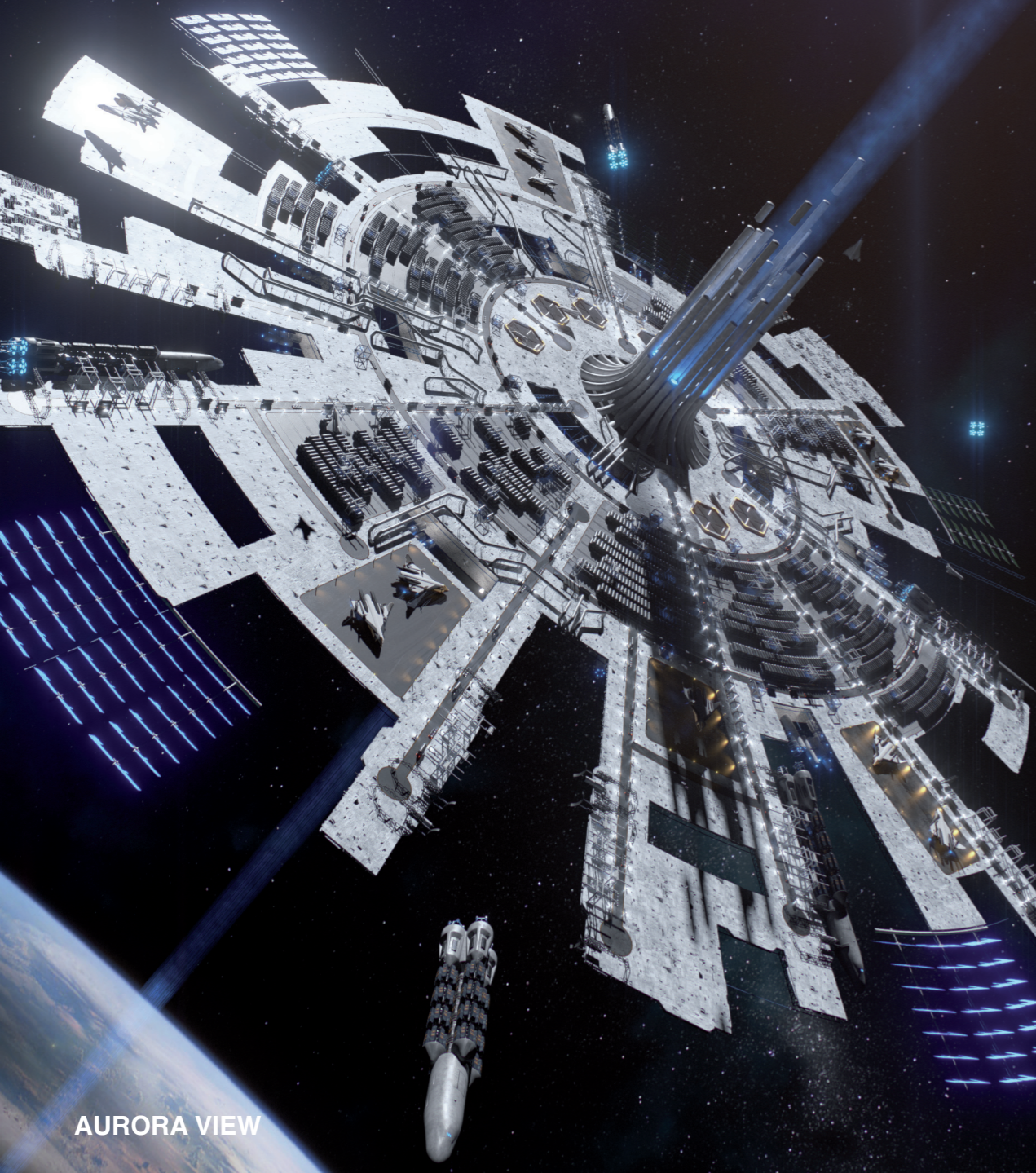


The access to space currently requires a large amount of energy, generates a high concentration of orbital debris and is neither regular, nor reliable. However leaving the atmosphere is the essential step in the realization of any space project of great extent.

We propose to create the first section of an Earth-Space link allowing freeing itself from the force of gravity. This connection will be similar to a regular rail, air or sea transportation line. It will serve an orbital hub, starting point of a new page in the space history.

True “*umbilical cord*” between Man and his home planet, it will provide a solution to the problems of waste, energy and transportation. It will also be an incubator for the future space dreams.



AURORA VIEW

SKYLINK

A first step towards infinity

I - SITUATION

1) HISTORY

What is the place of space exploration in History?

EXPLORE, CONQUER, EXPLOIT

Since ancient times, mankind has always wanted to increase its territory while exploring unknown areas. Examples of explorations and conquests have punctuated History like the discoveries of America, the poles or ocean rifts.

Now that all the continents have been explored and the depths of the oceans begin to reveal their secrets, it's not anymore a question of discovering, but of exploiting these territories. Only space, where all is possible remains phantasmagorical.

ONE SMALL STEP FOR MAN...

During the Cold War the competition between the United States and the USSR was the engine of the “*space conquest*”. Its culmination was the sending of the first men on the moon. During the following decades many architectural or scientific projects like those of Archigram, Foster & Partners and NASA succeeded one another. However, Man didn't settle in Space, he explored it, analysed it, polluted it but didn't “*conquer*” it. The “*small step*” of Armstrong appears today as a “*small step (...) for mankind*” on the timeline of History.

AND THEN?

After the fall of the USSR, international collaboration replaced ideological war.

Dominated by national or international agencies like ESA or NASA, space has interested private companies for commercial purposes through satellite launch or tourist space flights development.

2) CONTEXT

Now what?

CURRENT SITUATION

Abandoned for forty years, some projects of sending men to the moon or Mars were even put back on the agenda without certainties, however, on their achievement. Indeed, the recent economic crisis resulted in the reduction of the aerospace business through the postponement or the cancellation of projects such as orbital shuttles or lunar bases.

However, many space technologies have become available to private companies. This transfer is illustrated by examples like Xspace or Virgin Galactic.

CHALLENGES AHEAD

Despite scientific progress since the twentieth century, access to space remains a considerable technical and financial challenge. The difficulties of a project like Mars exploration show it.

Creating a real spatial connection therefore requires a major project resulting from a strong political and economic will and a collective human engagement.

3) ISSUES

What do we have to gain in the infinite?

The will of the triptych States + Businesses + Individuals is essential for the implementation of a large-scale spatial access.

STATES

For countries, it is primarily a political strategy of long-term governance to enable them to make history.

COMPANIES

For companies and financiers who will invest in the project, it is an economic strategy. Indeed, a flow of people and materials from new territories generates a stream of resources.

INDIVIDUALS

For some people, getting into a space adventure stands for a fresh start, lands to explore, discoveries, changes, hopes and dreams.

“To travel is requiring from space instantly what time could give us little by little only.” Paul Morand

Challenges in such a project's implementation and operation will be the melting pot of major scientific and technical progress. It is also a strategy for the long-term management of space environment and therefore our planet.

II - PROBLEMATICS

Which are the major difficulties of the space access?

Current space launcher vehicles are not adapted for mass transportation. Three major issues emerge in establishing an Earth-Space link.

1) WASTE

A clean and mastered space is the challenge of any galactic project. If man wants to develop Earth-Space exchanges, Earth orbit should not be saturated with waste.

According to Kessler's syndrome, a chain reaction is at work. Collisions between debris are multiplying, which increases the number of polluting objects. Thus the proportion of debris will continue to grow and putting object into orbit from Earth will become impossible if man continues his space activity with conventional launchers.

2) CONNECTION

There is currently no regular "link" between Earth and Space equivalent to the passengers and goods transportation by land, sea or air.

Unlike the airline industry, the space transportation does not flight between predefined locations or along known line and landing zones are random.

