over all area in one layer (4 face):
3 km²

MINIMUM capacity

Overall area of farm
400,980 km²

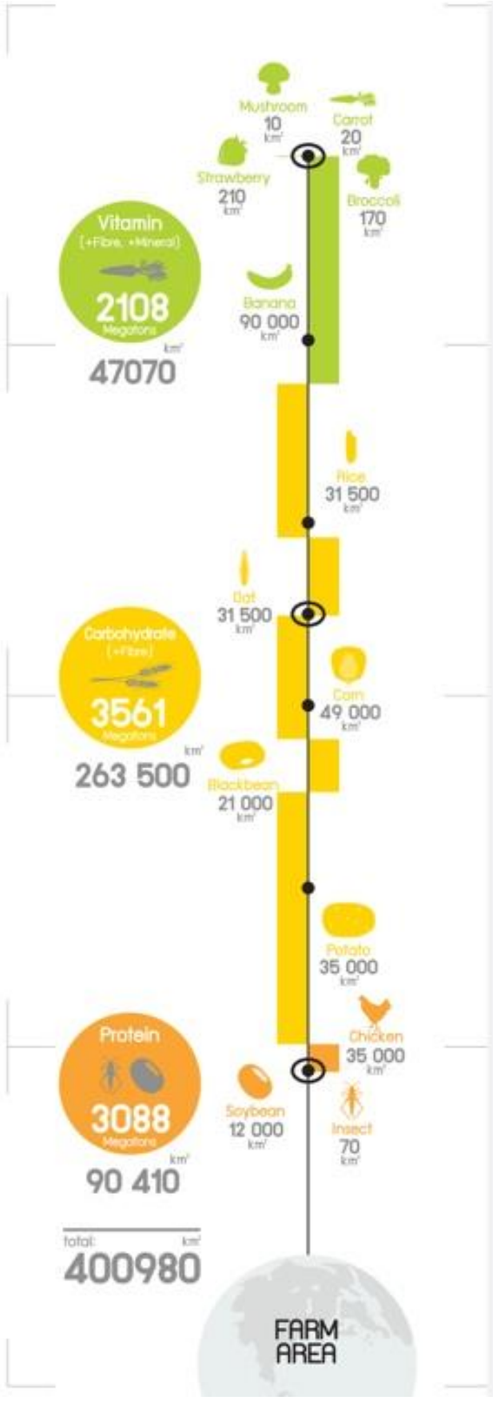
Number of layers:
133,660 layers

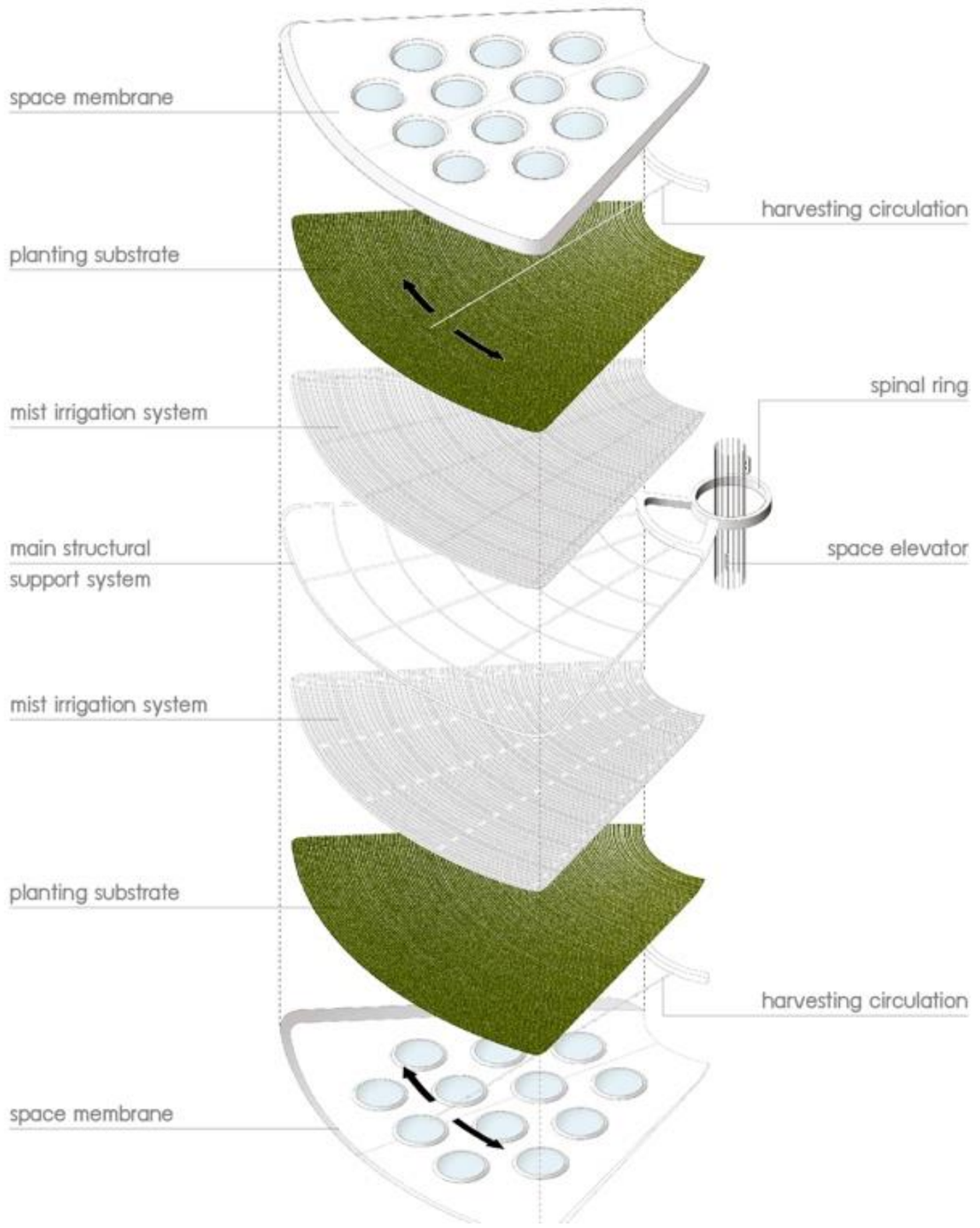
MAXIMUM capacity

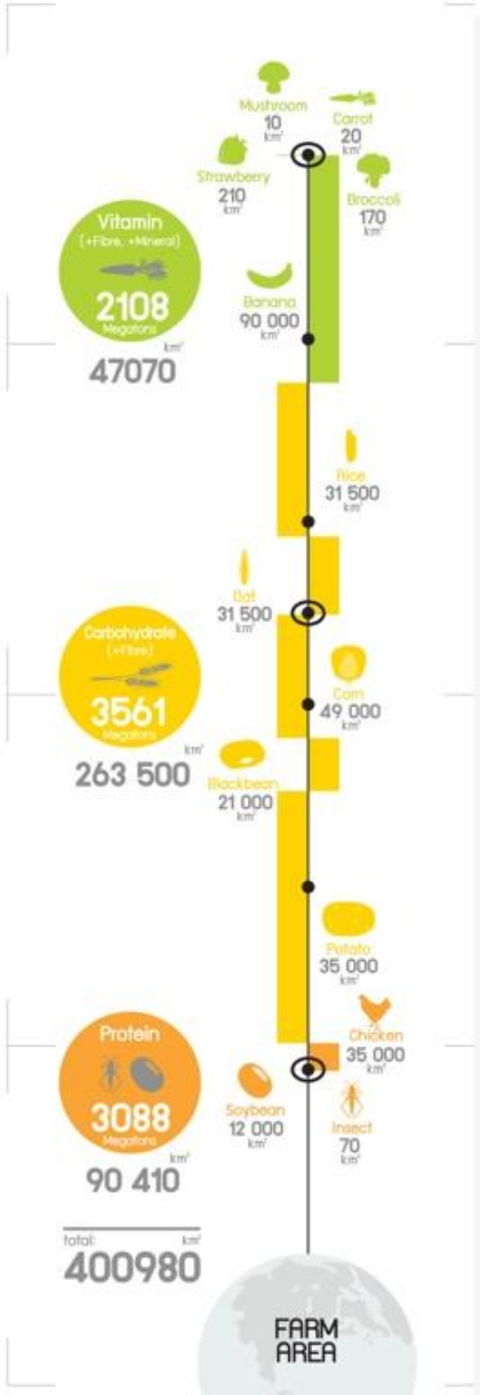
Overall area of farm
1,875,000 km²

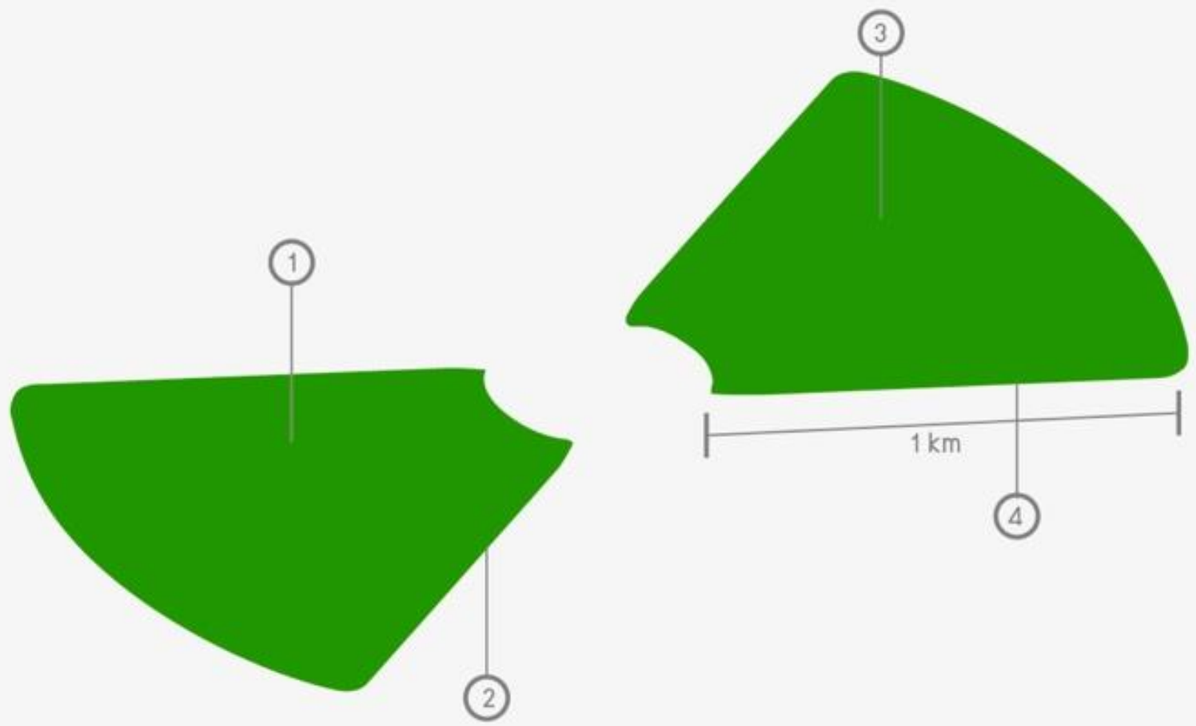
Number of layers:
625,000 layers

Ideal food production (2100) = 8757 megatons


Mushroom
10
Carrot
20
Strawberry
210
Broccoli
170
Vitamin
(+Fibre, +Mineral)
2108
Megatons
47070
Banana
90 000
Rice
31 500
Oat
31 500
Carbohydrate
(+Fibre)
3561
Megatons
263 500
Corn
49 000
Blackbean
21 000
Potato
35 000
Protein
3088
Megatons
90 410
Chicken
35 000
Soybean
12 000
Insect
70
total:
400980
FARM
AREA


space membrane
planting substrate
mist irrigation system
main structural
support system
mist irrigation system
planting substrate
space membrane
harvesting circulation
spinal ring
space elevator
harvesting circulation





Area per face:

0.785 km²

over all area in one layer (4 face):

3 km²

MINIMUM capacity

Overall area of farm

400,980 km²

Number of layers:

