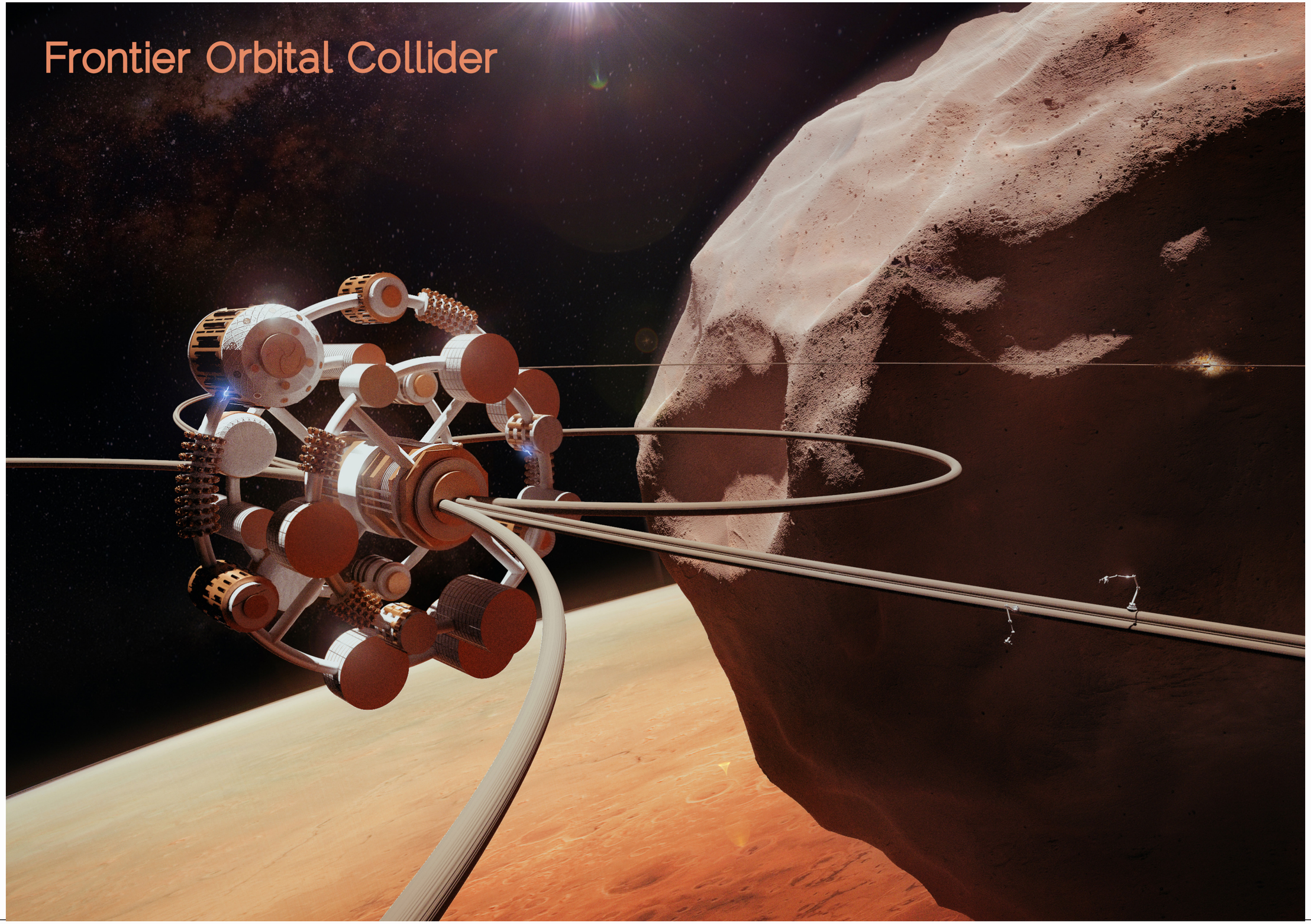
Frontier Orbital Collider



2015 JACQUES ROUGERIE FONDATION "INNOVATION AND ARCHITECTURE FOR SPACE" AWARD

NAME OF THE PROJECT FRONTIER ORBITAL COLLIDER

DESCRIPTION FRONTIER ORBITAL COLLIDER

FONDATION JACQUES ROUGERIE
GÉNÉRATION ESPACE MER
INSTITUT DE FRANCE

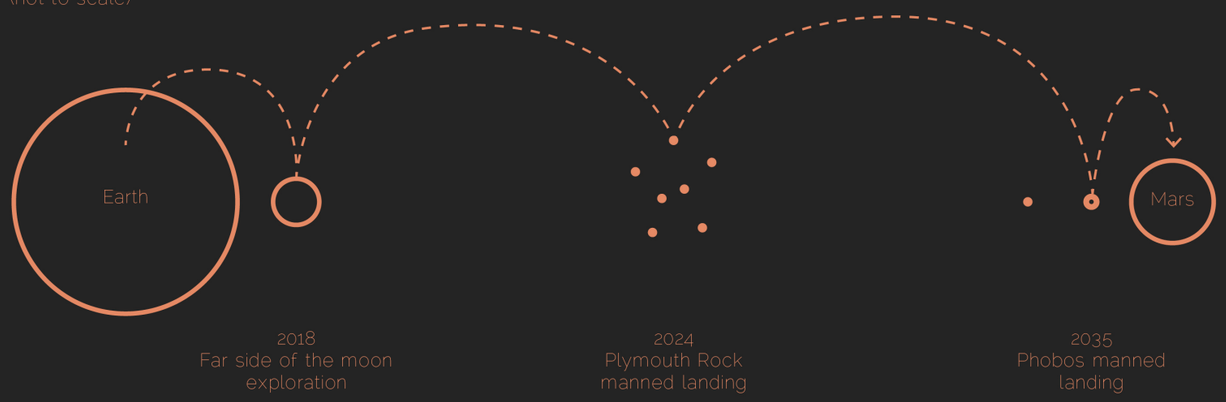
The Frontier

Science, our quest to understand life, the pursuit of knowledge and explanation of all things. From the miniscule particles of a molecule to the vast networks of galaxies that form our known universe. Human beings have endeavored to understand it all. This in turn affects the progression of our species, to constantly shifting new frontiers.