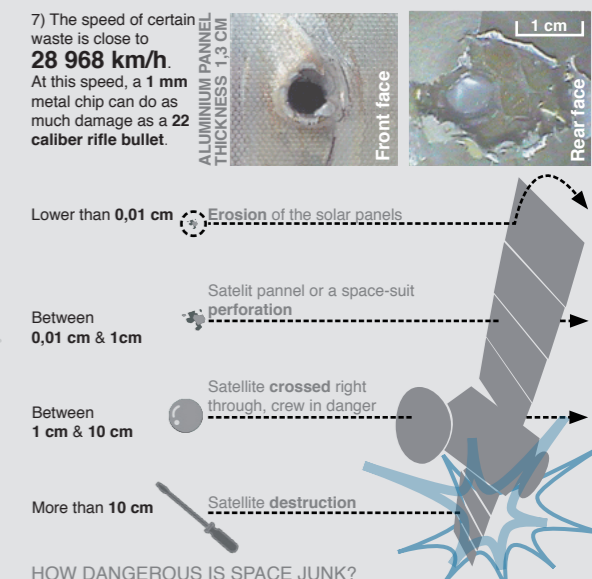
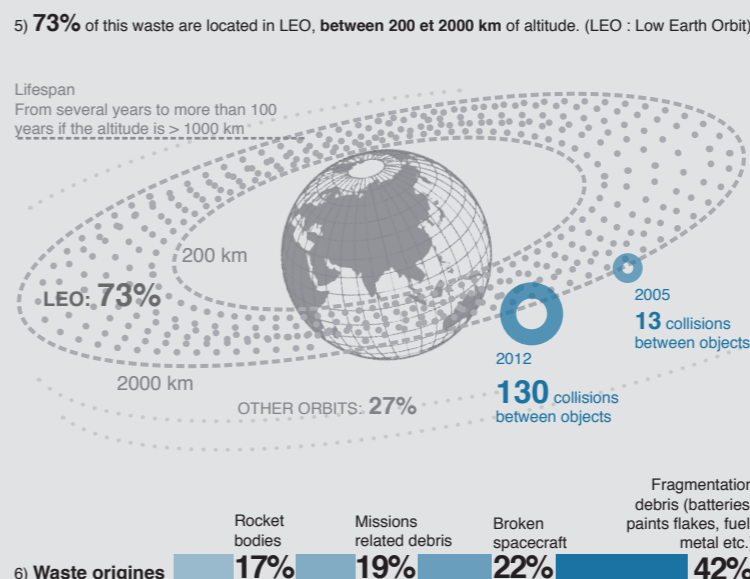
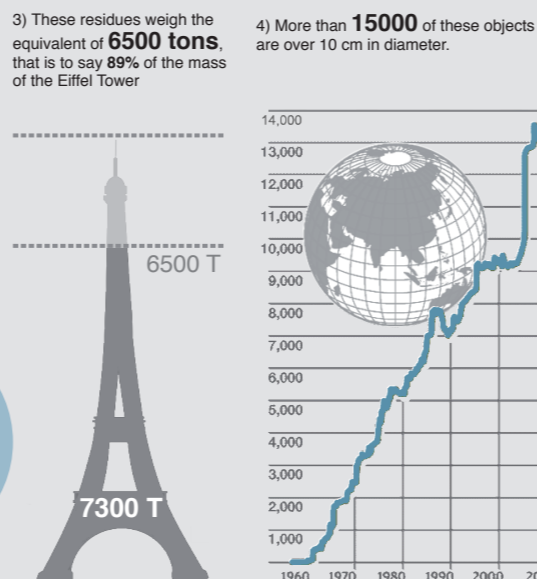
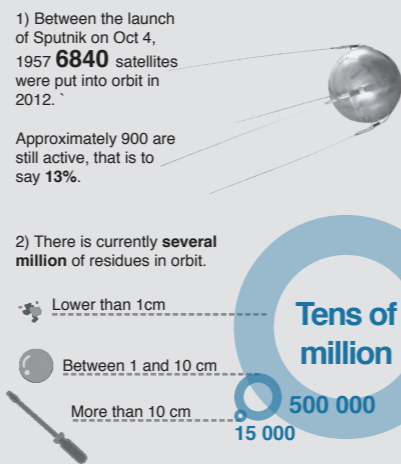
In addition, take-off and landing phases are much more delicate and risky than for any other means of transportation.

3) ENERGY

The current propulsion system by chemical reaction is basic compared to other technologies of the space industry. It has many risks when firing and appears polluting. A booster rocket is a consumable vehicle; almost all of its mass is dedicated to its propulsion. This expensive energy process has a huge impact on spacecraft's costs and the shipment capacities are thereby very limited.