133,660 layers

MAXIMUM capacity

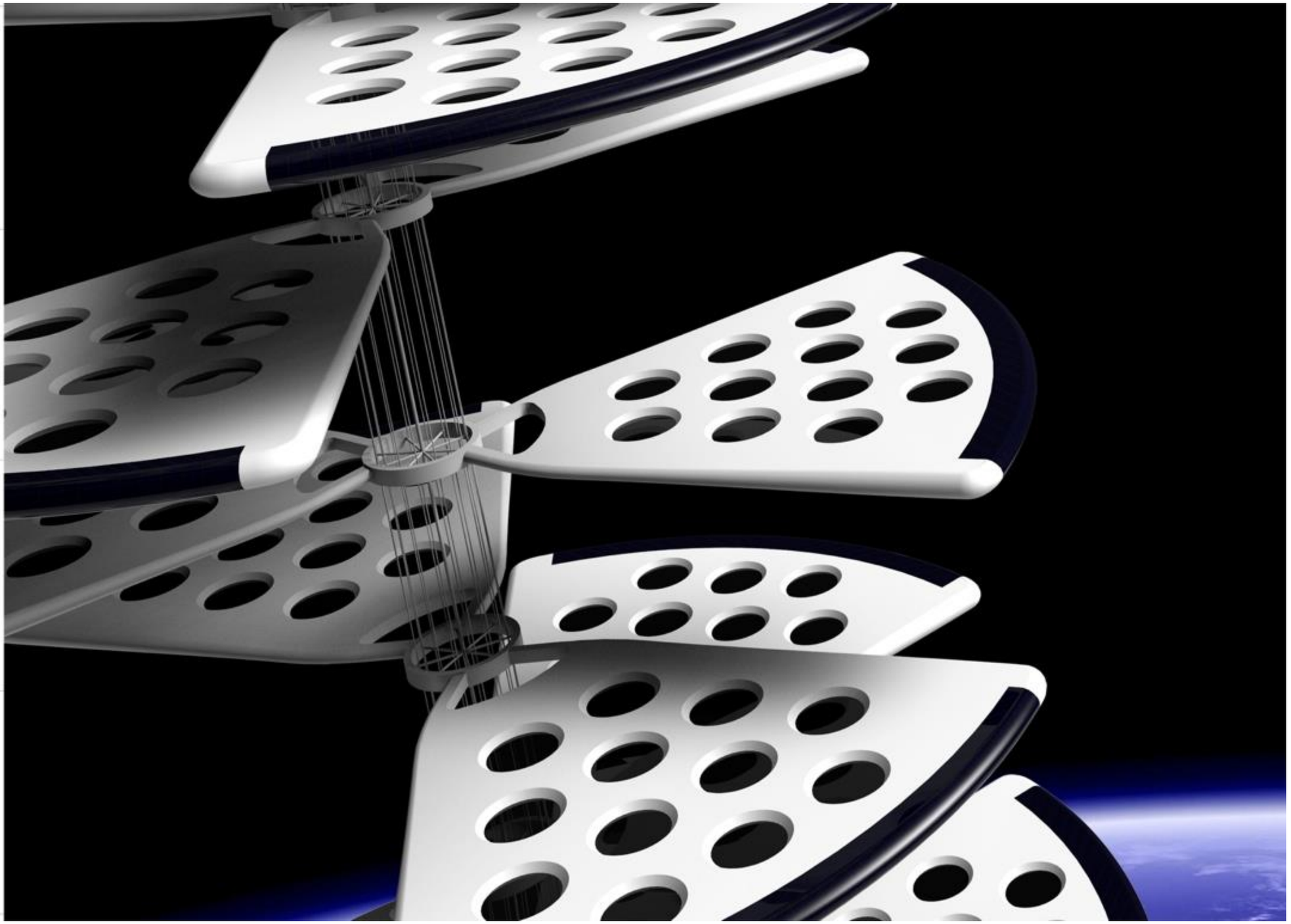
Overall area of farm

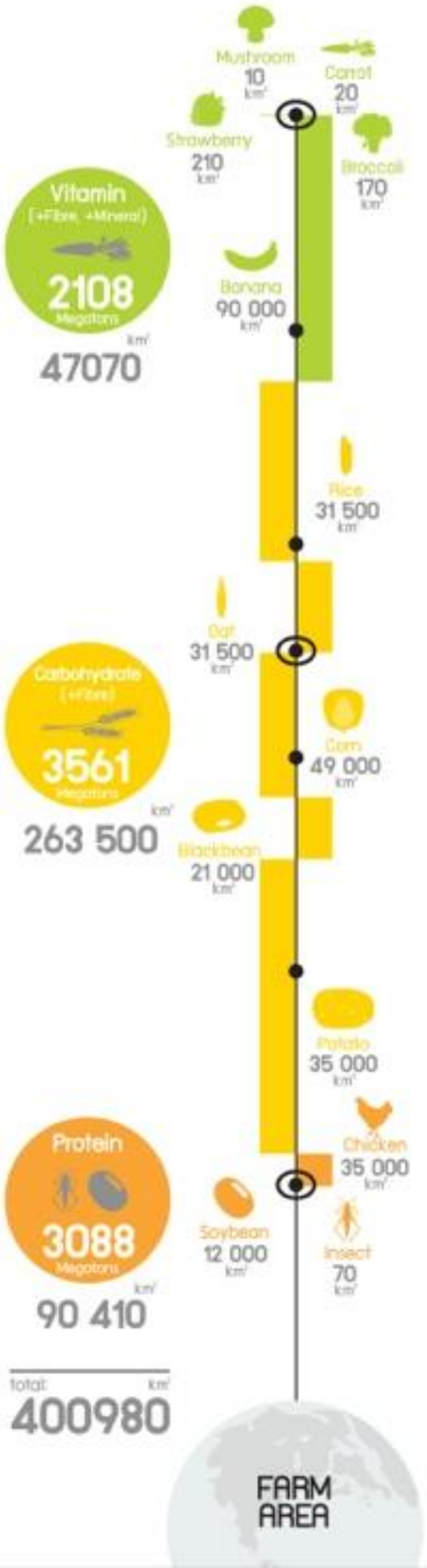
1,875,000 km²

Number of layers:

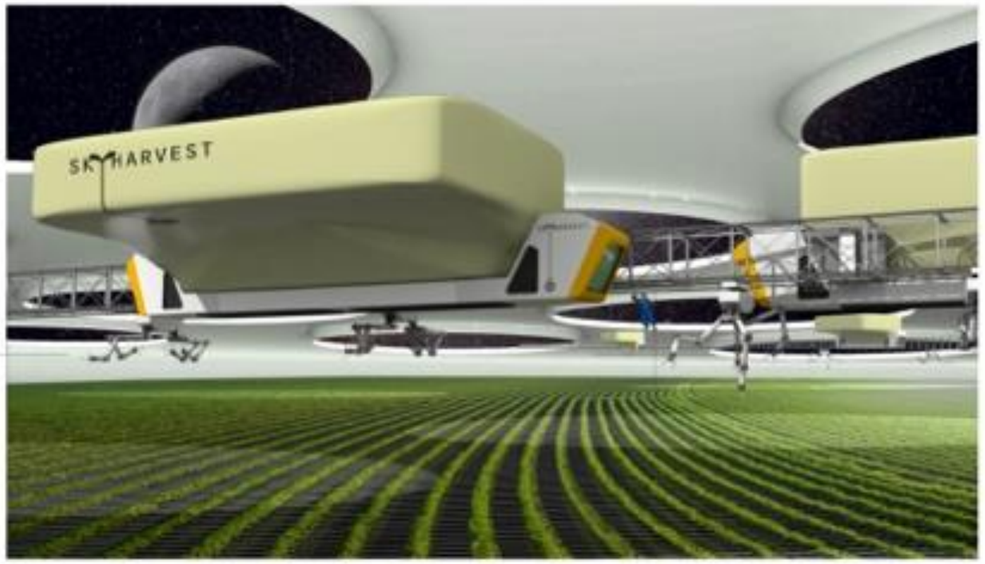
625,000 layers


Mushroom
10
km²
Carrot
20
km²
Strawberry
210
km²
Broccoli
170
km²
Vitamin
(+Fibre, +Mineral)
2108
Megatons
km²
47070
Banana
90 000
km²
Rice
31 500
km²
Oat
31 500
km²
Carbohydrate
(+Fibre)
3561
Megatons
km²
263 500
Corn
49 000
km²
Blackbean
21 000
km²
Potato
35 000
km²
Protein
3088
Megatons
km²
90 410
Chicken
35 000
km²
Soybean
12 000
km²
Insect
70
km²
total:
km²
400980
FARM
AREA