The Large Hadron Collider (LHC) demonstrates mankind's thirst for understanding. The LHC is a vast experiment, 27km of frozen and artificially vacuumed track that collides particles near to the speed of light, the universal speed limit. These collisions are captured by state of the art camera's called detectors, to the average human it is an impossibly intricate mega structure that exhibits our current expertise in pushing the frontiers of science. The aim of these experiments is to explore the matter that makes up everything, the intricately tiny fabric of particles, this is known as quantum physics.

Collider Evolution
1986 - 2035

NASA 'Stepping Stones' Concept
(not to scale)



Parallel to this quest to understand the super small, is the contrasting mission to explore space, to look up and understand the vast and possibly endless space above us, making sense of the inconceivably massive universe we exist in. We famously sent man into space and took steps on the moon, true landmarks of human exploration, by standing on the shoulders of these giants we plan to go to the next frontier, Mars. Using global collaborative efforts on earth, we plan to mark our arrival to a foreign planet around 2035.

In 2035 our quantum explorers plans a new addition in collider experiments, the presently nicknamed, Very Large Hadron Collider (VLHC.) Taking the same form as its predecessor but measuring at a larger 100km circumference. Like a collider we have a concept to collide the worlds of the small; quantum physics and the large; astrophysics. With two coinciding dates of 2035, we plan to combine the VLHC with the manned mission to Mars. One of the proposed mission plans for Mars is the 'stepping stone' approach. This sets out to send astronauts to Phobos, Mars's largest and closest moon. By using Phobos as an outpost the dangerous surface landing on Mars can be planned and in the meantime exploration of this unfamiliar moon can also commence.

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DESCRIPTION THE FRONTIER

FONDATION JACQUES ROUGERIE
GÉNÉRATION ESPACE MER
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Frontier Orbital Collider

Detector Hub

- Orbital Collider Detector
- Collder Accelerator Rings
- Large Living Capacity
- Large Work Capacity
- Spaceport
- LFTR Power System

Phobos Base

- Ice Mining
- Thorium Mining
- Material Collection
- Heliocentric Turning Mechanism
- Large Work Capacity
- LFTR Power System