SPACE JUNK

Some facts on space pollution



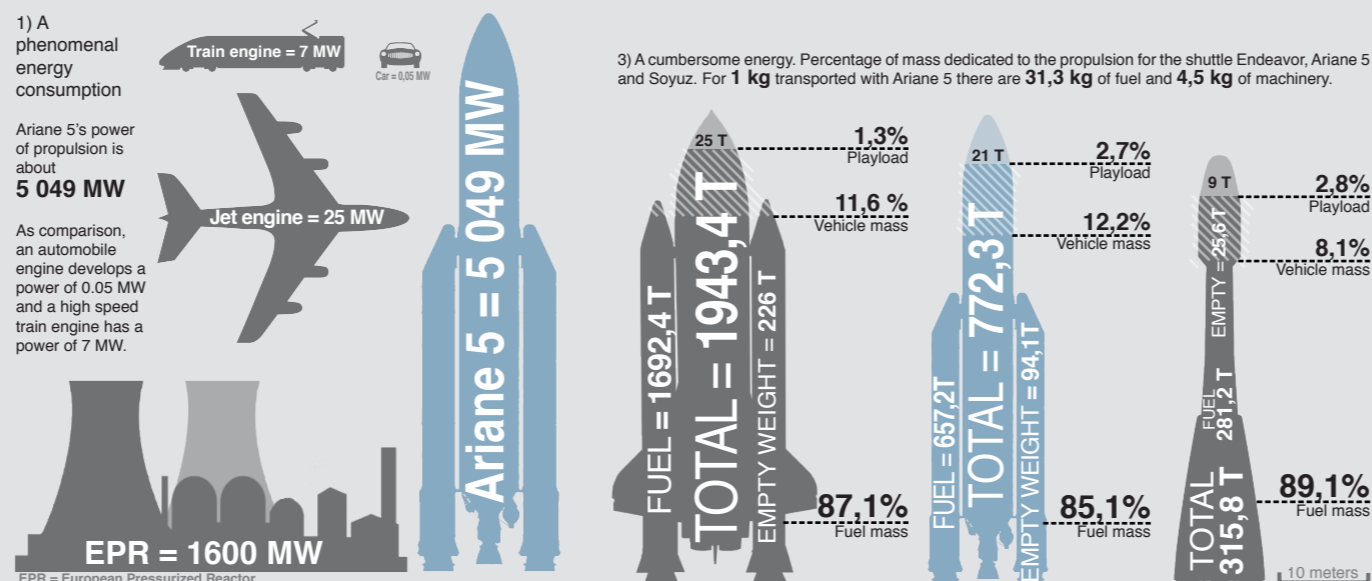
CONNECTION

Inventory of the flows between the Earth and Space



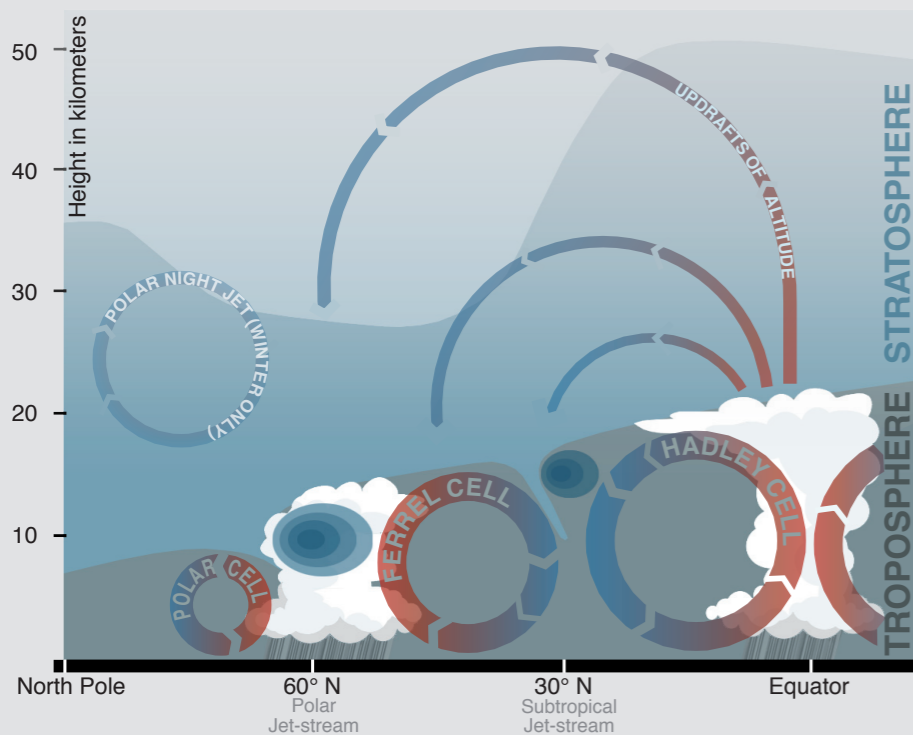
ENERGY

Energy situation of space transport



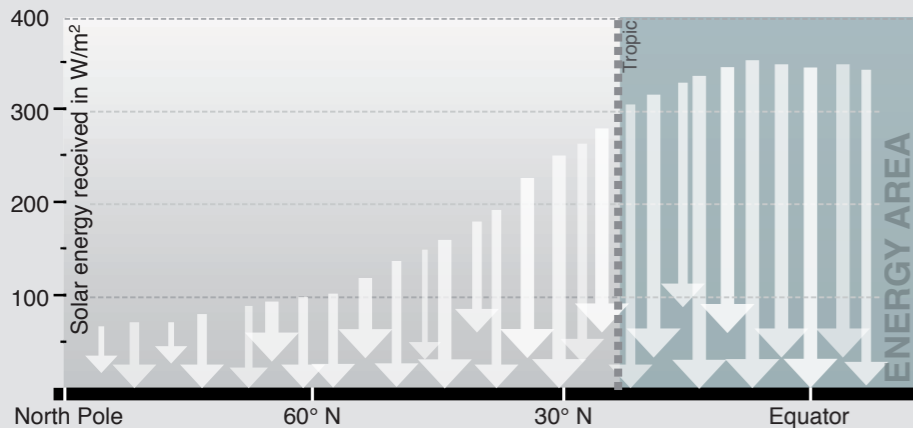
THE EQUATOR, IDEAL SITE

Take advantages of the natural and physical elements



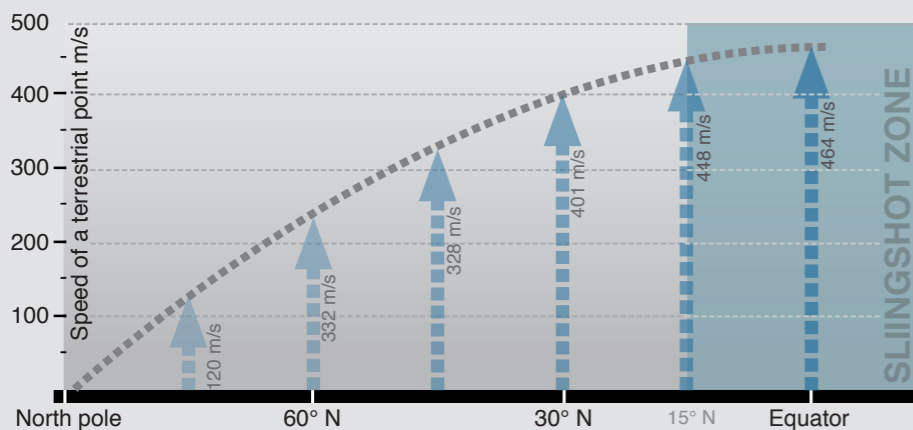
WINDS

Absence of jet streams and ascending winds



ENERGY

Using passive energy from the sun

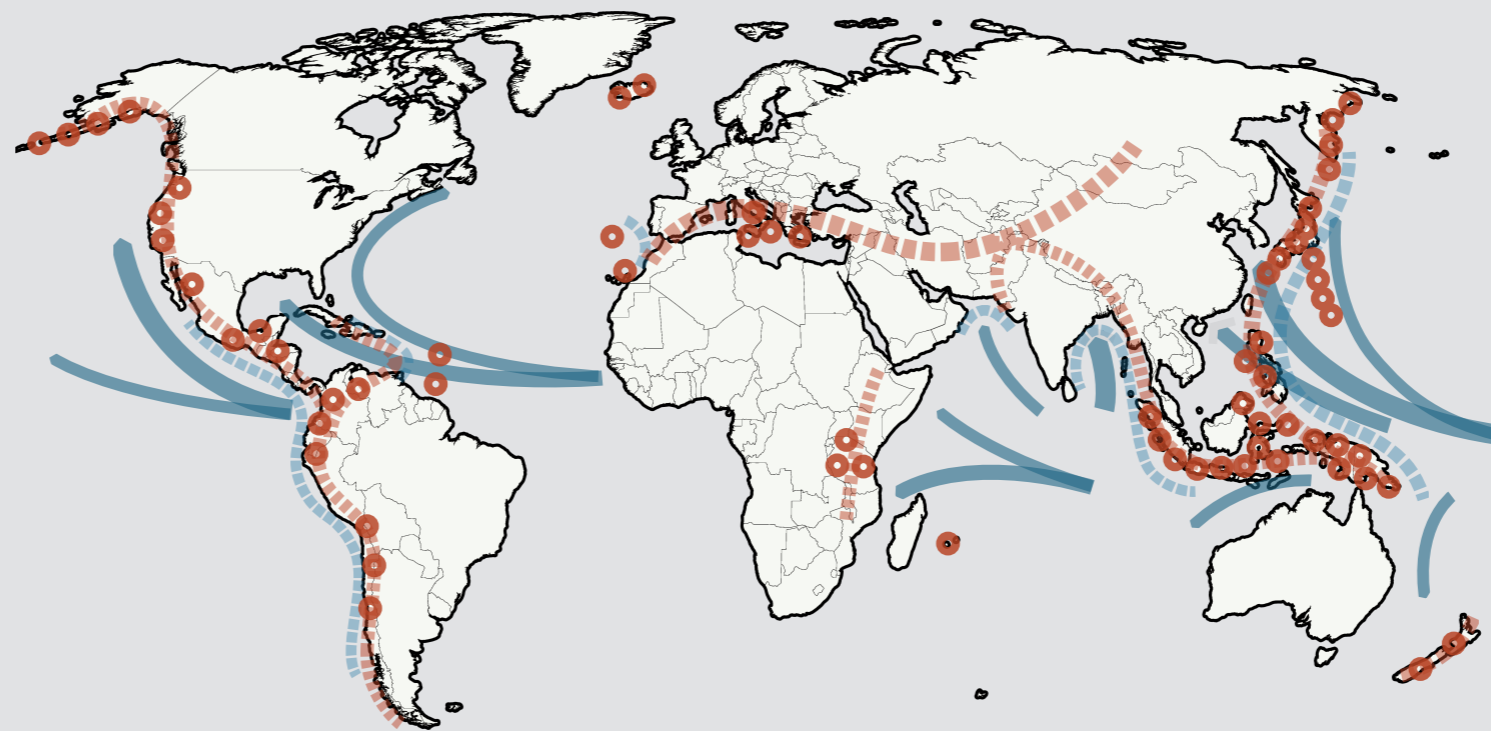


SPEED

Using gravitational slingshot

RISKY ZONES

Which places are inappropriate to establish a space connection?

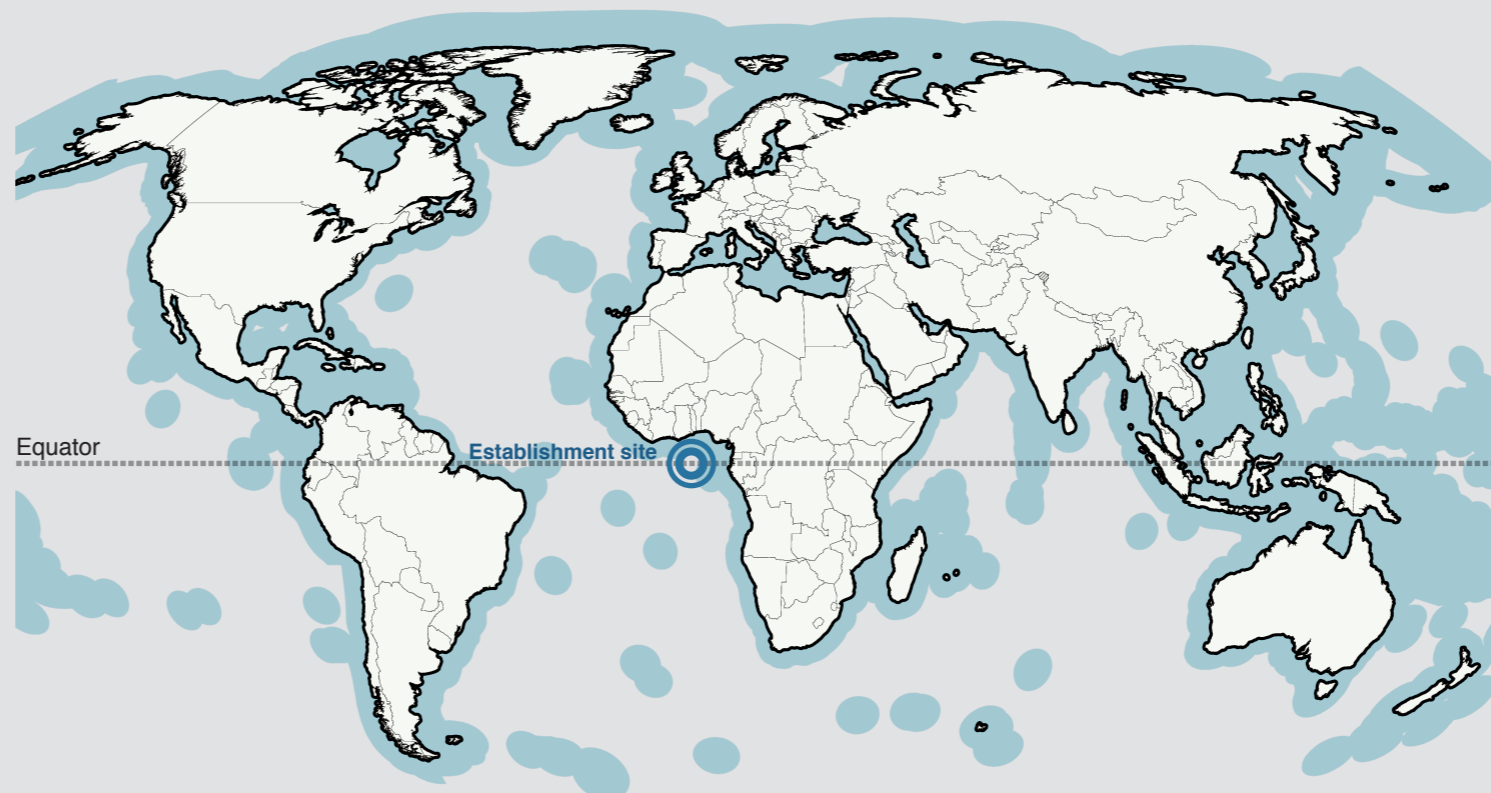


LEGEND

Cyclones trajectories Tsunamis zones Seismic areas Active volcanos

PROJECT LOCATION

A neutral space without natural risks, easily accessible, along the equator.