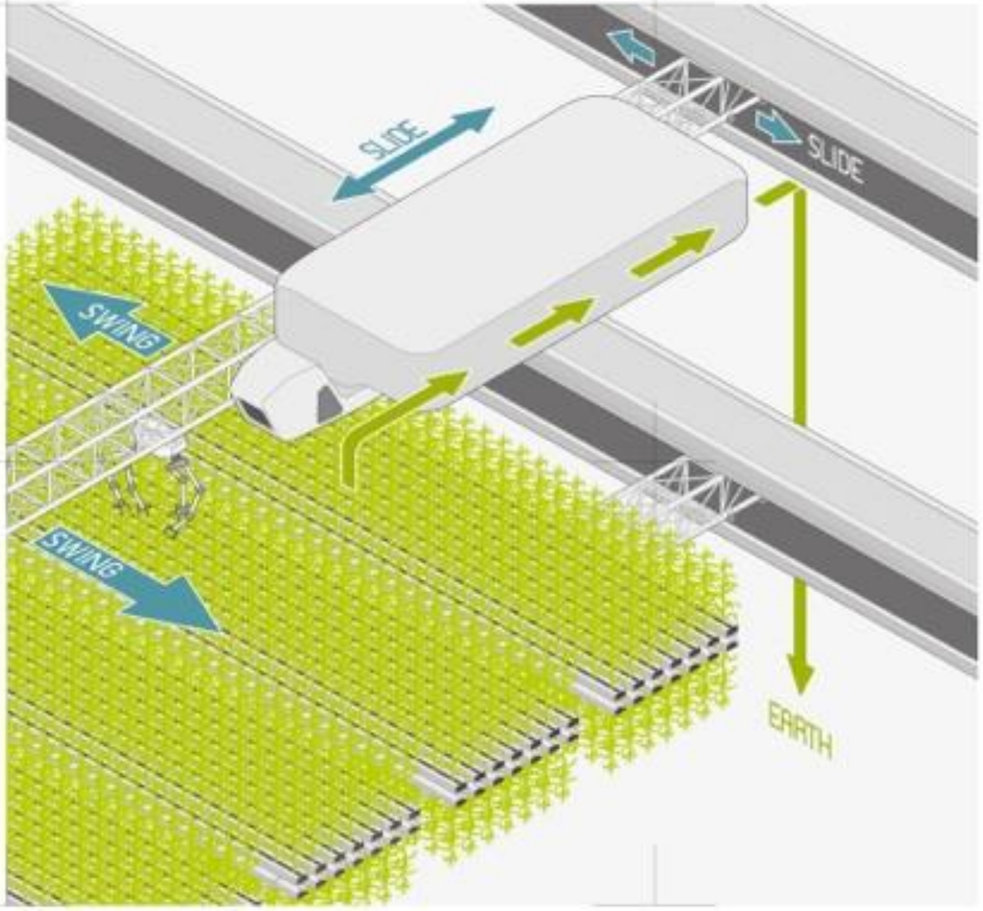
HARVEST

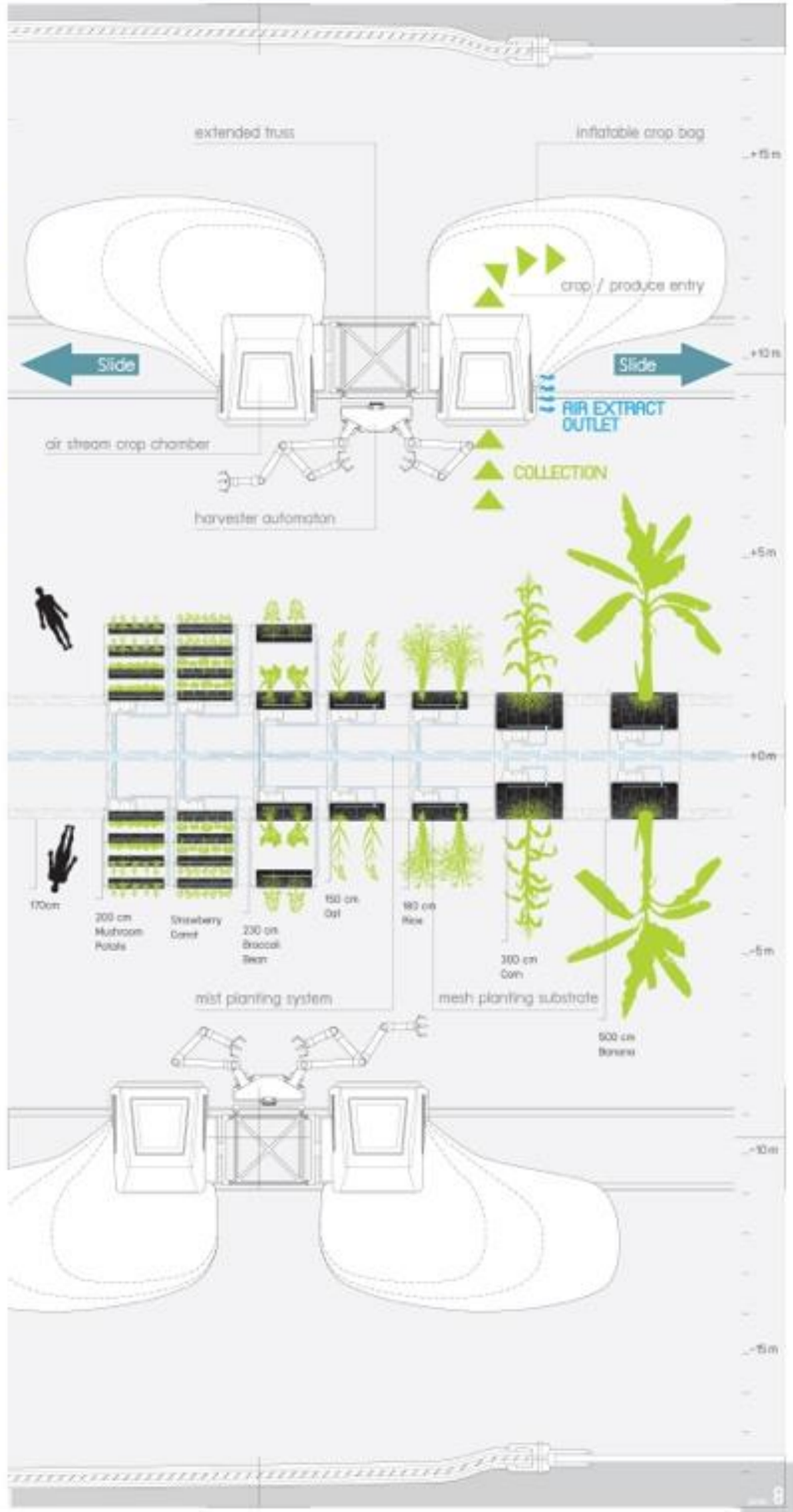


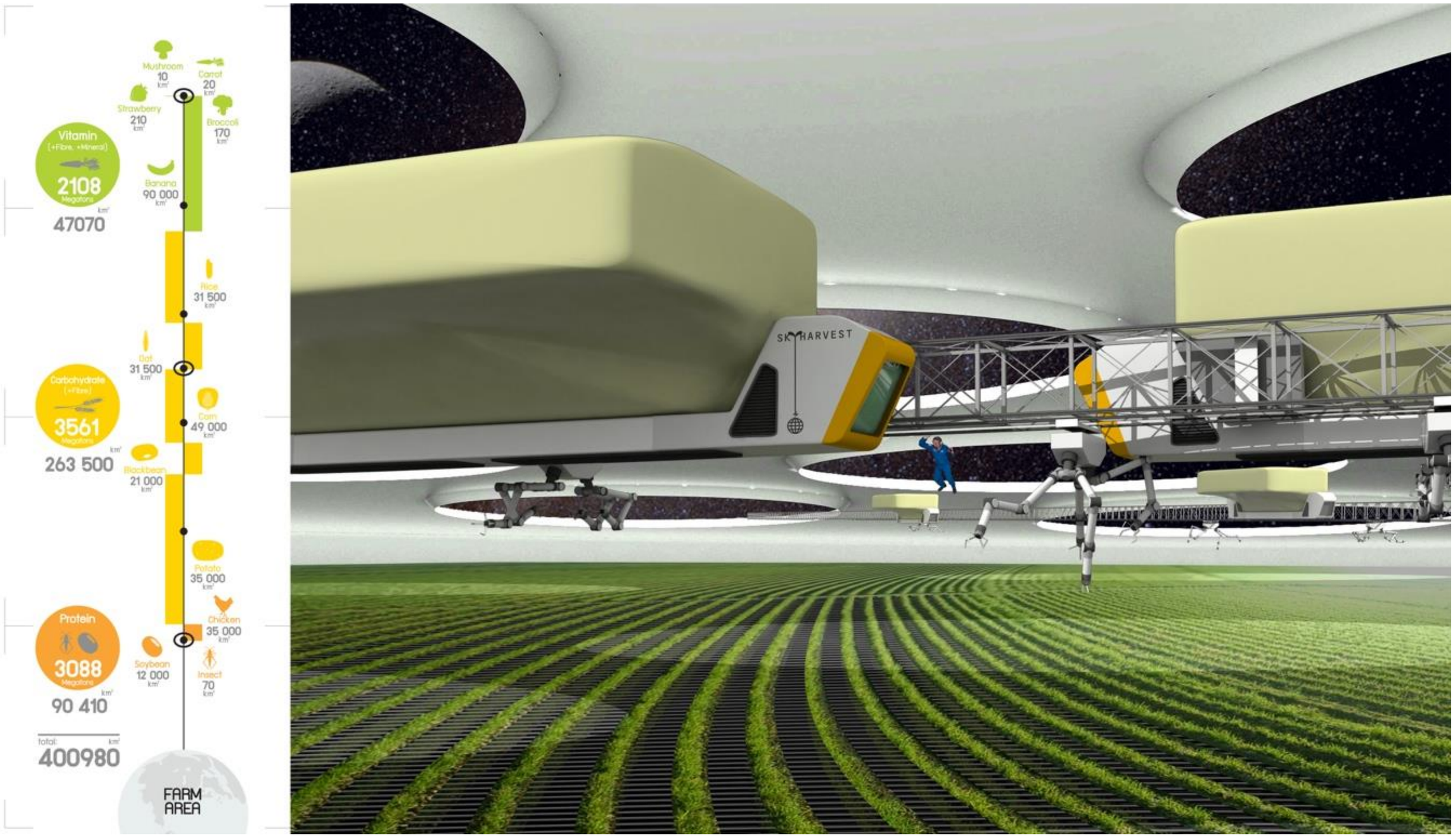
The SkyHarvest harvesting system is a complex automated structure. It does not use a growing medium. Irrigation involves a mist of nutrients absorbed slowly via a mesh screen. A soil-less environment produces faster growth rates and allows a higher density of plants/m2 to increase overall yield

Crops are collected via a series of cargo-vehicles activated during harvesting periods. These vehicles silently glide along extended truss-structures and use their omni-directional arms to precisely collect the ripened produce. An air-stream system allows all types of produce

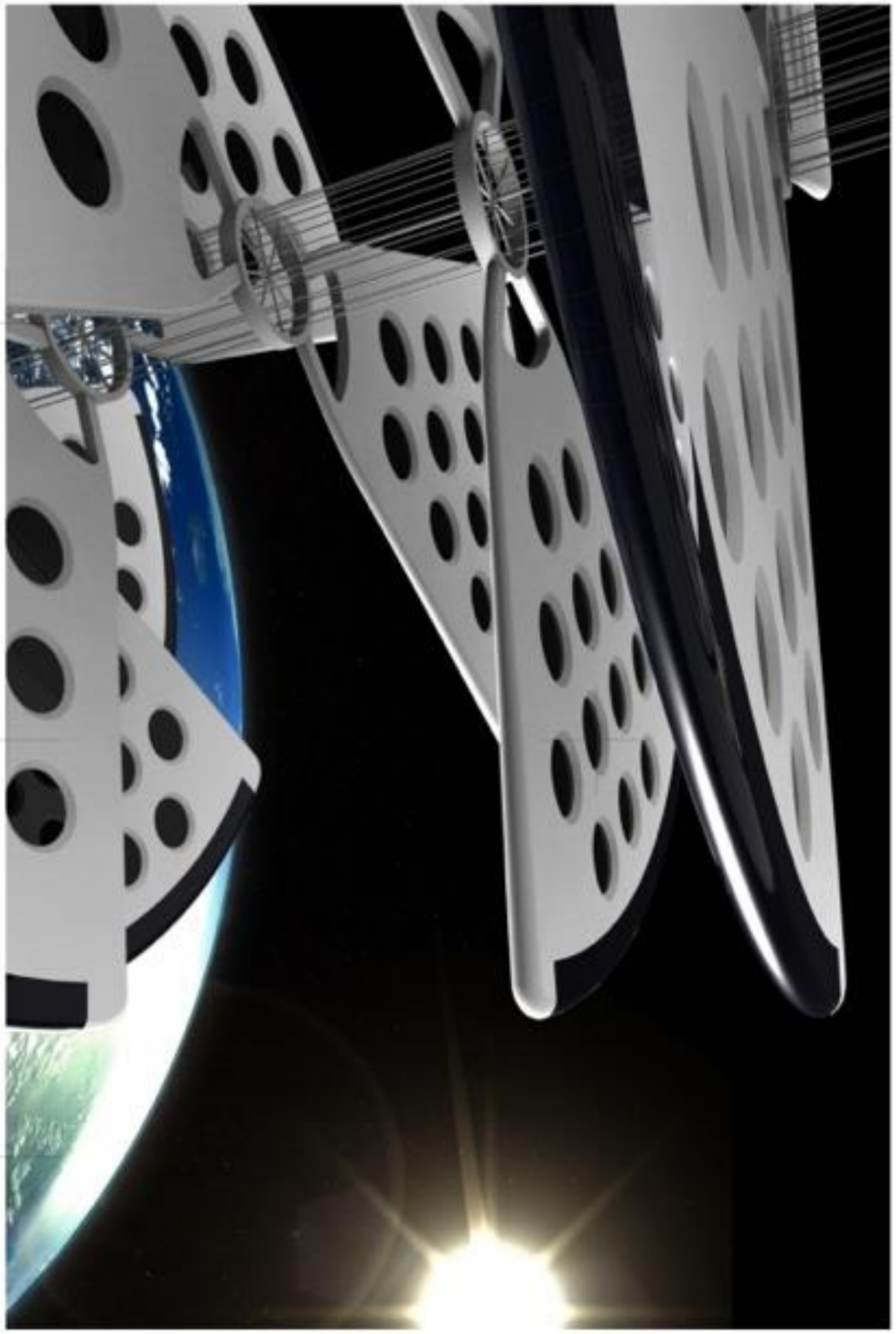
to be sucked into large fabric containers that sit alongside the cropping vehicles. In a single fluid process, large quantities of diverse 'produce' are collected, prepared and transported to a dedicated elevator hub for shuttling down to the Earth's surface for distibution.






Mushroom
10
km²
Carrot
20
km²
Strawberry
210
km²
Broccoli
170
km²
Vitamin
(+Fibre, +Mineral)
2108
Megatons
km²
47070
Banana
90 000
km²
Rice
31 500
km²
Oat
31 500
km²
Carbohydrate
(+Fibre)
3561
Megatons
km²
263 500
Corn
49 000
km²
Blackbean
21 000
km²
Potato
35 000
km²
Protein
3088
Megatons
km²
90 410
Chicken
35 000
km²
Soybean
12 000
km²
Insect
70
km²
total: km²
400980
FARM
AREA
SKYHARVEST

SOLAR FARM



Solar farms begin 10,000km above Earth. They collect an almost uninterrupted flow of solar radiation. This energy is transmitted back to Earth for distribution. Solar panels surround the outermost edges of each space farm. The minimum solar panel configuration provides 167,176,405 GwH.