Living Lab Modules

- 10x Person Living Capacity
- 10x Person Work Capacity
- PV Power System

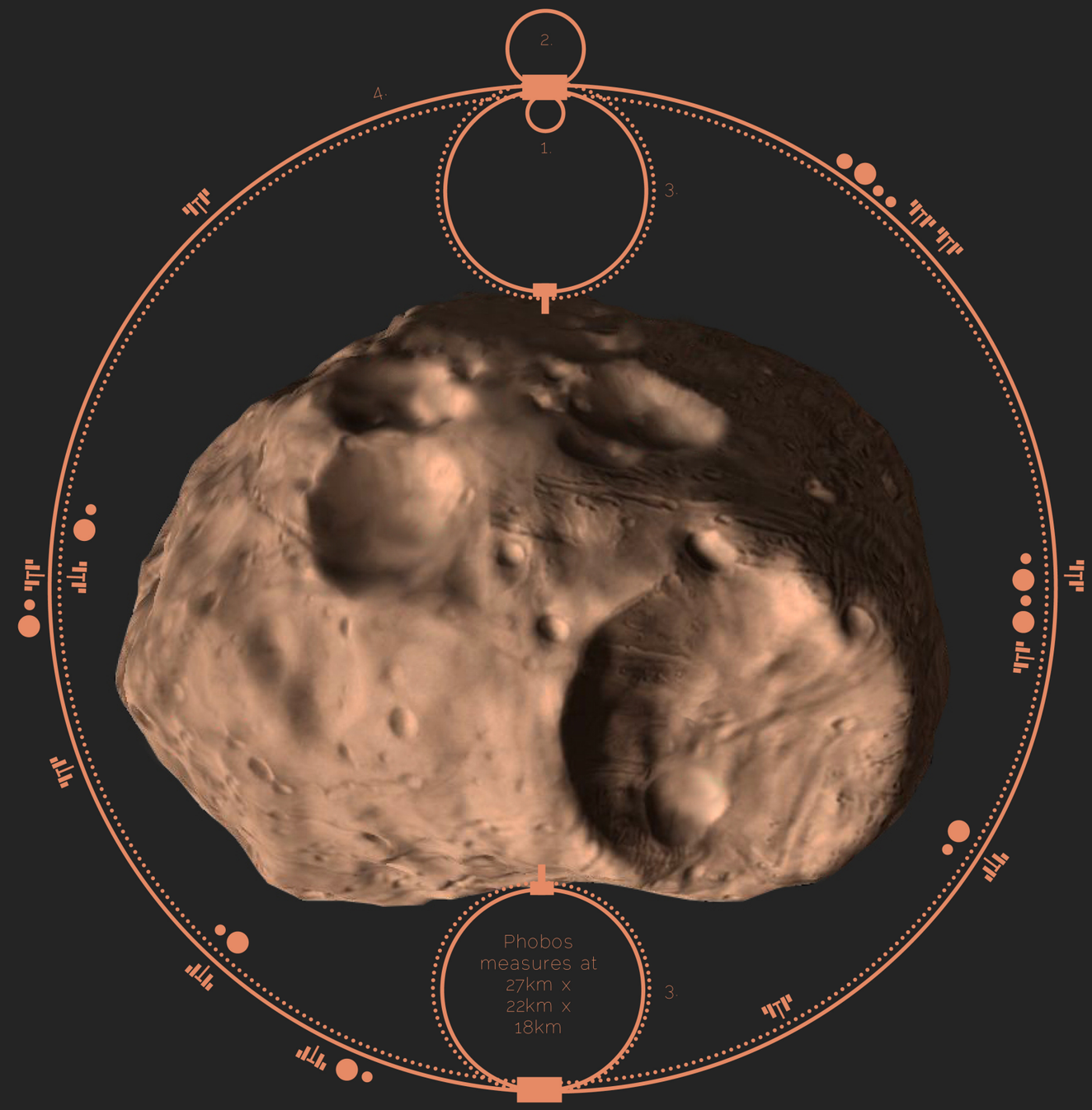
Telescope/Detector Modules

- Various Telescopes
- Various Detectors
- PV Power System

Collider Rings

1. -Primary Ring
2. -Secondary Ring
3. -Surface Ring
4. -Orbital Ring

Orbital Transporter



2015 JACQUES ROUGERIE FONDATION "INNOVATION AND ARCHITECTURE FOR SPACE" AWARD

NAME OF THE PROJECT FRONTIER ORBITAL COLLIDER

DESCRIPTION MASTERPLAN

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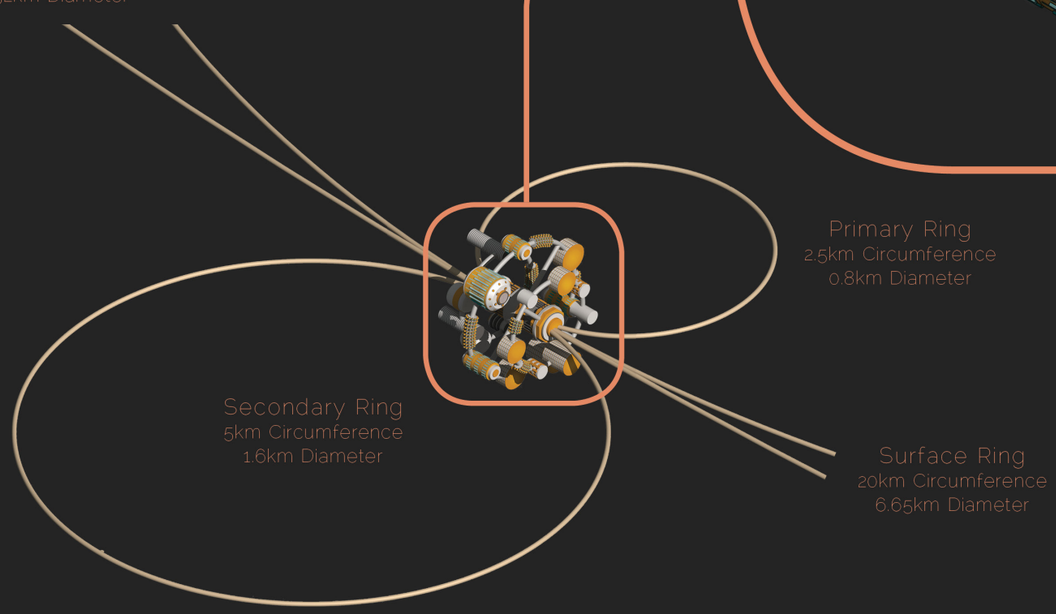
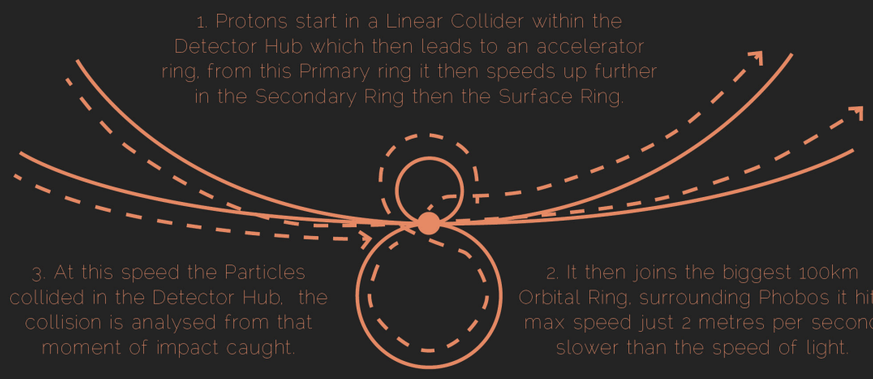
Detector Hub

To progress our understanding of the quantum world of particles we take current day experimentation and take it to a new frontier. The LHC (Large Hadron Collider) at Cern is a Hadron Collider, an experiment that involves colliding particles in a series of accelerator rings. A detector, a huge camera captures the moments of collision, for analysis. The LHC's primary ring goes from a 157m circumference to a 628m to 7km to 27km. For 2035 there is a plan to build a new Collider at Cern, the VLHC (Very Large Hadron Collider) This is set to be 100km in circumference. Our Orbital Collider meets that circumference. The large detector acts as the central hub of our project.





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NAME OF THE PROJECT FRONTIER ORBITAL COLLIDER

DESCRIPTION DETECTOR HUB

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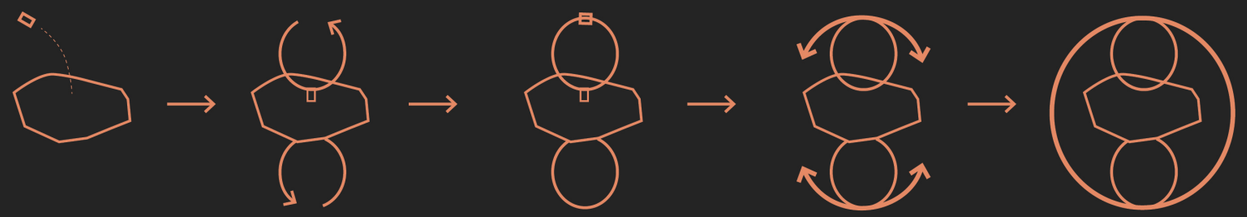
Orbital Construction

To create such a vast construction we seek to utilise materials sourced from space. Much like the ISS, the various living modules, laboratories, PV panels would all have to be launched from earth in a gradual process that would see our space station grow. However to create such a vast 100km ring we would use a step buy step process utilizing 3d printing technology to literally form our orbital from dust.