LEGEND

International waters Exclusive economic zone

III - PROJECT DESCRIPTION

1) SITE

Where to establish the project?

OCEAN

The project is located in international waters, a maritime neutral space favorable to the production of energy and resources required for its functioning. The ocean also allows to serve it easily and widely whatever the using nations.

EQUATOR

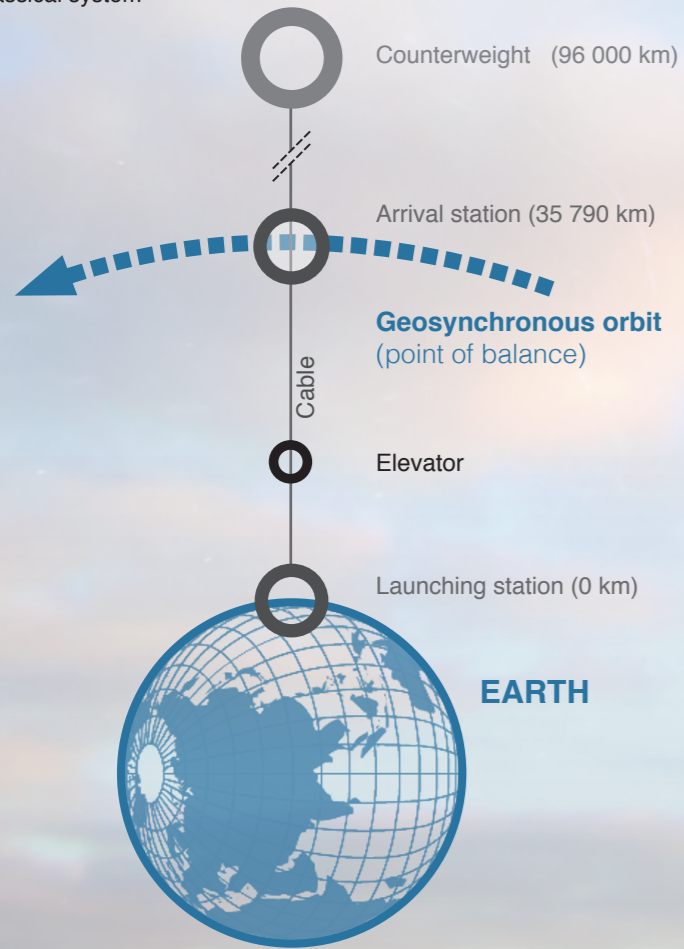
The equatorial location allows using the slingshot effect. This area also benefits from updrafts increasing the upper limit of the atmosphere and it is not topped by a jet stream that may affect the stability of the device. Finally, it's the area that receives the most solar energy.

AFRICA

The optimum location is in an area without natural diseases in the South of Benin. The African continent is in full development and has huge energy, human and economic potentials. The project would raise it at the same level as the others.

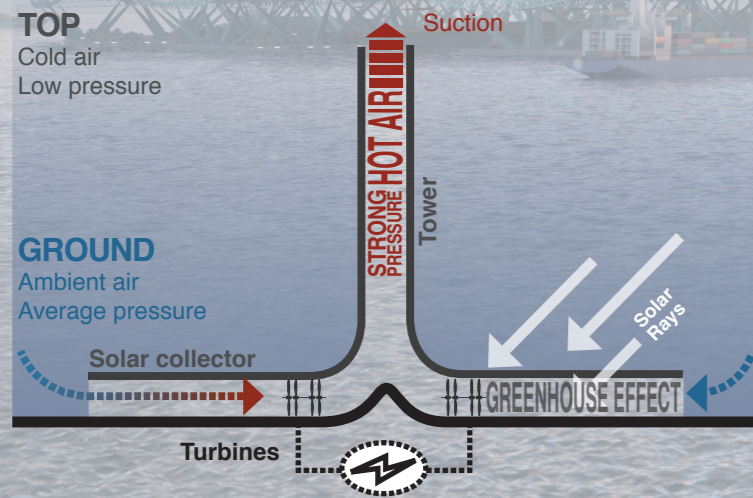
SPACE ELEVATOR PRINCIPLE

Classical system

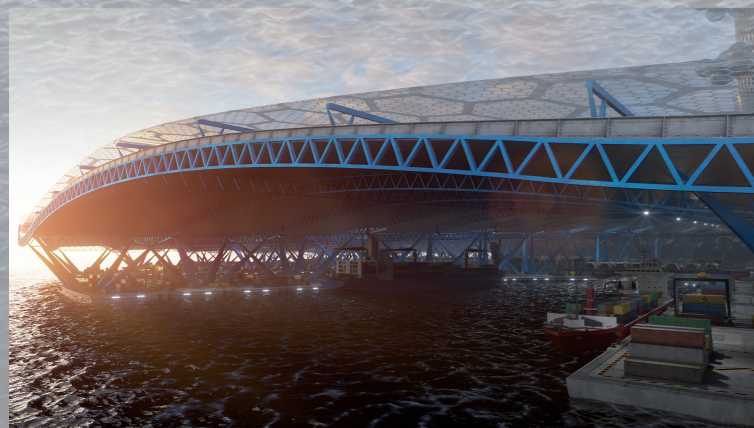


SOLAR CHIMNEY PRINCIPLE

How to free from gravity force in a soft way?



VIEW FROM A WARF



OCÉANE

Altitude: 0 km
Pressure : 1012 hPa
Temperature: 27°C

2) CONCEPT

Which are the principles of the project?

The project revisits the space elevator idea.

PRINCIPLE

A space elevator is a proposed type of transportation system from an Earth surface into an orbit by a cable with one end attached near the equator and the other end in space beyond geostationary orbit at 36 000 km of altitude. The system is maintained

by a counterweight located at 91000 km. The competing forces of gravity, stronger at the lower end, and the centrifugal force, stronger at the upper end, would result in the cable being held up, under tension, and stationary over a single position on Earth. Once deployed, the cable would be ascended repeatedly by mechanical means to reach orbit.

IMPROVEMENTS

The proposed project solves the main weaknesses of the current space elevator systems: the resistance of the cable, its vulnerability to space

bodies, the possible imbalance of the device's axis due to the mass of the Moon and the cable vibrations.

VISION

The main idea is to create a direct line between the Earth and the Space, the first stone of a large spatial planning. It would be a portal to the stars and an entrance for any visitors but also an intergalactic lighthouse, the symbol of the union of all the human peoples.

ENVIRONMENT

The goal is to overcome the force

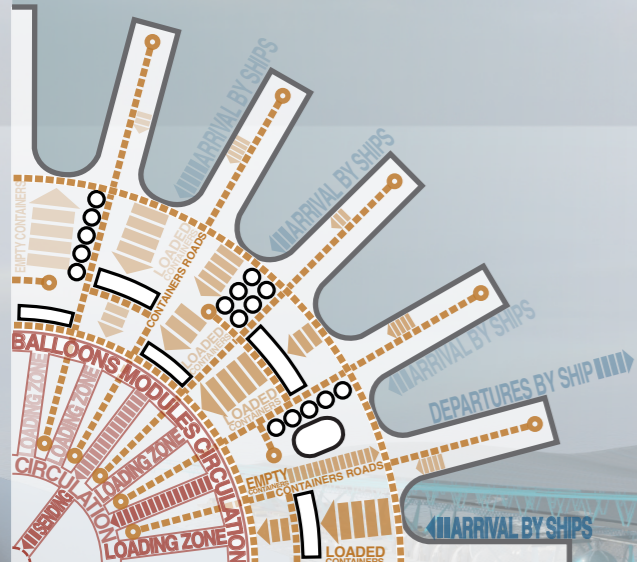
of gravity in a large scale without disrupting the Earth's environment. Using passive natural energies to send men and material in space is one of the fundamental elements of the project. The device will work thanks to actual "physical" force unlike current spacecrafts powered by polluting "chemical reactions".