With a 2013 global consumption figure reaching 20,000,000 GwH, the minimum configuration already exceeds requirements seven times over. A maximum surface area configuration produces 763,020,000 GwH, a figure considered beyond necessity. Advances in solar-efficiency increase performance by a factor of ten. Situated outside of Earth's atmosphere, the panel's performance increase by a further factor of ten. (98) With solar panels situated outside Earth's atmosphere, exposure time increases from 4 - 16 hrs/days

SOLAR CAPACITY

X10 CAPACITY

EARTH SPACE

In space (at satellite heights) the energy harnessed by Solar cells is ten times the capacity than on Earth

SOLAR AREA

SUN LIGHT

16hr. POTENTIAL period for sunlight

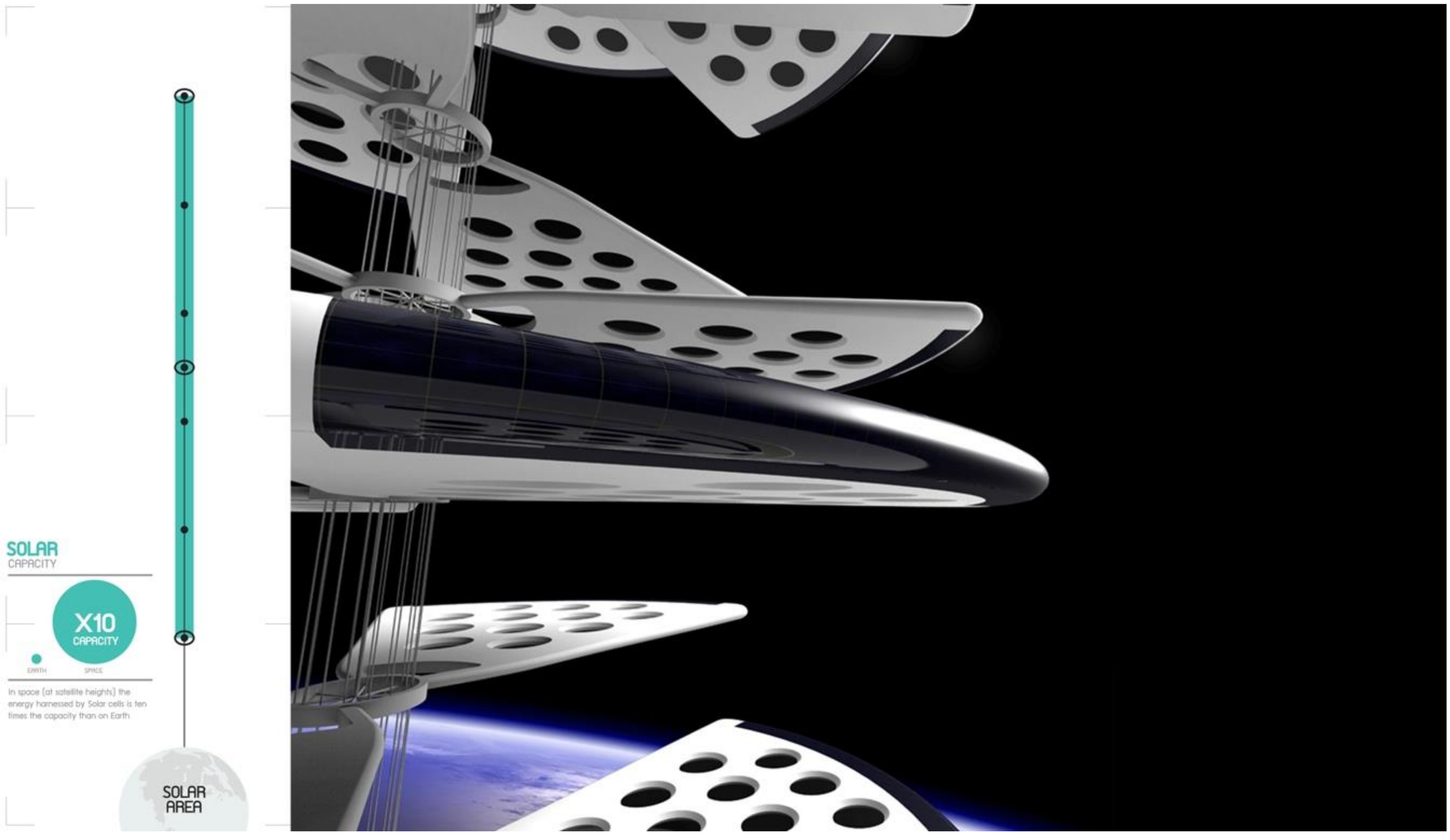
Area of Solar cell per one unit:

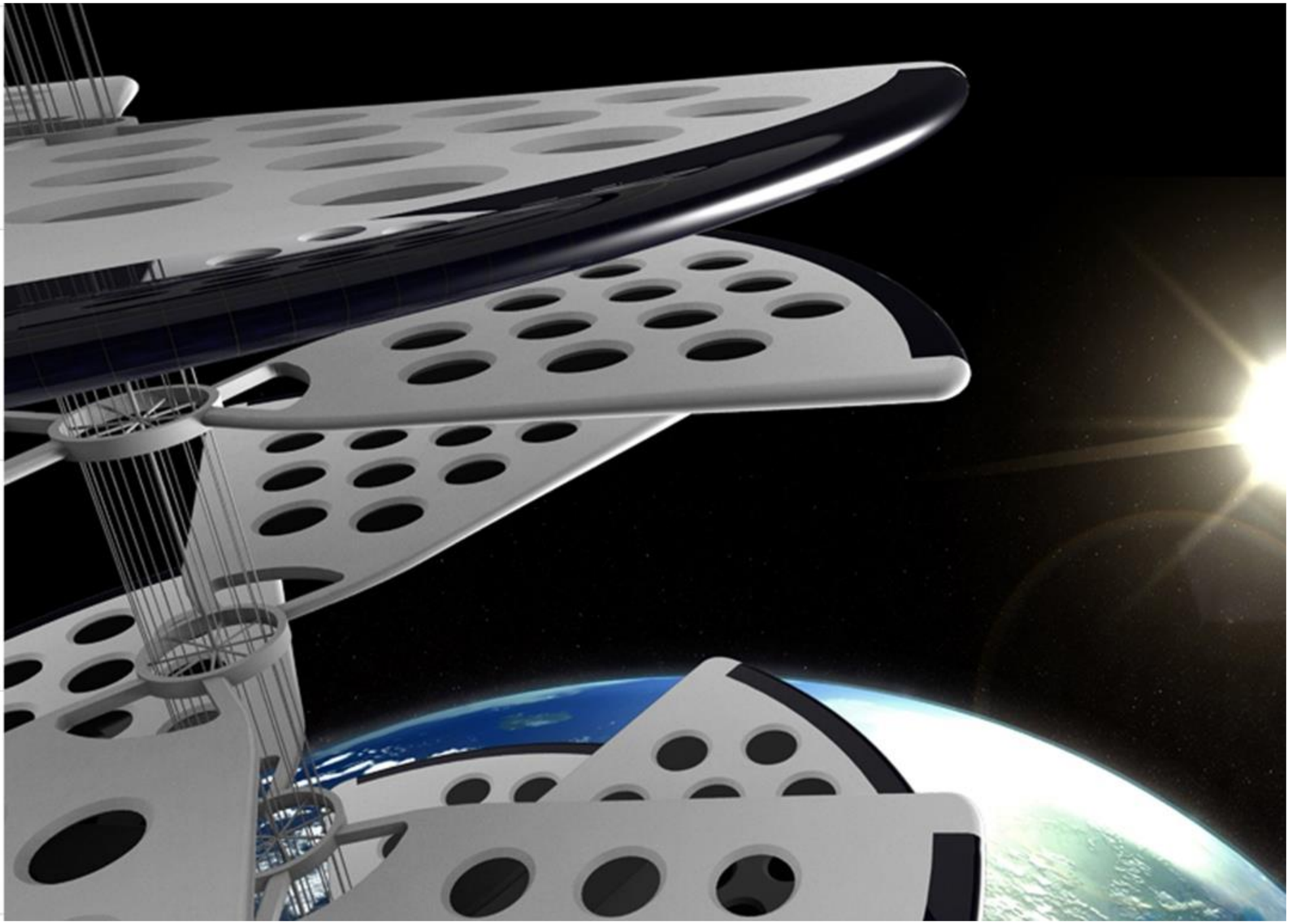
0.0471 km²

25,920 GWh / km² / year (2100)

MINIMUM capacity	MAXIMUM capacity
Overall area of Solar cells: 6295 km²	Overall area of Solar cells: 29437 km²
Number of layers: 133,660 layers	Number of layers: 625,000 layers
Overall energy produced / year (2100): 167,176,405 GWh	Overall energy produced / year (2100): 763,020,000 GWh

World electricity consumption (2100) = 28,602,000 GWh


SOLAR
CAPACITY
X10
CAPACITY
EARTH
SPACE
In space (at satellite heights) the energy harnessed by Solar cells is ten times the capacity than on Earth
SOLAR
AREA



SOLAR
CAPACITY

X10
CAPACITY

EARTH SPACE

In space (at satellite heights) the energy harnessed by Solar cells is ten times the capacity than on Earth

SOLAR
AREA

SKYHARVEST


SKYHARVEST
SKYHARVEST
HARVESTER
SKYHARVEST

SKYHARVEST

ALOXYGEN

藻を活用した火星移住計画の提案

ALOXYGEN
~Earth Homing Your Mars Life~

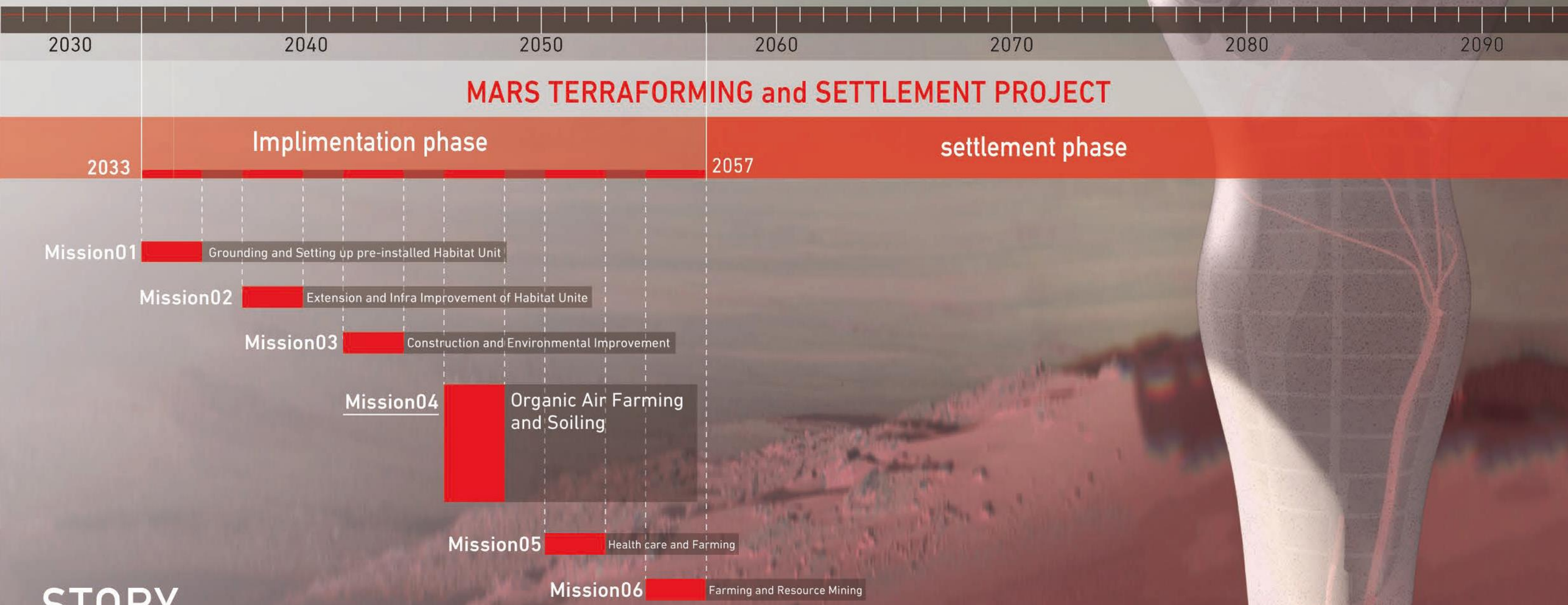
MARS Settlement Project

The big picture of the whole story is to create "Earth Homing" environment on Mars, and send Mankind to settle safe and healthy there by 2057.

01

ALOXYGEN = ALGAE + OXYGEN

ALOXYGEN serves Earth quality natural Organic fresh air for settler on Mars. ALOXYGEN also can produce nutritious food, bio-petroleum and compost every 2~3 weeks constantly. This system is going to be developed on terraforming in the future.



STORY

MTSP (Mars Terraforming and Settlement Project) is the most ambitious frontier project in human history. The idea of this MTSP is to bring Mankind to Mars and settle them down safe and healthy. It is planned to be completed by 2088 for turning Mars into "Earth Homing" colony for human being. This colony has to realize self-sustain environment with minimum resource supply from Earth. 40% of food has to be grown locally, 80% of air and water supply from recycling and percolation system, and 100% of energy resource production on Mars. In terms of achieving this big project,

MTSP is divided two phases. First phase is called "Implementation Phase" and second one is named "Settlement Phase.

The "Implementation Phase" is going to be completed by well-trained crew within 6 Missions from 2033 to 2057 for installing habitable units, basic infrastructure, transportation, farming soil and energy solution. It makes easier access to Mars for non-trained settlers in "Settlement Phase" in the end. Each Mission in first phase is scheduled 31 months long period.