First printer arrives with basic living nodes

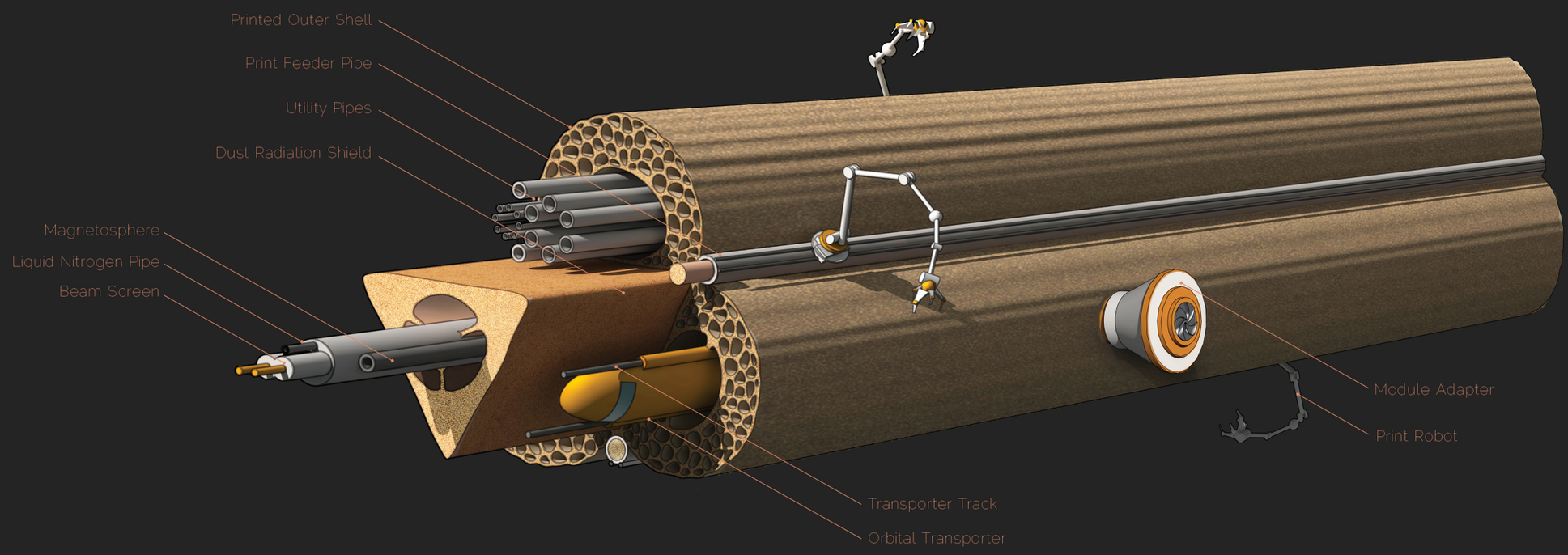
Phobos base formed and dust mining starts. Printing starts on Secondary Colliders

Poles are linked and Orbital collider detector forms the main hub of the project.

Printing starts on 100km collider from 4 points on either pole.

When all points meet the Orbital is complete around the circumference of Phobos.

Below shows a test on lunar 3d prinitng by Monolite UK, Laboratorio Percro and Foster + Partners. This shows a standard Lunar building block using regolith (dust) from the Lunar surface. We plan to emulate this same process and architecture for our printing using Phobos regolith.



Typical Orbital Pipe Section

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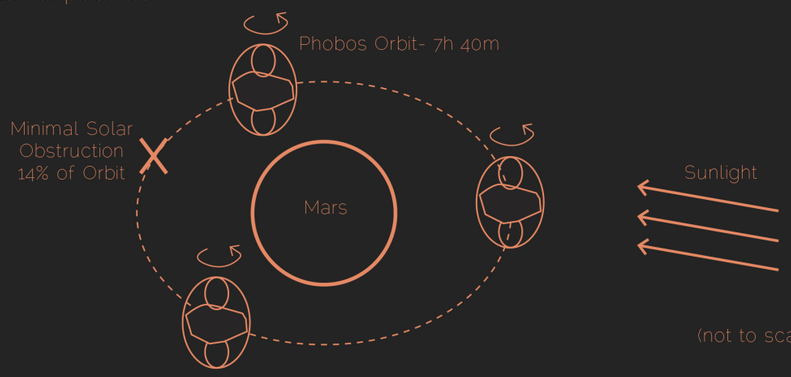
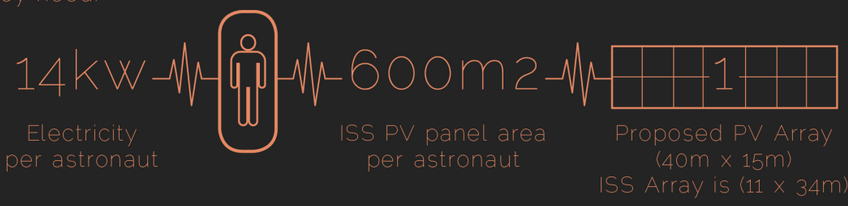
Space Resourcing

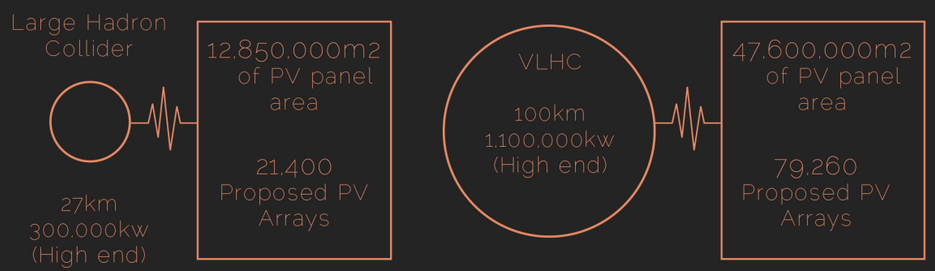
Our electrical systems are initially dependent on solar arrays. Our orbital has a mechanism to keep our ring spinning in order to keep our whole structure on a heliocentric orbit that can spin on an axis in relation to the sun, to maximise solar exposure.

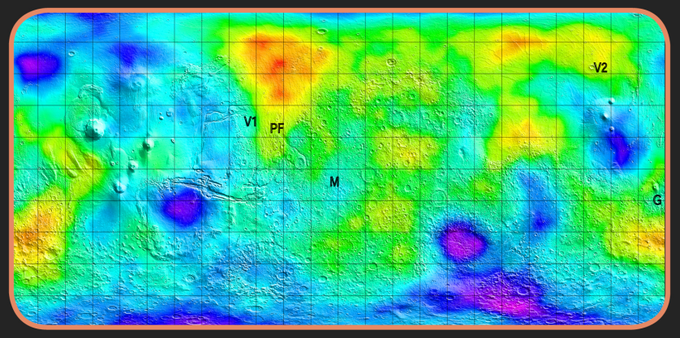


Although our solar arrays can work efficiently in this way by forming part of our sustainable living system, that's based on per astronaut, so whenever the orbital has a new inhabitant it also needs new solar panels to facilitate their energy needs. Using information on the ISS we can work out the proportional amount of electricity needed per astronaut and how much m2 of solar panels they need.