FONDATION JACQUES ROUGERIE
GÉNÉRATION ESPACE MER
INSTITUT DE FRANCE

OCÉANE FUNCTIONING

How does the maritime platform work?



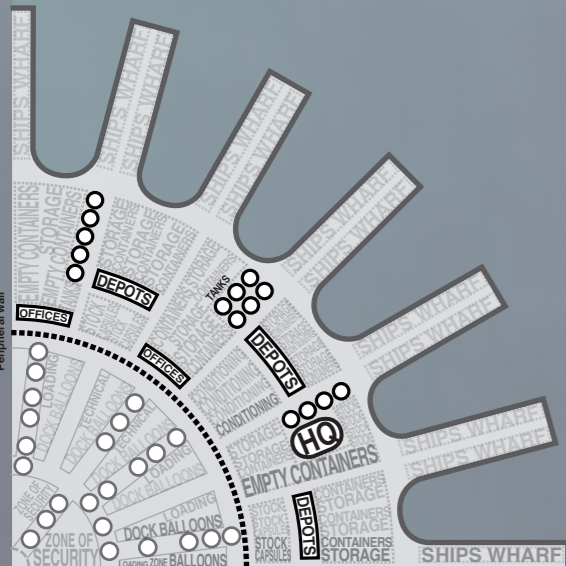
CIRCULATION PLAN

What are the main circulation?



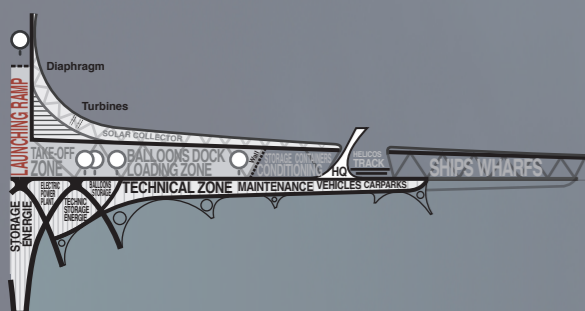
CIRCULATION SECTION

0 100 200 500m



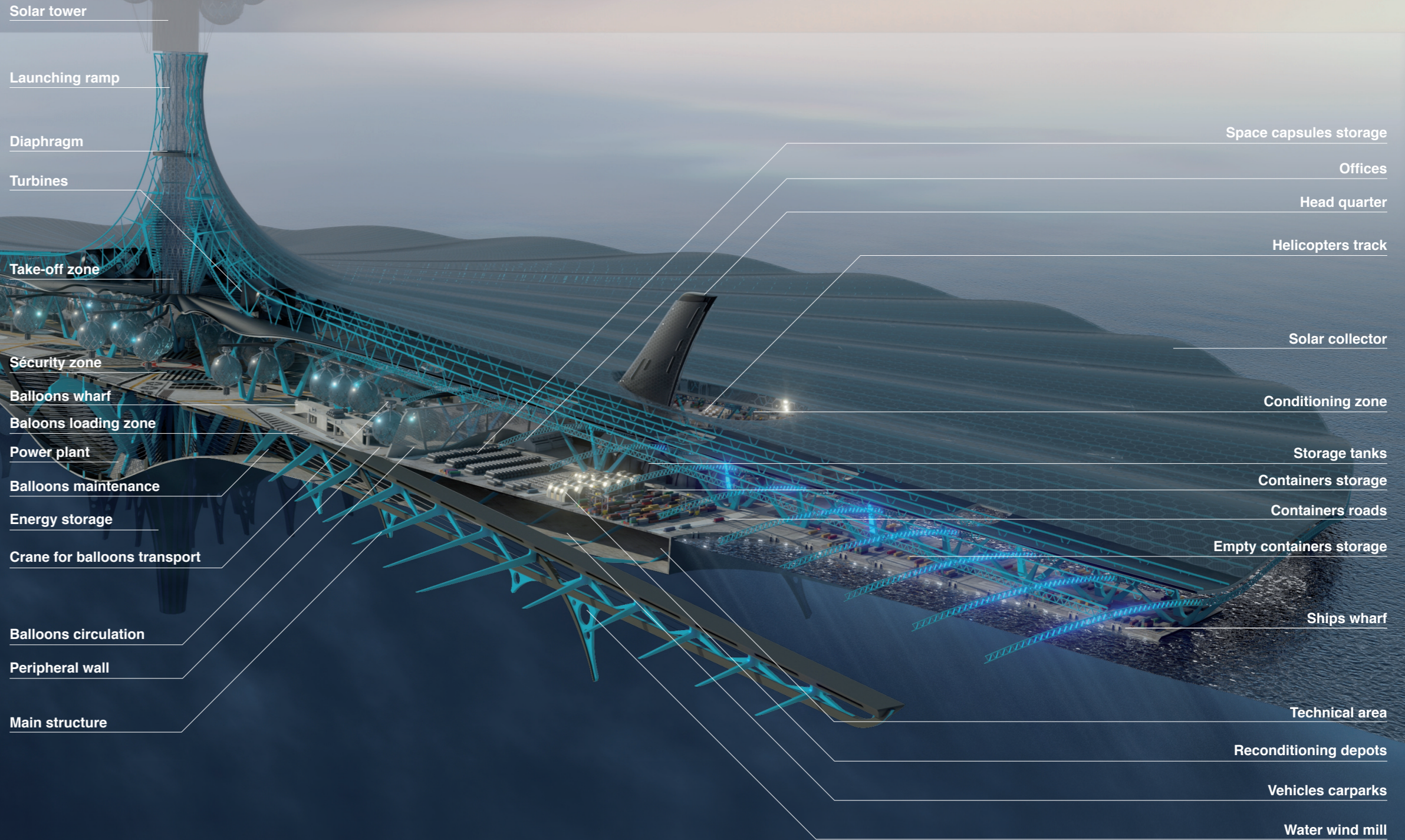
PROGRAMMATIC PLAN

What are the main functions?



PROGRAMMATIC SECTION

0 100 200 500m



3) FUNCTIONING

How does it work?

BASIC DEVICE

In order to escape from the gravity force using as few energy as possible, the first 90 kilometres work as a giant solar tower.

A solar tower uses the greenhouse effect and the chimney effect to activate turbines that generate electricity. A

greenhouse, the "collector", placed at the base, heats the air with the sun. The difference of pressure and temperature between the bottom and the top generates an upward airflow: the warm air lighter than cold air rises. It is the engine of the project.

The theoretical power of a 1000 meter solar tower is estimated at 200 MW.

OCÉANE

A floating logistics, loading & shipping

platform acts as energy collector and launching ramp. It has harbours, storage spaces, loading areas and a vast greenhouse supplying the chimney and its turbines with hot air.

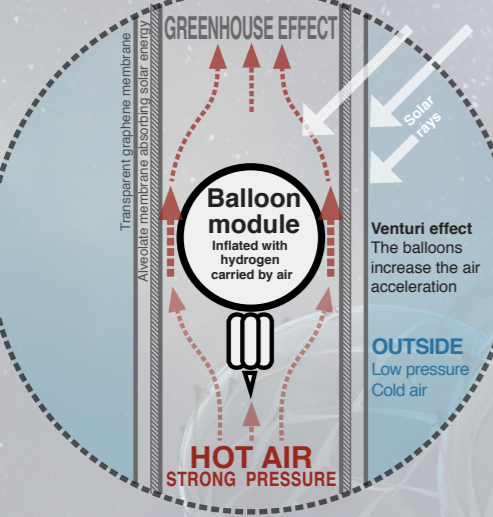
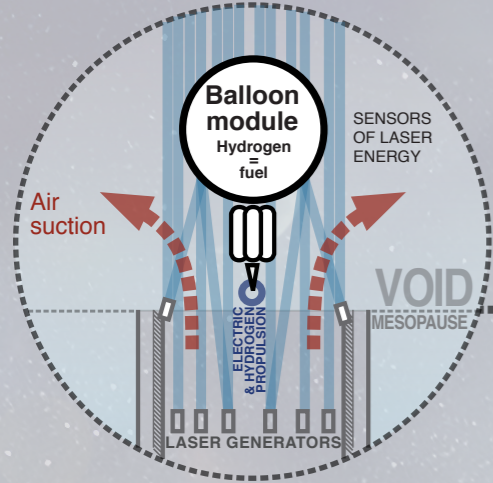
MATERIAL

The main constructive material is the graphene. Its mass is 160 g / m³, that is to say 7.5 times lighter than air. It is harder than diamond and can, with the same thickness of a cling film resist to

a nail of 1mm weighing 2 tons. Almost transparent, it absorbs only 2.3% of the light.