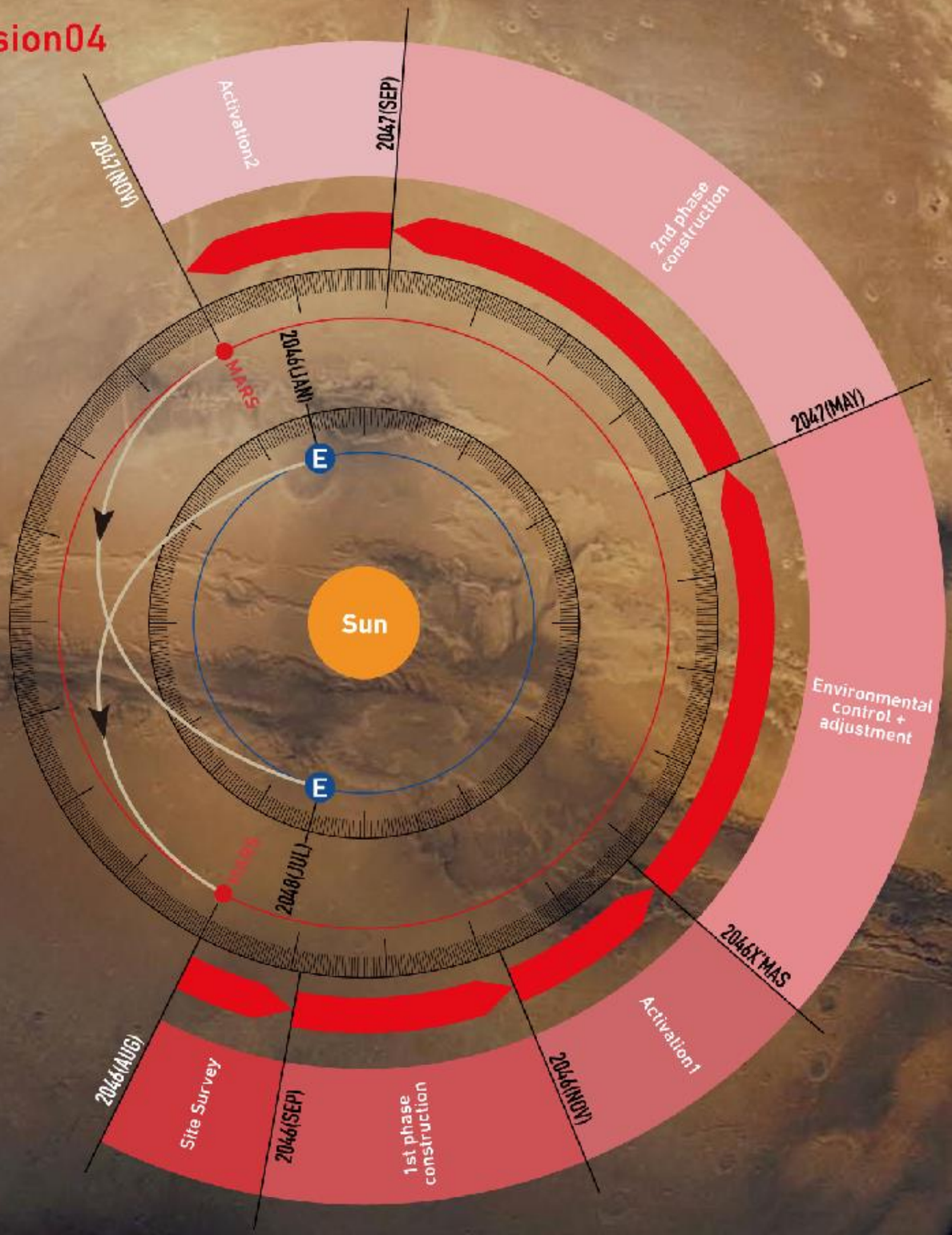
JACQUES ROUGERIE FOUNDATION
INSTITUT DE FRANCE

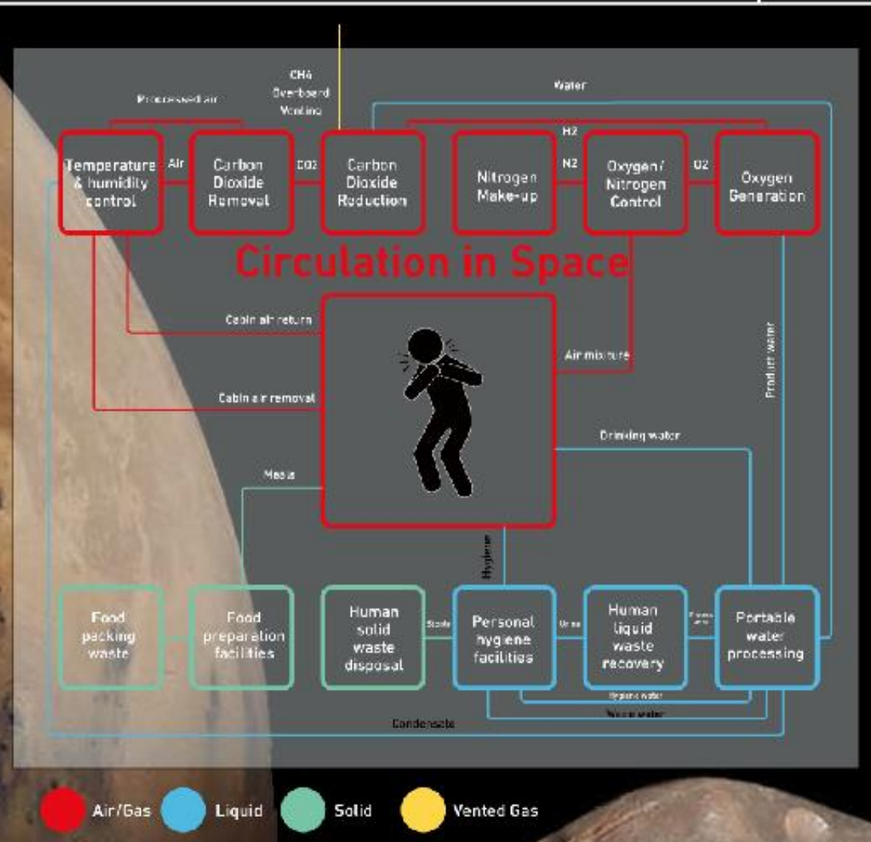
ALOXYGEN
-Earth Homing Your Mars Life-

Suffocation on MARS

It had occurred a mysterious symptom of suffocation during the project on Mars. Mission4 is about journeying towards to Mars for solving this problem.

Mission04





Suffocation

Many of the crews reported the suffocation during the mission on Mars, however the environmental research didn't find any cause of this symptom at the first place. According to the analysis through past three Missions, many of the crew members, who work very hard under pressure, were having symptom of suffocation often, however scientifically qualified fine air was well circulated in the room. The research team of their suffocation couldn' t discover any physical cause, and it had been a mysterious phenomenon for many years. After some analysis done by psychiatrist, the research team finally found that the "AIR" is the solution for this problem.

The crew members have many works to do everyday, heavy schedule and always feeling of oppression in artificially controlled room. We can' t simply be in such a circumstance, because our mental is not designed for being long time under artificial environment without nature for long time, since mankind never be isolated from nature in human history. Existing Environmental Control and Life Support System is an artificial process in closed environment which simply caused suffocation.

Mission4 is now journeying towards to Mars for solving the problem of suffocation. Their mission is scheduled 31 months long, from departure to Mars until returning to Earth. Duration of single trip between two planets is about 8 months on Hohmann Transfer Orbit. And 15 months working mission on the surface of Mars.

JACQUES ROUGERIE FOUNDATION
INSTITUT DE FRANCE

ALOXYGEN
~Earth Homing Your Mars Life~

Algae Solution

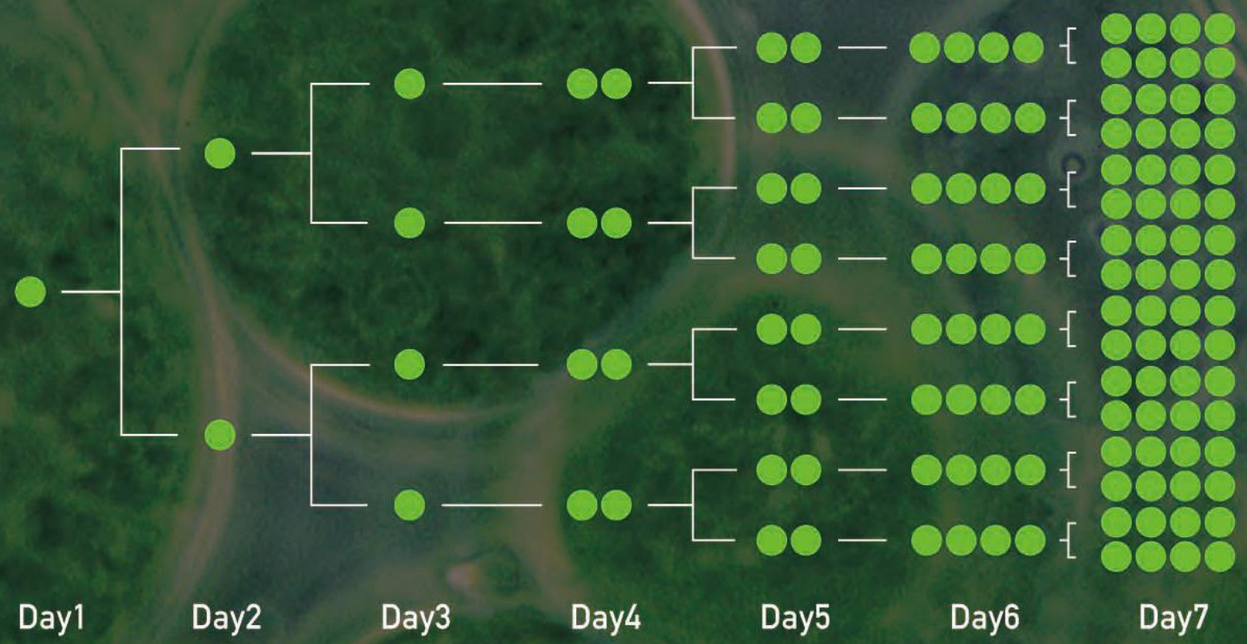
Algae is one of the first and the best organisms to take as company with you to the outer space mission for your survival.

More Oxygen with ALGAE

For Supplying 1.5L of Oxygen/day (human demands), you need 7.5 trees or 30L of Algae.Tree requires fertilized soil, amount of water and large environment, however Algae only require 30 Litter of water and much smaller environment for producing the same amount of Oxygen.

ALGAE is Rapid Proliferating Organism

A single cell of Algae will rapidly multiply 64 within 1 week, and 8,192 within 2 weeks!



ALGAE is Nutritious Food

- Protain
- Vitamin
- Mineral
- Amino Acid
- DHA

Algae include plenty of Protein, Vitamin, Mineral, Amino Acid and DHA.

Protein Proportion

50%

20%

Algae contains amount of protein almost 50% of its whole body.

ALGAE is Bio-petroleum

The organic oil is for generating electricity in the future.

ALGAE for Relaxation

Green is simply a color of Earth that all crews are missing on Mars.

JACQUES ROUGERIE FOUNDATION
INSTITUT DE FRANCE

ALOXYGEN
~Earth Homing Your Mars Life~

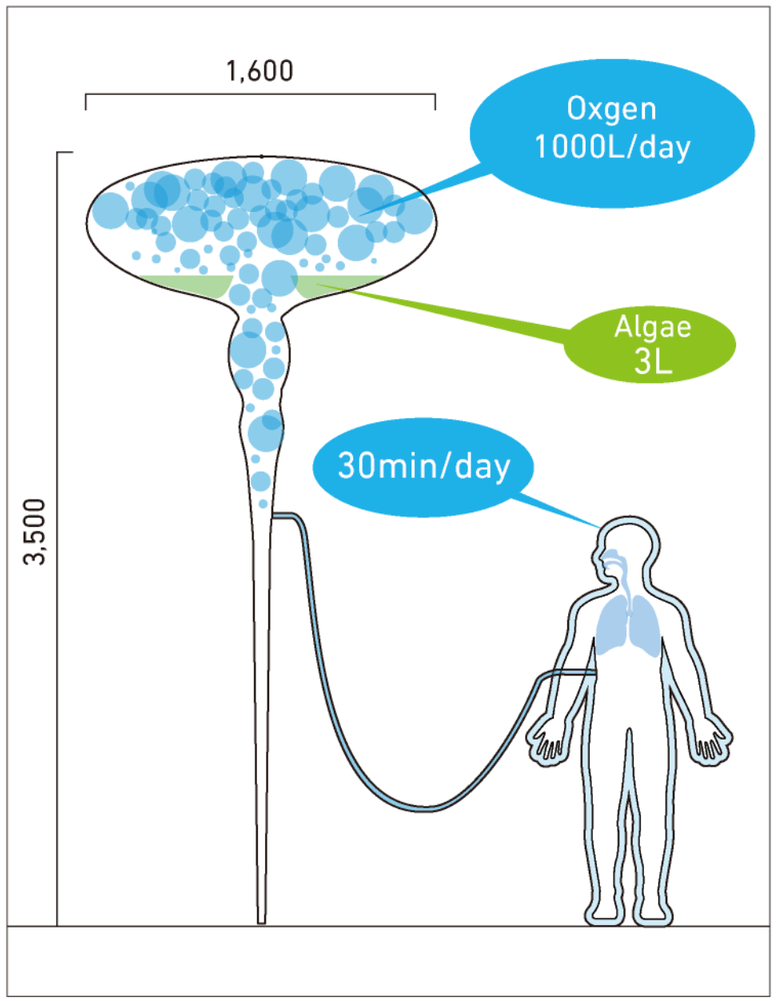
MARS Organic Air Farming

ALOXYGEN, the mushroom shaped product is simply a closed incubator with micro eco system that produce Organic Oxygen.