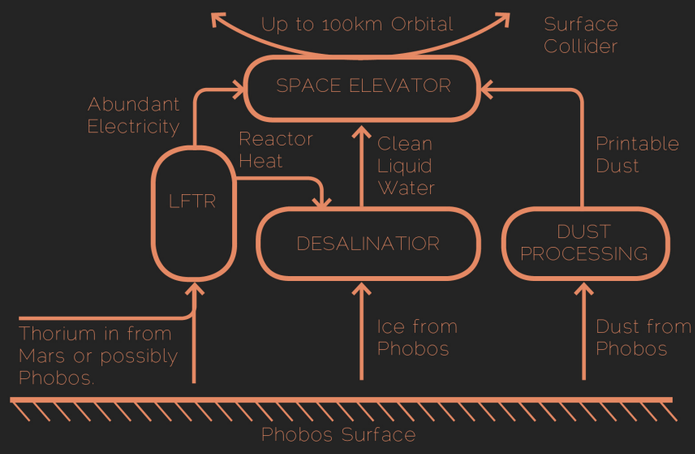


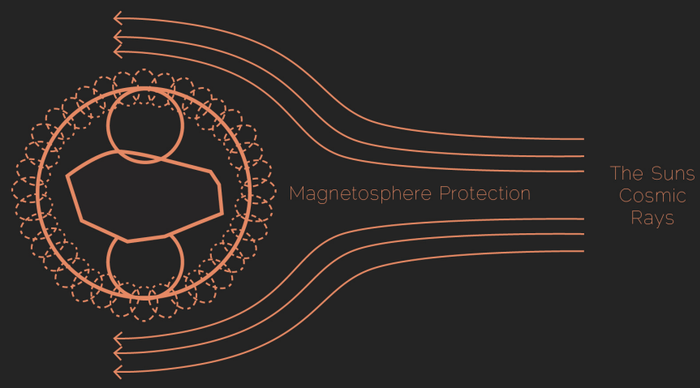
This electrical demand for survival and basic lab gear maybe obtainable by scaling up the amount of PV's we attach to the orbital, the problem arises when the 100km Collider needs to be turned on. As you can see by scaling up the demands of the current LHC at Cern, the demands of a solar powered Collider are vastly unrealistic.





Thorium Map of Mars. Red areas show high densities of Thorium on the Martian surface.



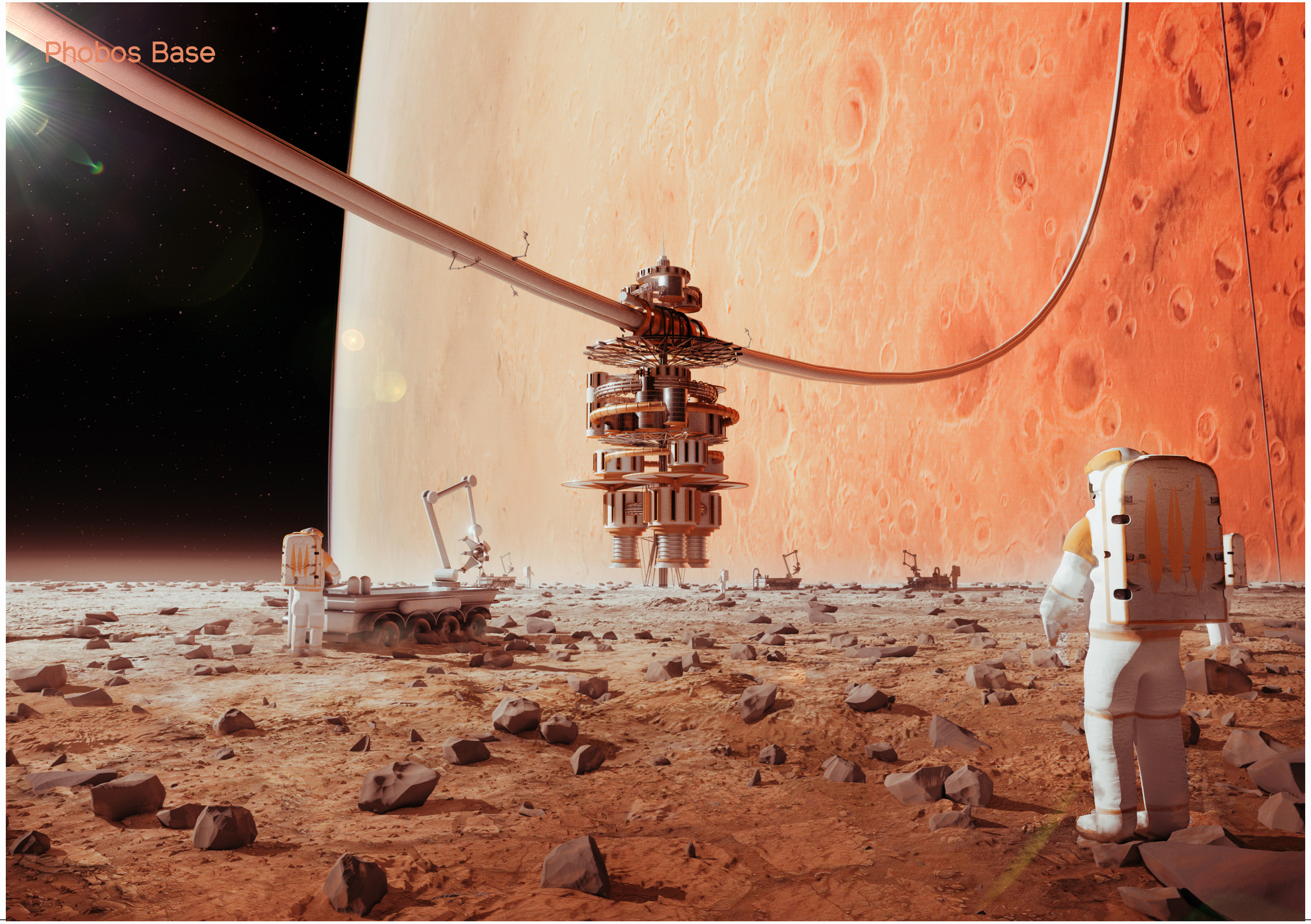


We now know that the surface of Mars is abundant in Thorium (Th.) This element can be mined and used in a Liquid Thorium Fluoride Reactor (LFTR.) 900kg of mined Thorium in a LFTR can produce 1,000mw of electricity, more than enough for future expansion and power needed for our colliders. There is a possibility due to Thoriums abundance it could also be sourced from Phobos.