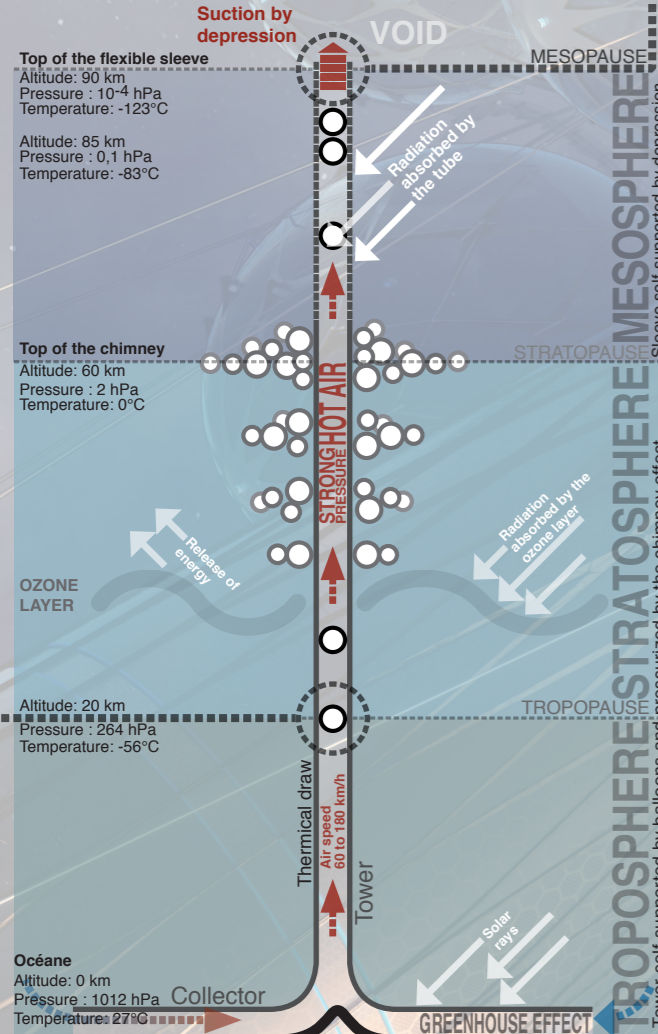
CHIMNEY FUNCTIONING

Which are the thermodynamic principles of the tower?

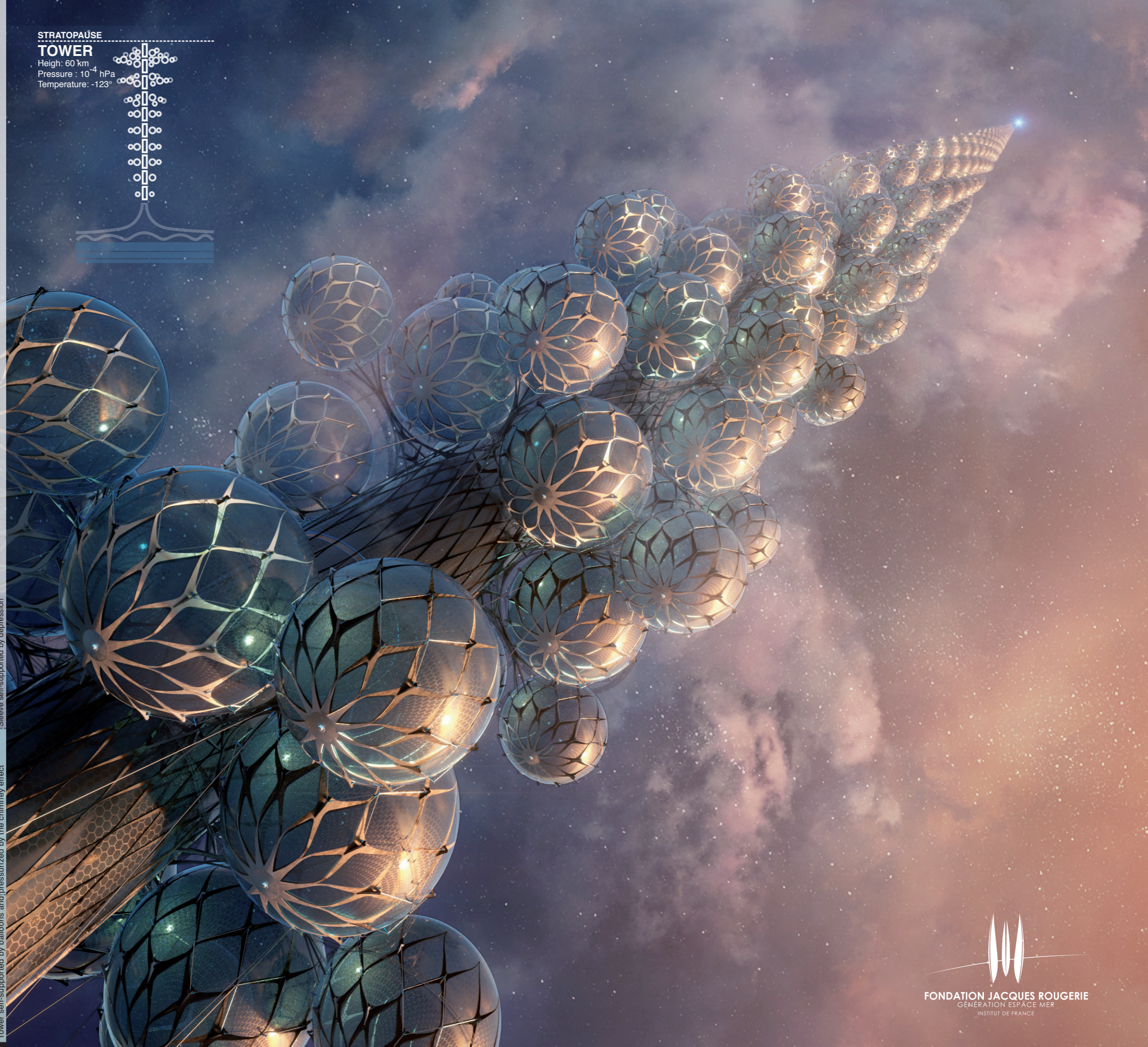


SPACE PORTION FUNCTIONING
How to propel the transporter outside of the chimney?

ATMOSPHERIC SECTION How to propel the transporter inside the chimney?



TOWER self-supported by balloons and pressurized by the chimney effect



SPACESHIPS

The project uses inflatable modules composed of three parts: a graphene airship, a capsule transportation cluster, and an electric space propulsion. From 0 to 90 km the device operates as a vertical air line sucked up by chimney's airflow. Between 90 and 35,784 km, an electric reactor powered by laser waves propels the aircrafts.

EARTH SECTION

The first part of the elevator is a solar tower up to the Mesopause. The temperature there is -123°C and the pressure is 10^{-4} hPa. At the sea level on the equator, the average temperature is 26.9°C and the pressure is 1012 hPa. This is the optimum atmospheric temperature difference between the base and the top of the solar tower.

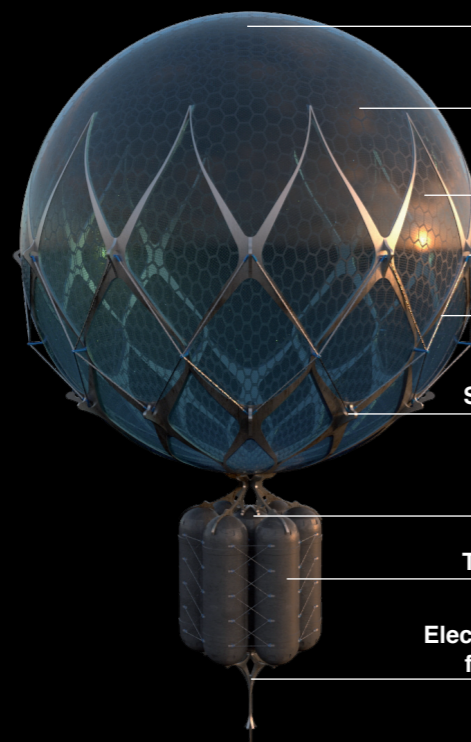
The production of electricity from such a tower would be at least 12,000 MW, enough to supply 12 million homes.

Platforms floating in the air maintain the chimney. An airtight transparent membrane constitutes its envelope. Inside, the air is heated by the greenhouse effect during its ascent, increasing the chimney effect.

SPACE SECTION

In addition to supply the vessel, the swivelling microwave generators placed on the top of the chimney adjust the geostationary platform position. Lasers do not create a physical link between the Earth and the Space part of the elevator. This section is thus insensitive to waste or maintenance problems.