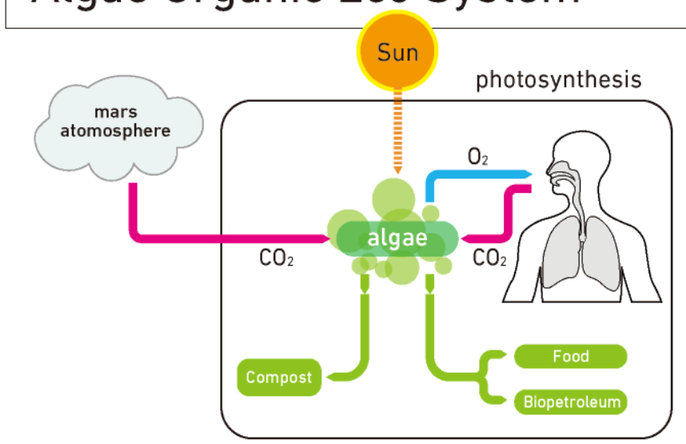
ALOXYGEN ~Earth Homing Your Mars Life~

MARS ORGANIC AIR FARMING
ALOXYGEN is an air server for Mars settler. It provides Earth quality natural Organic fresh air for vitalizing people physically and mentally in extreme environment on Mars. ALOXYGEN contains Algae incubator that generate Organic Oxygen by its photosynthesis.
The product is not only producing Oxygen, but also nutritious food, bio-petroleum and compost for soiling. ALOXYGEN invites human to complete algae micro eco system for gaining Carbon Dioxide from human breath. And this eco system is going to be developed on terraforming program in the future.

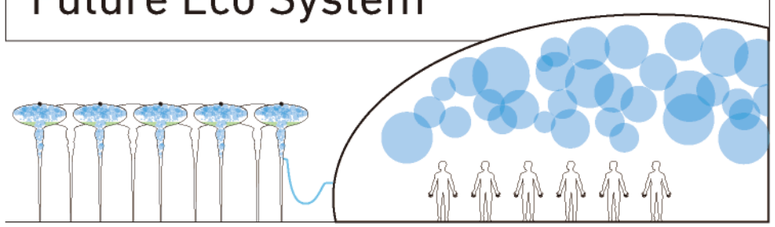
Our trained crew, Dr. Alg Aethome, engineer and biologist, is one of the 7crews in Mission4 this time. His mission is to complete first phase of ALOXYGEN installation before Christmas in 2046.
Once ALOXYGEN is installed, other crew members and settler can own their own ALOXYGEN, therefore you can name them, maintain them, take care of them, love their growth, and enjoy your own fresh air. Rising your ALOXYGEN with temperature control, circulation and feeding is one of the important activity that simply connect you to "a life of Earth" that keep you healthy as human being.



Algae Organic Eco System



Future Eco System



In 2088
1,300 ALOXYGENs support
pressurized Biosphere Dome.

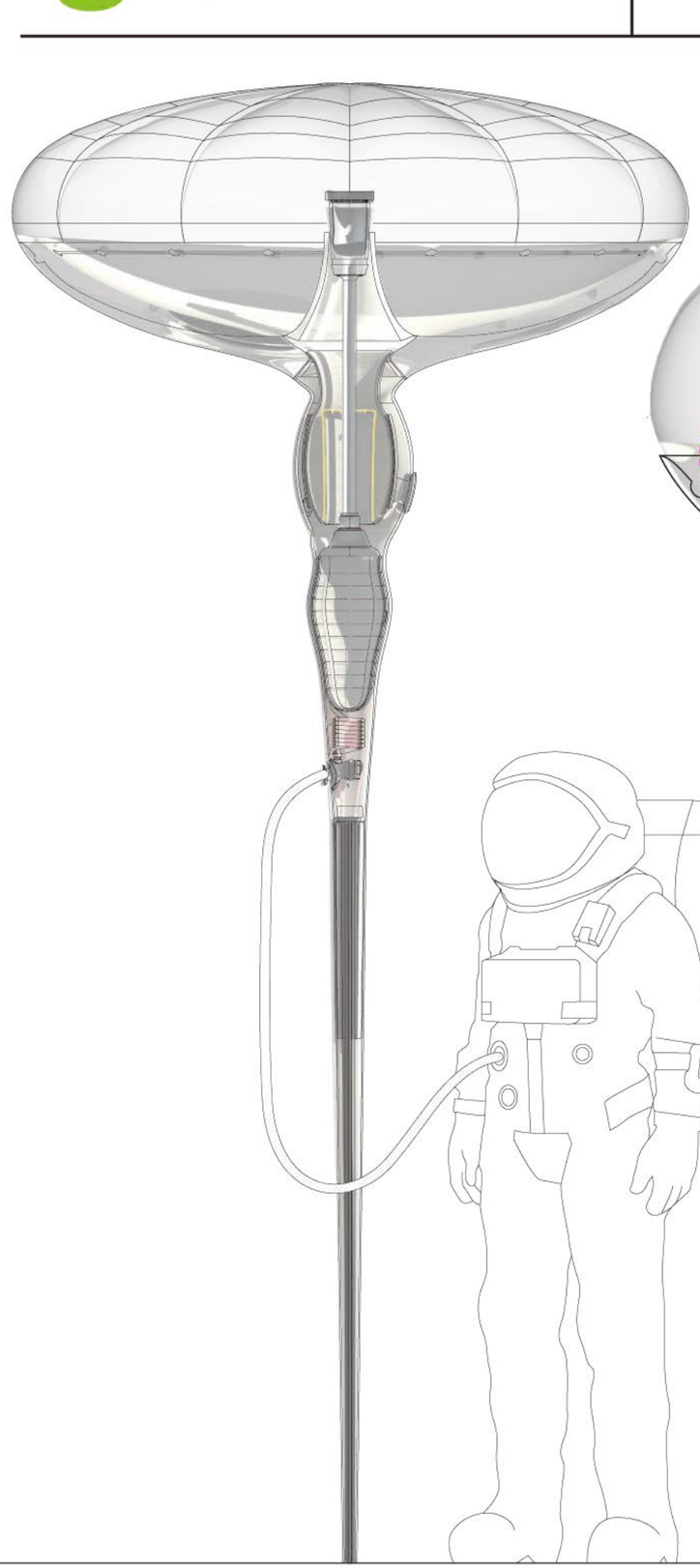
JACQUES ROUGERIE FOUNDATION
INSTITUT DE FRANCE

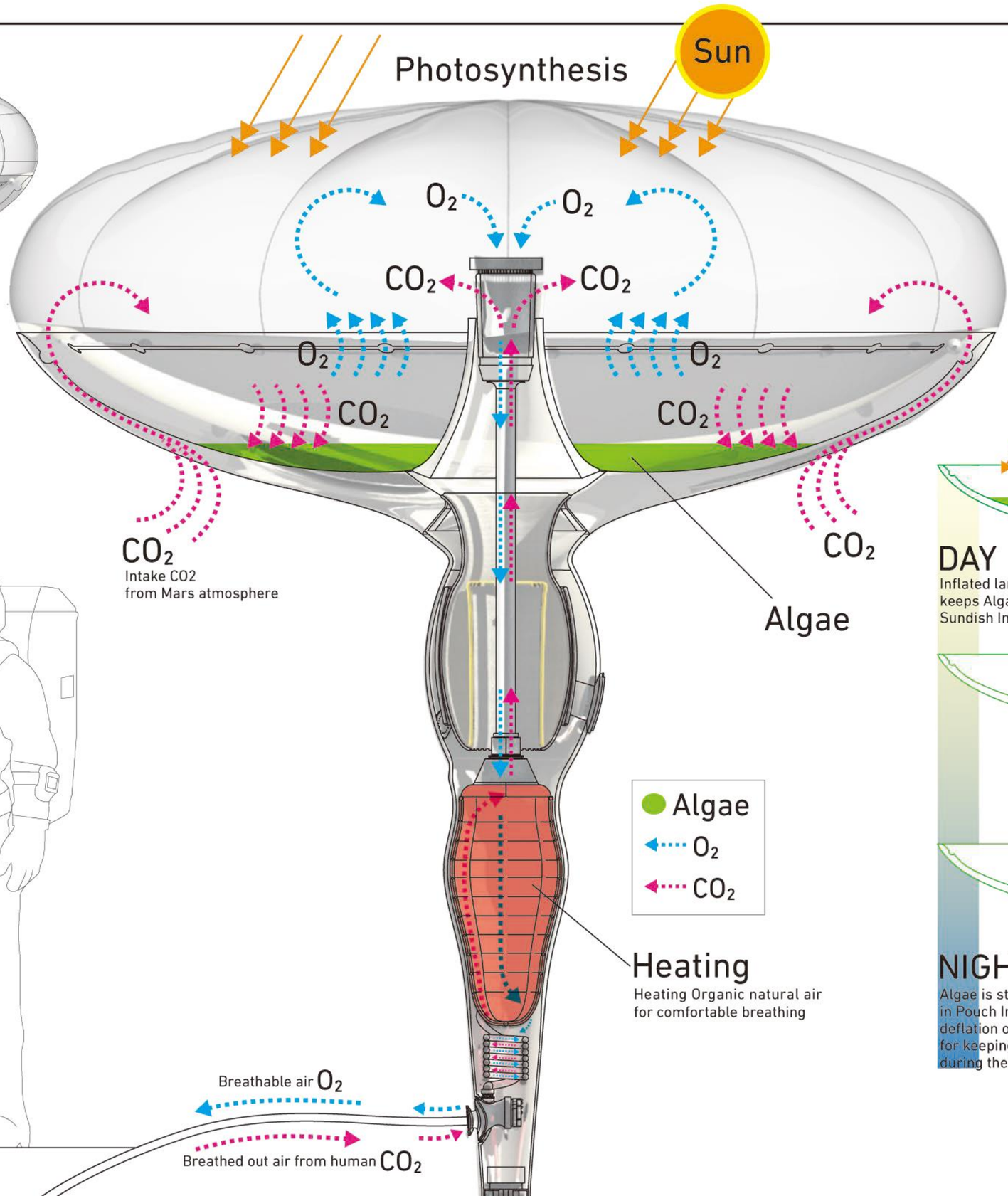
ALOXYGEN
~Earth Homing Your Mars Life~

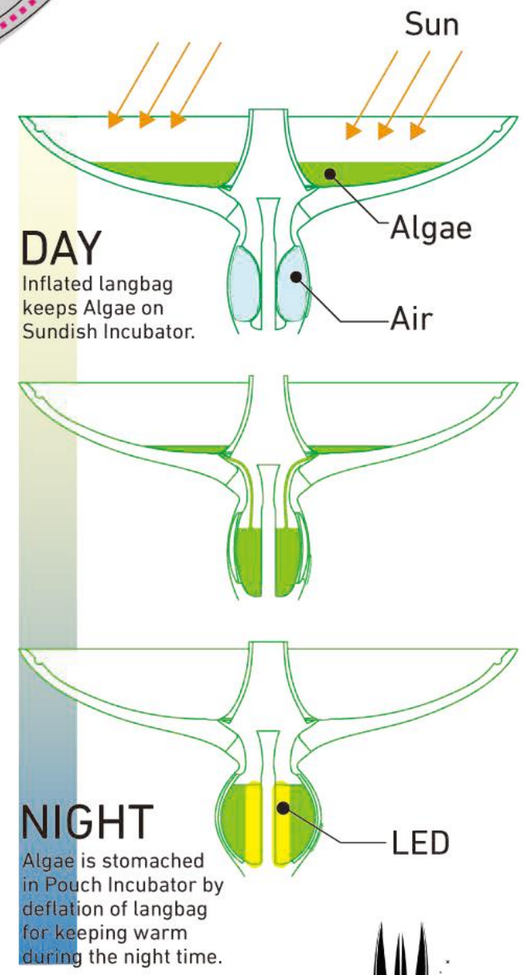
Algae and Air Circulation

Algae produces O2 during the day time on Photosynthesis Balloon effectively and stomached into thermal incubator during the night time.