This creates a Phobos base (diagram left) that is responsible for mining Thorium from Mars or Phobos, to create electricity. Ice to then desalinate into clean water using the reactor's heat. Phobos dust is collected to print the vast orbital. This whole structure acts as the base to spin the whole orbital in order to maximise the solar exposure explained earlier. The Surface Collider provides the transportation or space elevator to transport supplies and people up to the Detector Hub.

With the massive electrical input necessary to power our orbital collider we can also create the necessary protection needed against the Sun's cosmic rays. On Earth our magnetic North and South Poles create an magnetosphere, a shield that protects us from these highly radioactive and fatal rays. The whole collider is lined with an electrical system capable of creating an artificial magnetosphere.

Phobos Base



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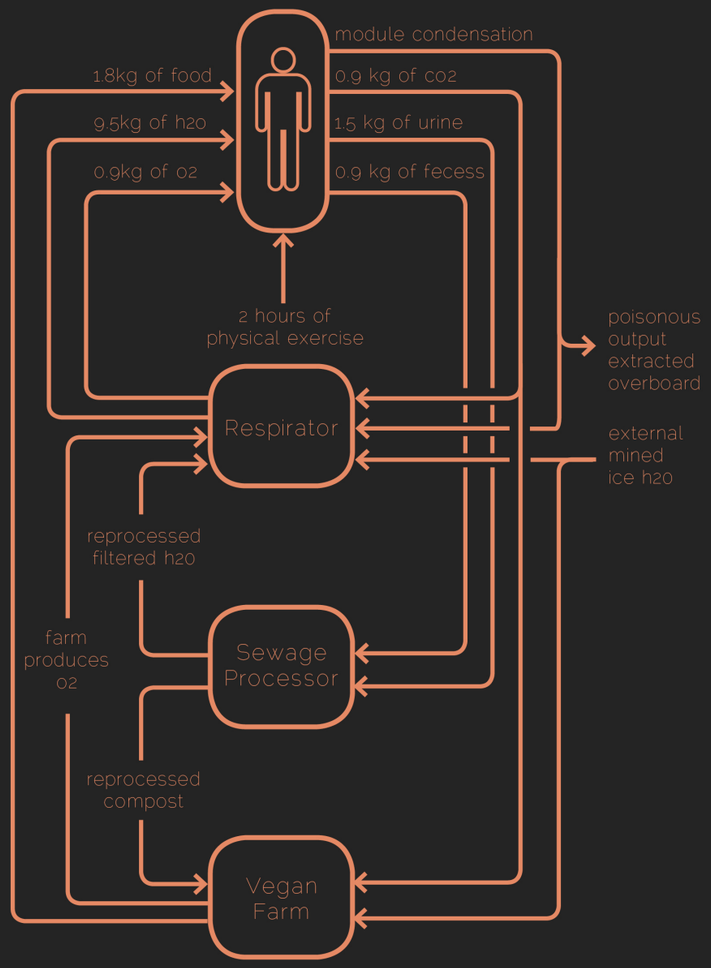
DESCRIPTION PHOBOS BASE

FONDATION JACQUES ROUGERIE
GÉNÉRATION ESPACE MER
INSTITUT DE FRANCE

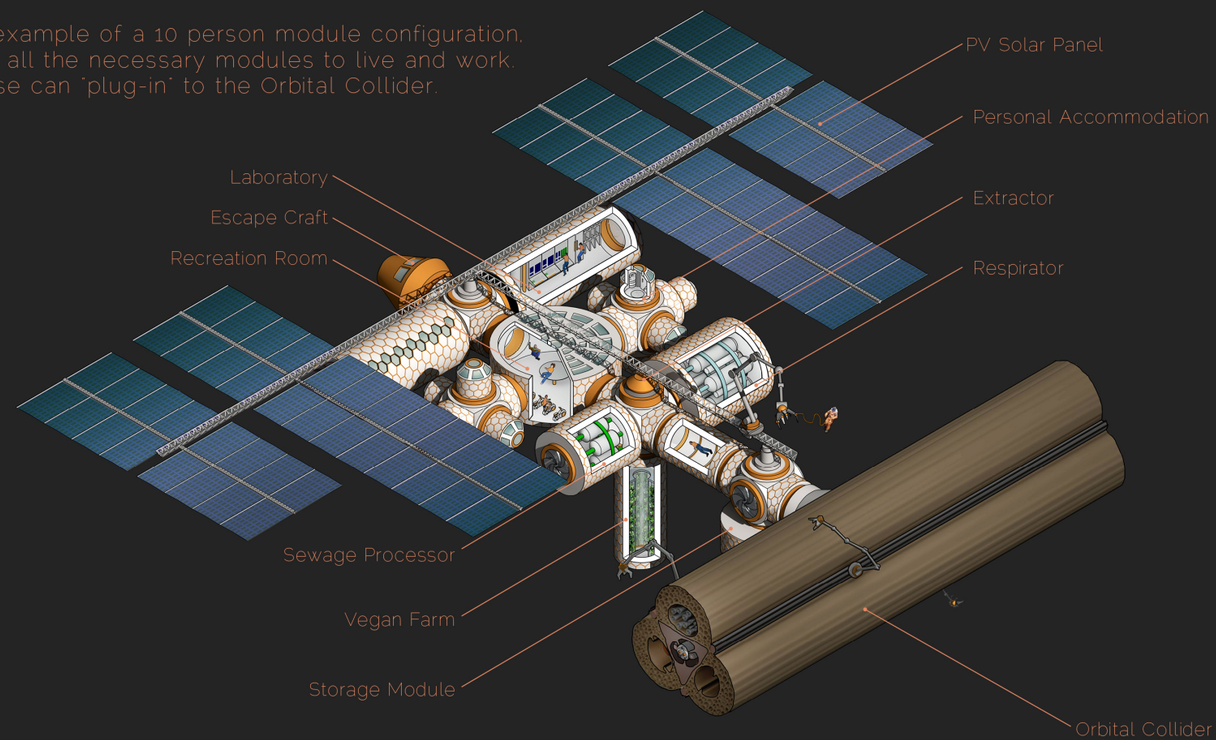
Life Support System

The International Space Station (ISS) demonstrates a partially sustainable living condition by creating a feedback loop utilising human bi-products and recycling them into necessary human resources for life. The diagram demonstrates our adaption of the ISS model, using numbers calculated relative to one Astronaut, which we can then upscale and multiply per additional astronaut.