SPACETRANSPORTER DETAIL



Hydrogen filling

Balloon (from 0 to 90 km of altitude)

Alveolate graphene membrane

Attachement point

Graphene structure

Sensor of laser energy

Hydrogen tank

Transportation module

Electric propeller (starting from 90 km of altitude)

Fixing ring of the module

Pressurized space module

Magnetic system for displacements on gravity 0

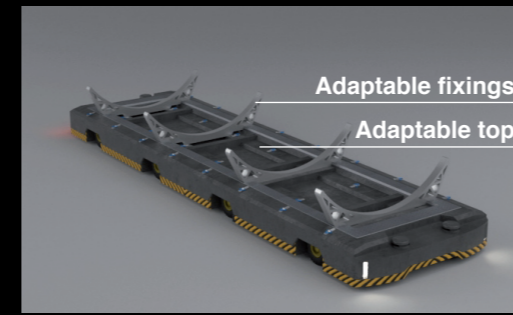
Ground laser guidance

CONTAINER CARRIER

Automated transport vehicles for the containers on Ocean and Aurora.



Naval container



Adaptable fixings

Adaptable top



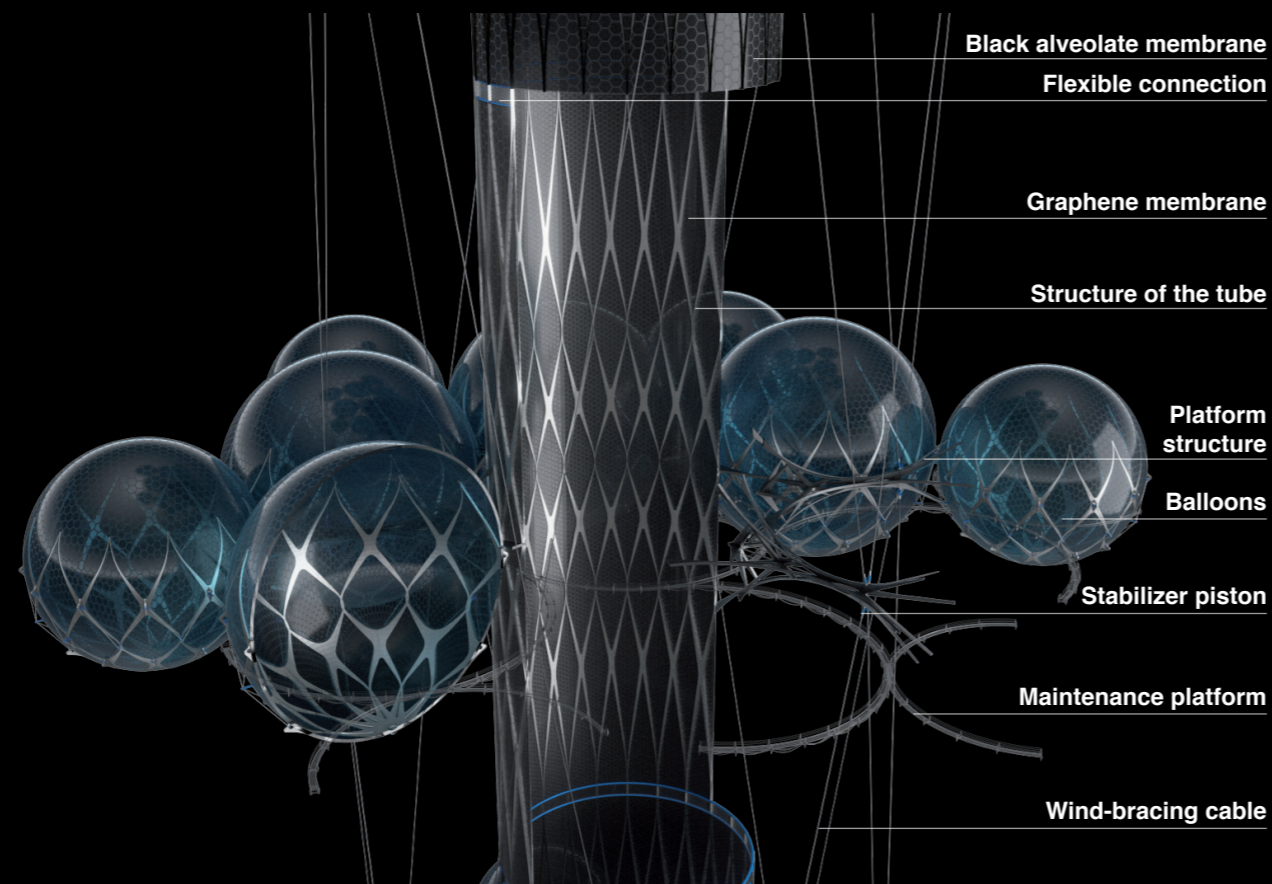
Fixing ring of the module

Pressurized space module

Magnetic system for displacements on gravity 0

Ground laser guidance

PERSPECTIVE SECTION OF A PLATFORM



Black alveolate membrane

Flexible connection

Graphene membrane

Structure of the tube

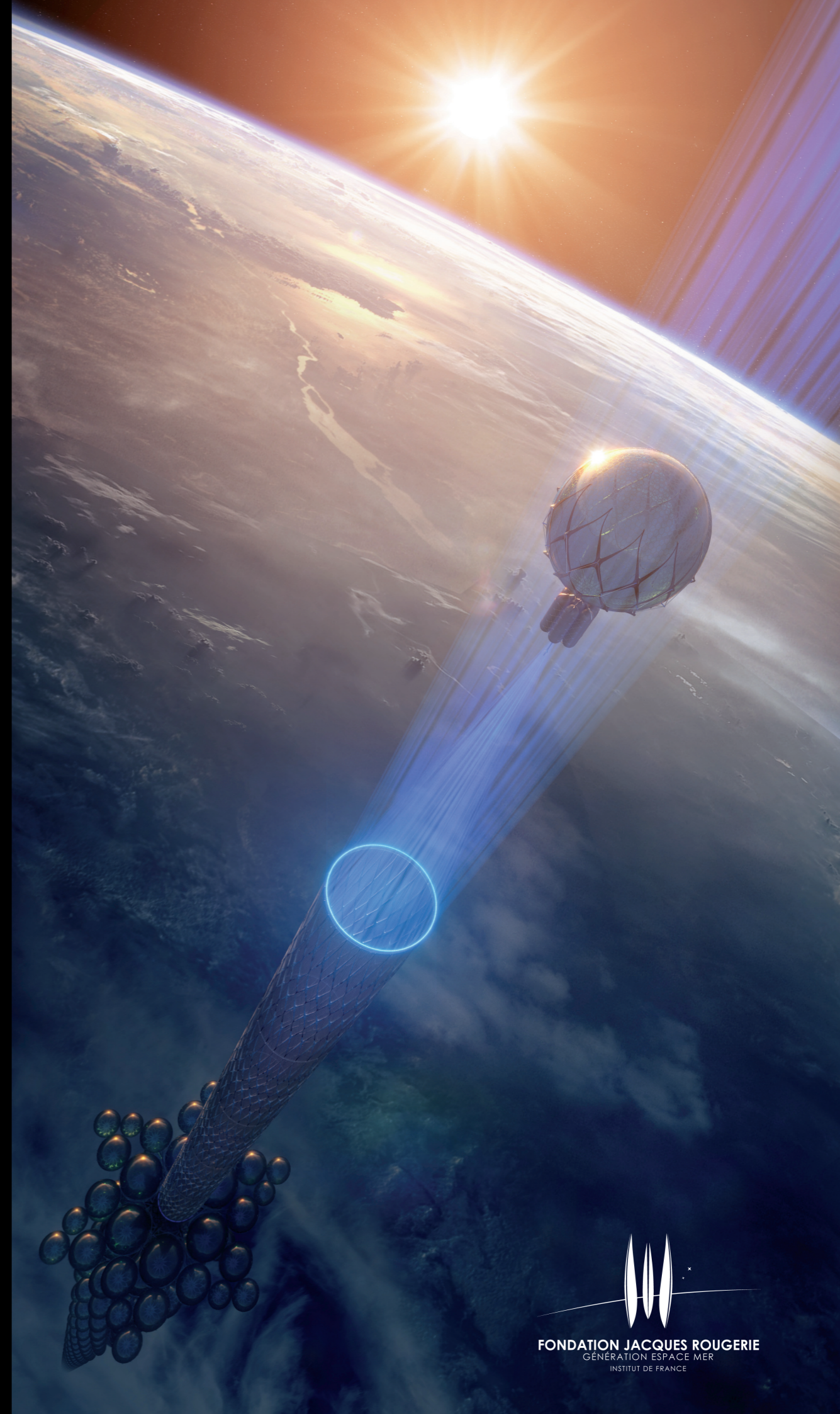
Platform structure

Balloons

Stabilizer piston

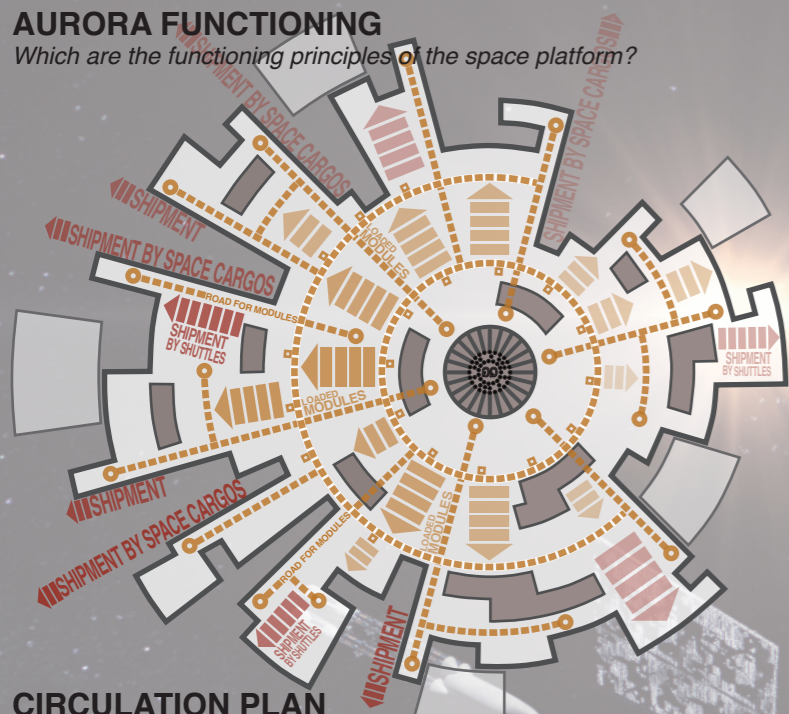
Maintenance platform

Wind-bracing cable



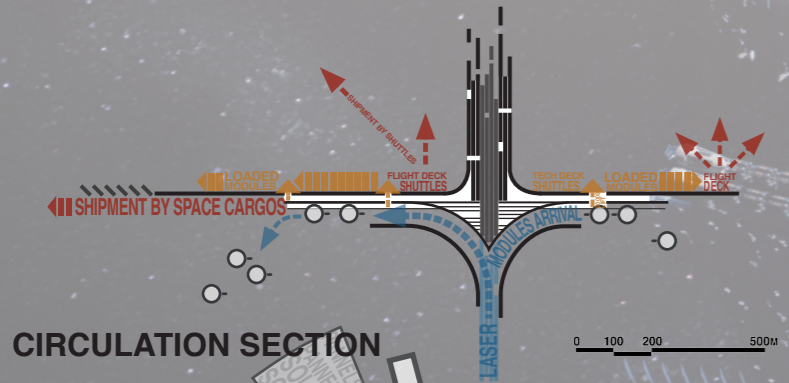
AURORA FUNCTIONING

Which are the functioning principles of the space platform?

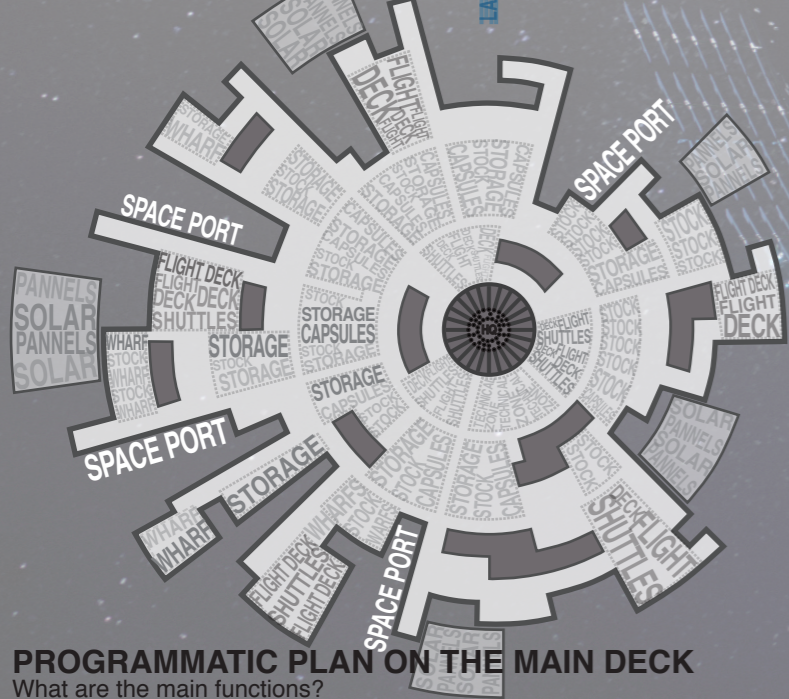


CIRCULATION PLAN

What are the main circulation?

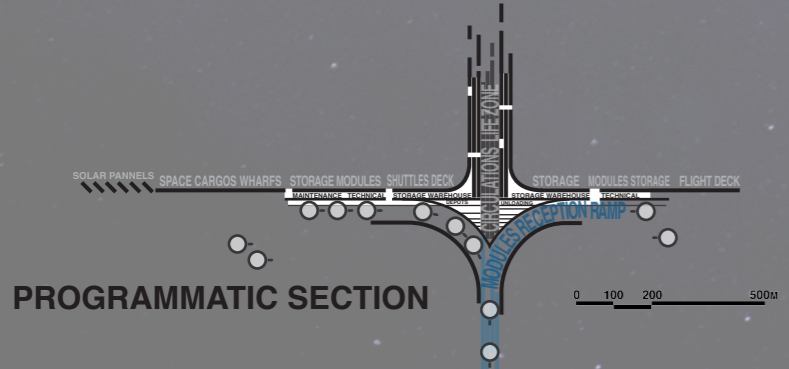


CIRCULATION SECTION



PROGRAMMATIC PLAN ON THE MAIN DECK

What are the main functions?



PROGRAMMATIC SECTION



GEOSYNCHRONOUS ORBIT

AURORA

Altitude: 35 790 km
Pressure : 0 hPa
Temperature :
-126°C to 149°C

Laser beam

PERSPECTIVE SECTION OF AURORA