05





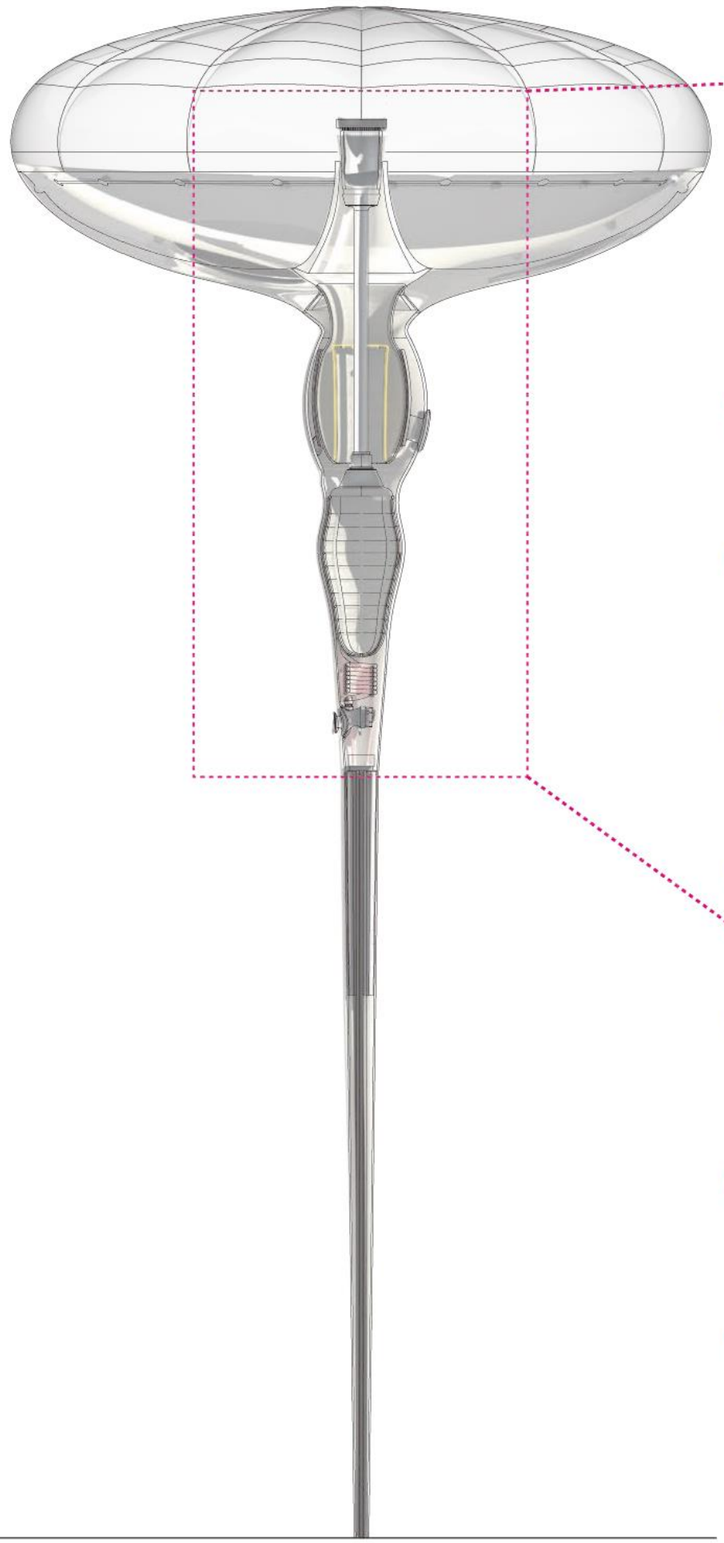


JACQUES ROUGERIE FOUNDATION
INSTITUT DE FRANCE

ALOXYGEN
~Earth Homing Your Mars Life~

Organs and Function

Biomaterial is partially used in this product because of durability compare to existing silicon based material. It is replaceable when the organs get older.



Anatomy Section

A Vent-Throat
Dual Ventilation system for O2 inlet and CO2 outlet

A Inlet Grill
Intake for Mars atmosphere (CO2)

a Lungbag
Pneumatic controller for Algae Incubator

a Pouch Incubator
for Algae for night sleep

a Algae Port
Activation Intake for Algae Socket injection

A O2 Bio-Pump
Room for breathing air storage and pumping system

E Heater
For Adjustment of breathing air temperature

A Air
a algae
E Energy

A Outlet Nozzle
Releasing CO2 from Mars for Algae' s Photosynthesis

E LED
Photosynthesis enhancer during night time

a Actuator for lungbag
Pulse control system for Lungbag

A Actuator for Vent-Throat
Controlling air traffic of O2 and CO2

A CO2 Vesslel
Bringing CO2 from breathing air to Algae Incubator

A Air Intake Port
Connect air-tube from Life Support system

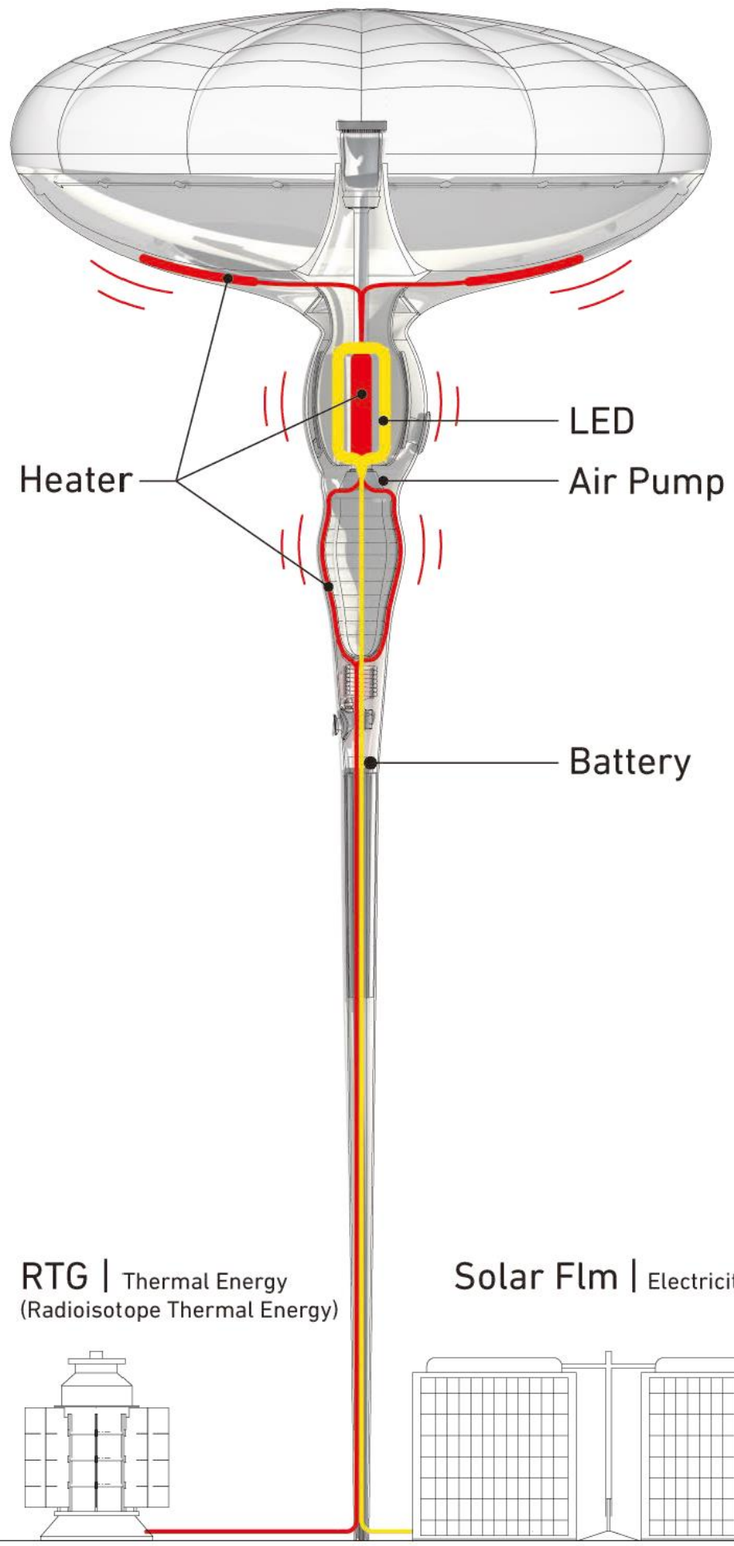
E Battery
Multi layered flexible solid electrolyte battery pack