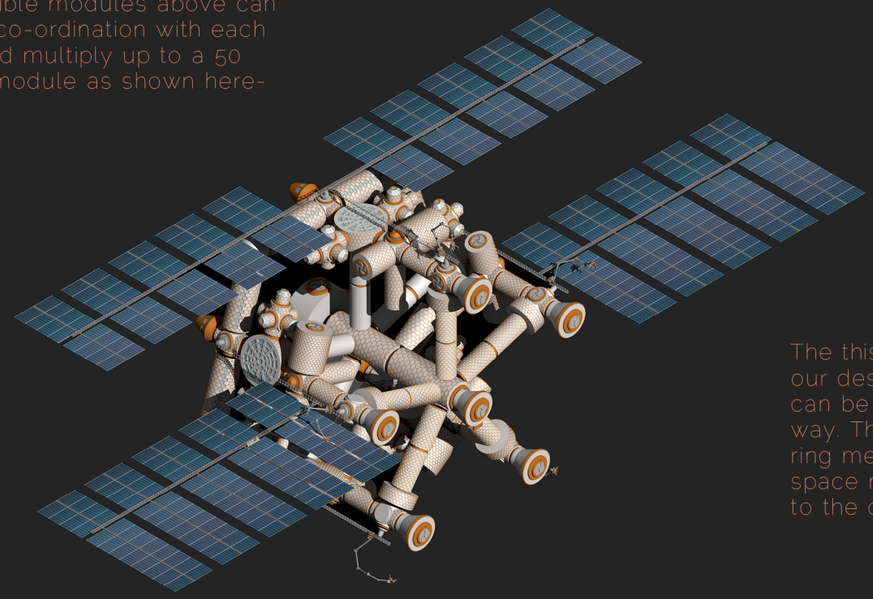


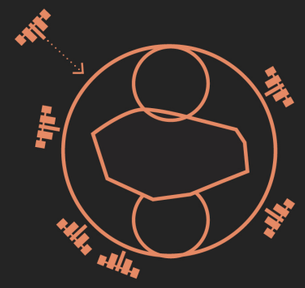
*All amounts per person, per day

An example of a 10 person module configuration, with all the necessary modules to live and work. These can "plug-in" to the Orbital Collider.



The flexible modules above can work in co-ordination with each other and multiply up to a 50 person module as shown here-





(not to scale)

The this metabolistic approach to our design, means that everything can be multiplied up in a flexible way. The vastness of the collider ring means plenty of future Martian space missions can dock like shown to the collider ring.

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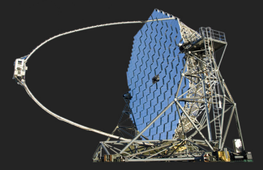
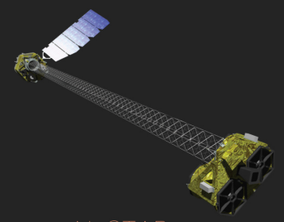
GÉNÉRATION ESPACE MER
INSTITUT DE FRANCE

Developing the Orbital

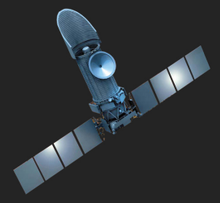
To further the scientific mission of the Orbital we can conduct other scientific experiments alongside the Collider. With such a vast framework in place, the Orbital can accommodate various Telescopes and detectors. Below shows the current level of these instruments, these can be "plugged-in" to our vast orbital.