Deck under construction

Magnetic platform

Space containers storage

Space shuttle

Solar pannels

Circulation roads

Magnetic flight deck

Space cargo mooring

Space cargo wharfs

Extension modules

Storage warehouse

Unloading zone

Head quarter

Operational area

Offices

Life area

Public facilities

Elevator

Circulation zone

Main structure

Technical area

Shuttles gate

Maintenance zone

Spaceship warehouse

Energy storage

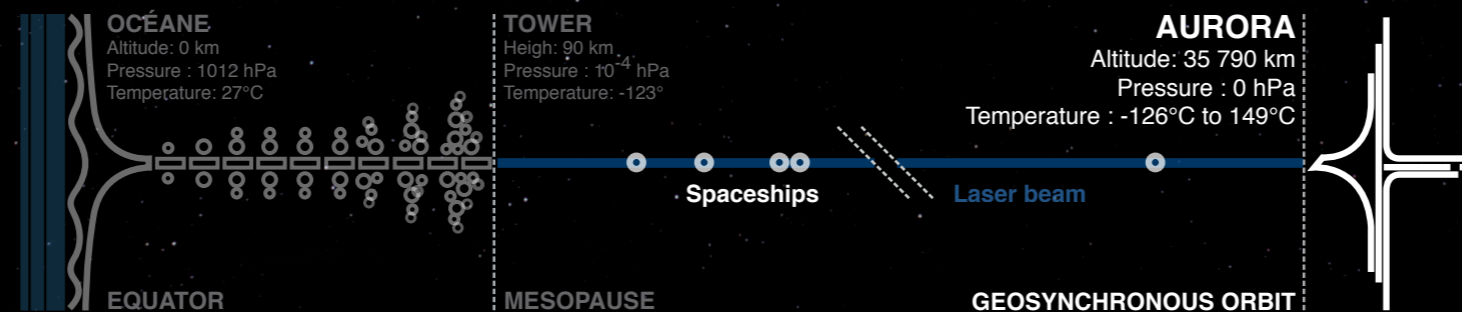
Laser energy recuperator

Spacetransporter

Reception ramp

AURORA

At 35,784 km, a geostationary logistics platform tops the project. Veritable space transfer port, it is organized as an aircraft carrier. It has goods storage, loading and unloading areas, catapulting mechanisms, space wharfs and living areas. It's a space hub leading to infinity.





A link to the sky powered by the sun, the water, and the air faces the great climatic challenges and enables the creation of a reliable, clean and regular Earth-Space connection. It will be the first stretch of an intergalactic line, the first step of mankind to a veritable access to the universe.

“The universe is a common good of humanity” according to the Outer Space Treaty of 1967. A great scientific and technical international program with a unifying power is thus essential for the success of the project.

Skylink opens new prospects for travel and discovery. It's a vessel for imagination that catalyses the major space projects to come.

It's up to anyone to get on with their dreams...