JACQUES ROUGERIE FOUNDATION
INSTITUT DE FRANCE

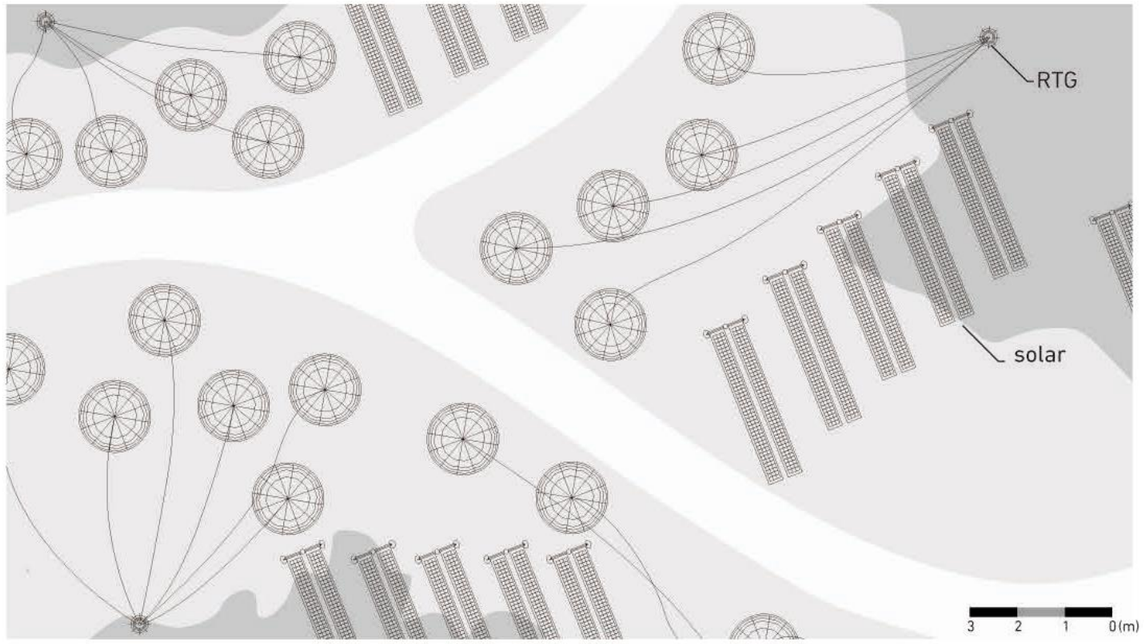
ALOXYGEN
~Earth Homing Your Mars Life~

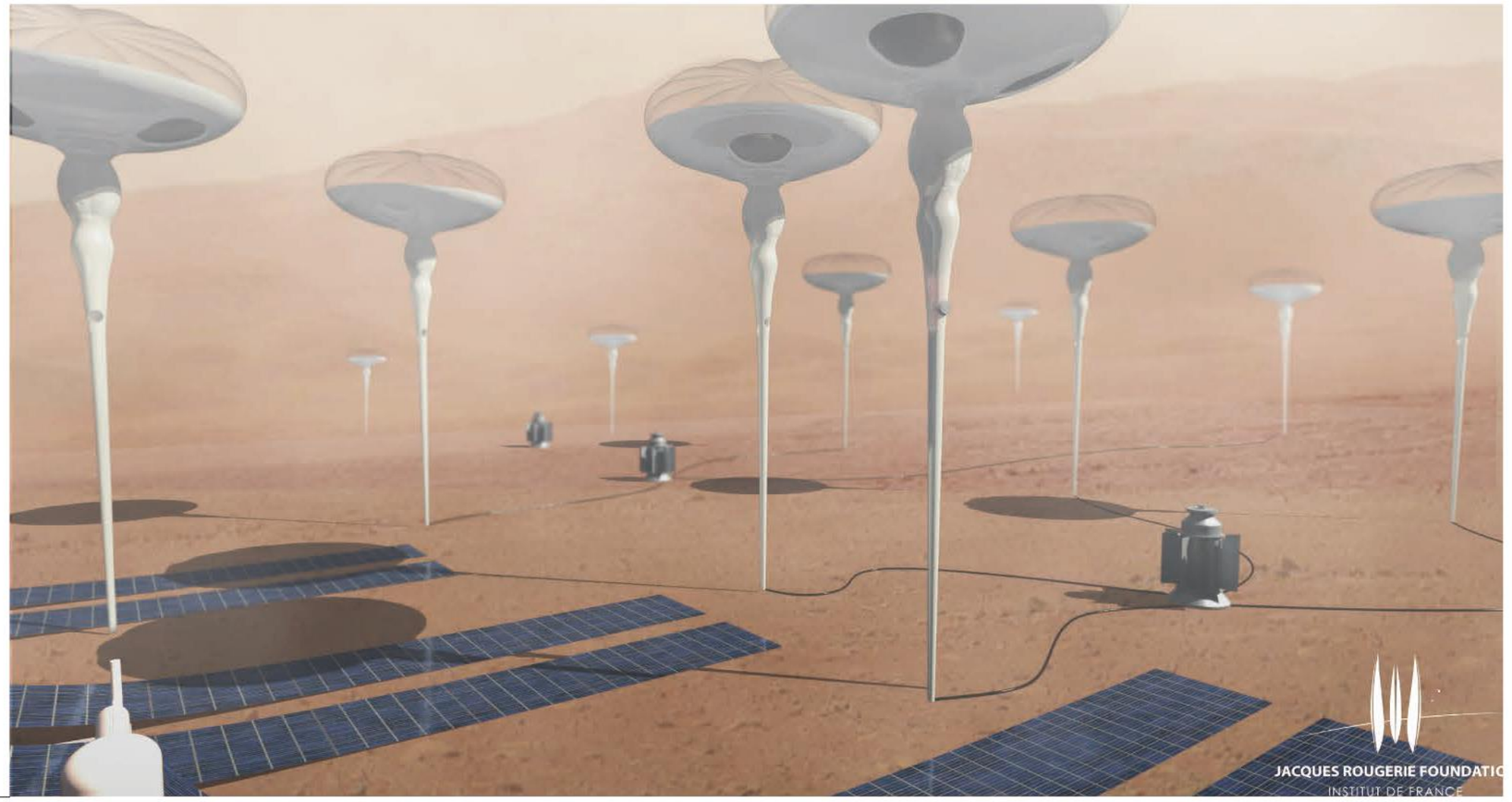
Energy System

ALOXYGEN is powered by solar cells for electricity and Radioisotope Thermoelectric Generator (RTG) for heating system.



ALOXYGEN requires small amount of electricity for making pulse to activate the whole system, however it requires large amount of thermal energy, because of keeping ideal temperature in cold weather on Mars. RTG (Radioisotope Thermoelectric Generator) provides 3500W ~ 4000W, for 25~30 ALOXYGENs at the same time. Number of solar film will generate 80kW for the first installation.

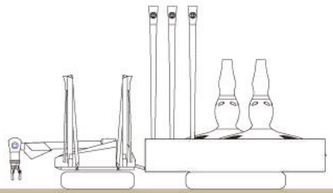




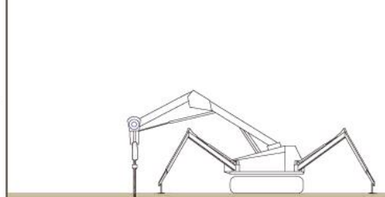
ALOXYGEN
~Earth Homing Your Mars Life~

Installation and Activation

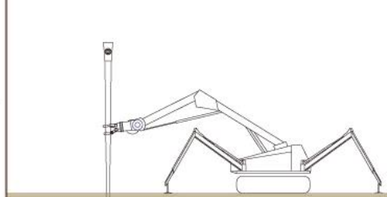
Construction of ALOXYGEN is very simple, such as boring vertical and build vertical. Apply Algae Socket which contains frozen Algae cell into Injection Inlet of ALOXYGEN for activate this system.



1: TRANSPORTATION: Carrying ALOXYGEN to planting site by Spider construction robot.

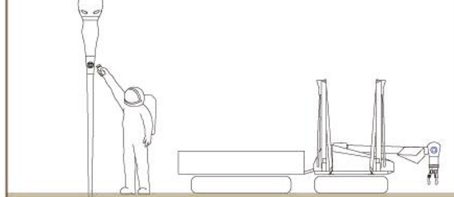


2: GROUNDING: Boring firm ground in the depth of 1500m.



3: CONSTRUCTION1: Positioning Main Mast vertically into the ground hole and strengthen the base.

4: CONSTRUCTION2: Attaching Incubator unit on top of the Main Mast.



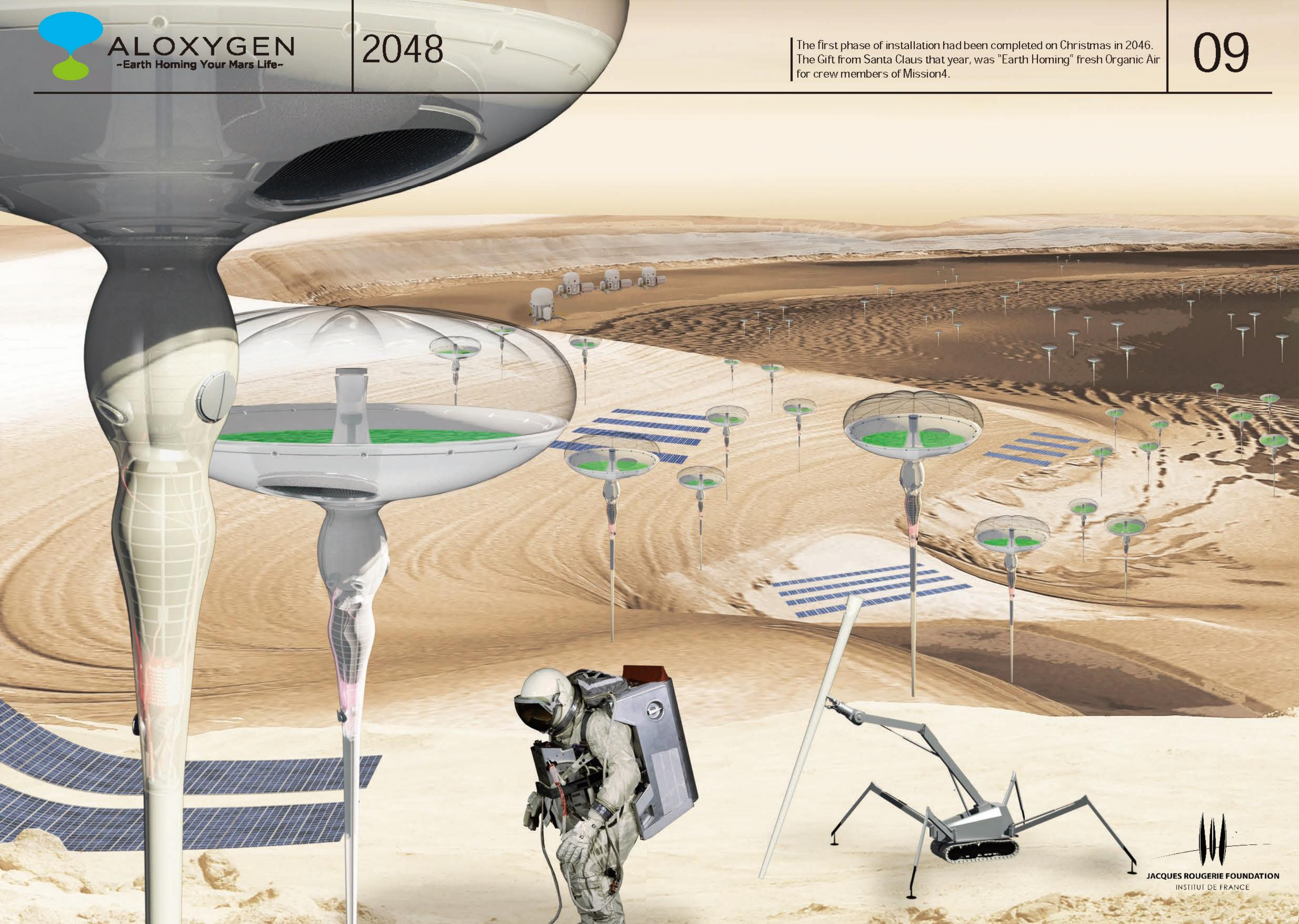
5: ACTIVATION: Inject the Algae Socket into the body and defrost and activate photosynthesis.

JACQUES ROUGERIE FOUNDATION
INSTITUT DE FRANCE

ALOXYGEN
~Earth Homing Your Mars Life~

2048

The first phase of installation had been completed on Christmas in 2046.
The Gift from Santa Claus that year, was "Earth Homing" fresh Organic Air for crew members of Mission4.

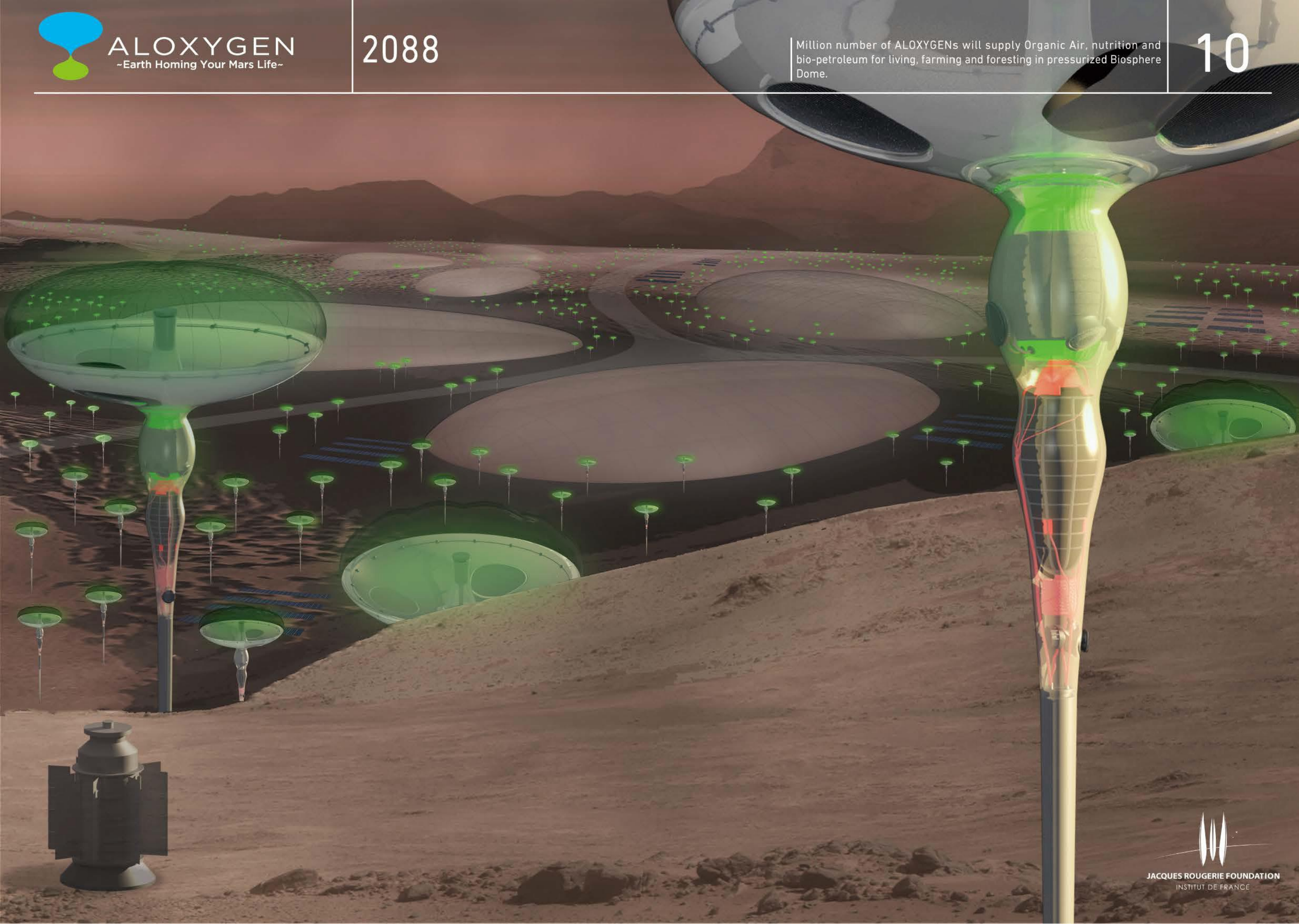


JACQUES ROUGERIE FOUNDATION
INSTITUT DE FRANCE

ALOXYGEN
~Earth Homing Your Mars Life~

2088

Million number of ALOXYGENs will supply Organic Air, nutrition and bio-petroleum for living, farming and foresting in pressurized Biosphere Dome.



JACQUES ROUGERIE FOUNDATION
INSTITUT DE FRANCE