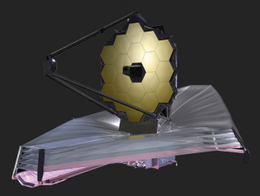
MAGIC
Gamma Ray Telescope



NuSTAR
X-Ray Telescope

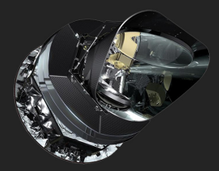


SPEKTR-UV
UV Telescope

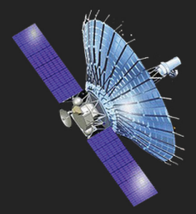


JAMES WEBB
Visible Spectrum Telescope

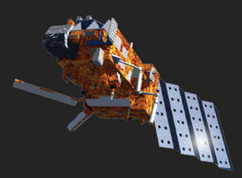
SPITZER
Infrared Telescope



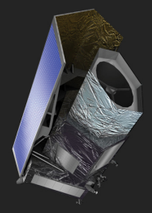
PLANCK
Microwave Telescope



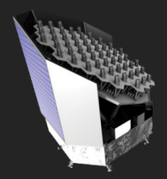
SPEKTR-R
Radio Telescope



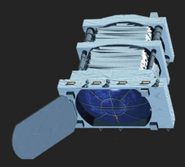
MetOp-SG
Meteorological Telescope



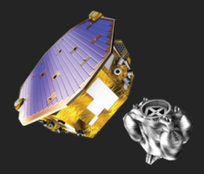
EUCLID
Dark Matter Detector



PLATO
Exo-Planet Detector

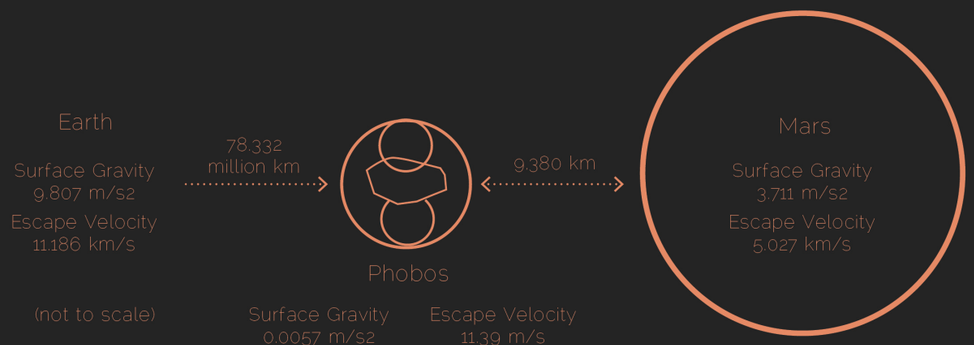


EUSO
Cosmic Ray/Neutrino Detector

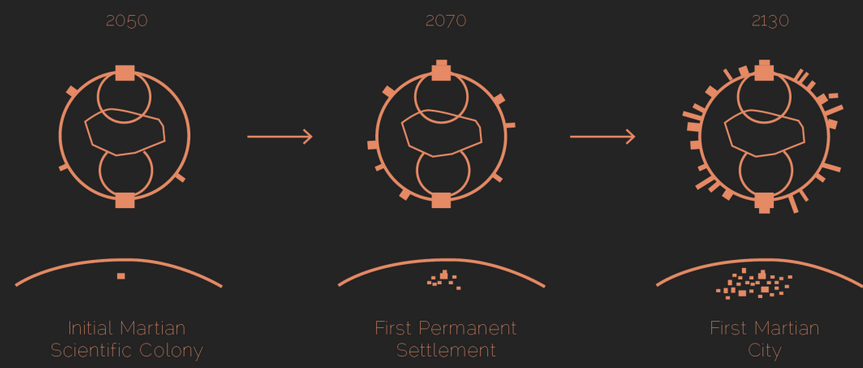


LISA Pathfinder
Gravitantional Wave Detector

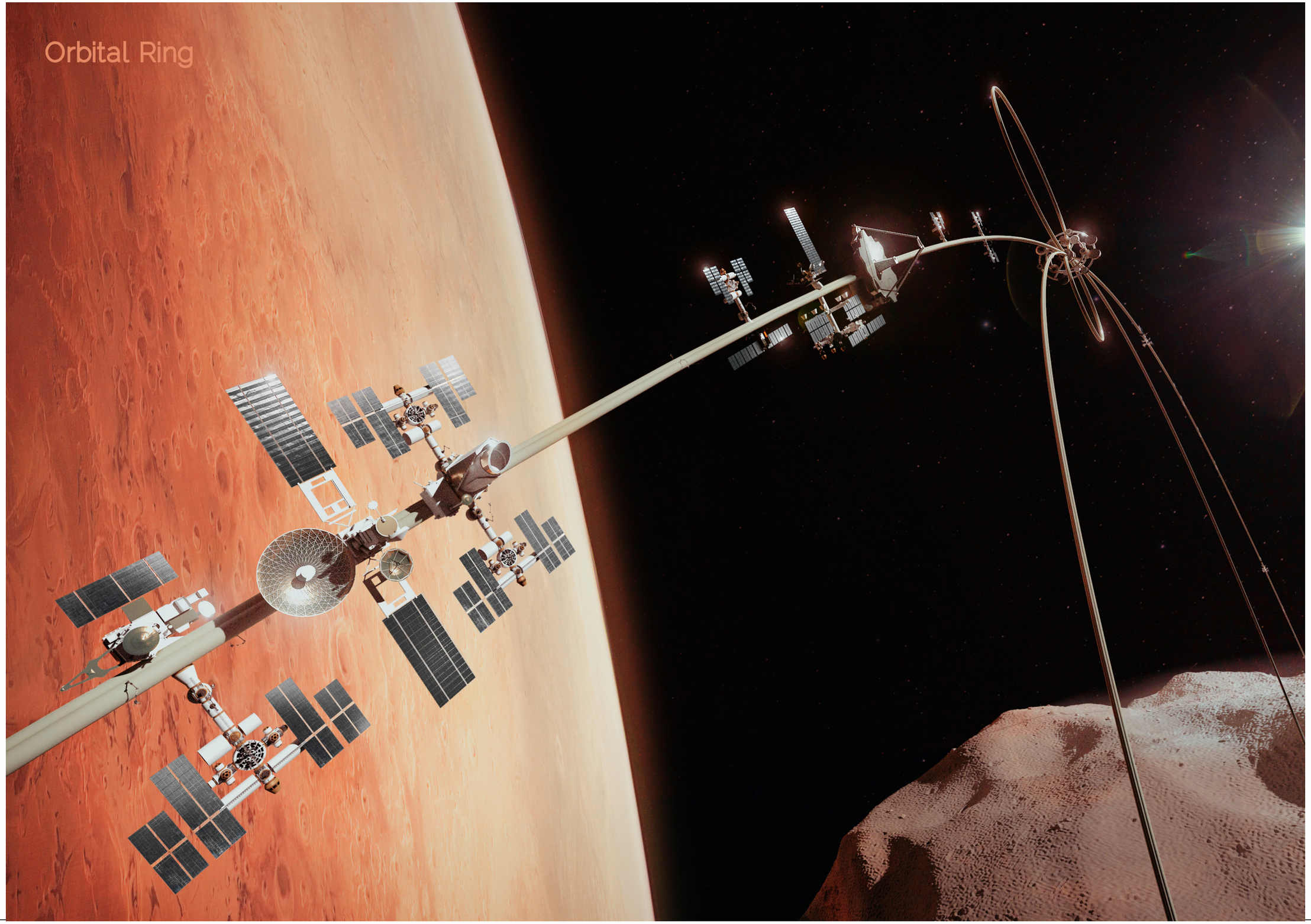
The Orbital can function as a space station, much like a space airport. Landings on Mars require a lot more care and skill due to a higher gravitational pull. Phobos has a fraction of Earths gravity and no atmosphere so its easier after the 78 million km journey from Earth taking about 260 days at the closet orbit, to stop of at Phobos and prepare for a Martian surface landing, which is just 9km from Phobos. This concept is proposed for by NASA in their "stepping stones" concept for Mars landings.



From our manned arrival on Mars, the birth of a new colony can then commence and the frontier is again shifted. In a similar fashion to human exploration and expansion on earth, the orbital will still serve as a platform for further development. Modules can continually be added in parallel to any Martian settlements.



The flexibility of our orbital will then act as an important link, a spaceport to act as transition from space travel to the Martian colony below. Even with our new Martian home, the orbitals place will forever represent the literal scientific collision between the tiny particles that make up our universe in our collider experiments, and the continued exploration of the possibly endless expanse of space from our new Martian cosmic horizon.



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INSTITUT DE FRANCE