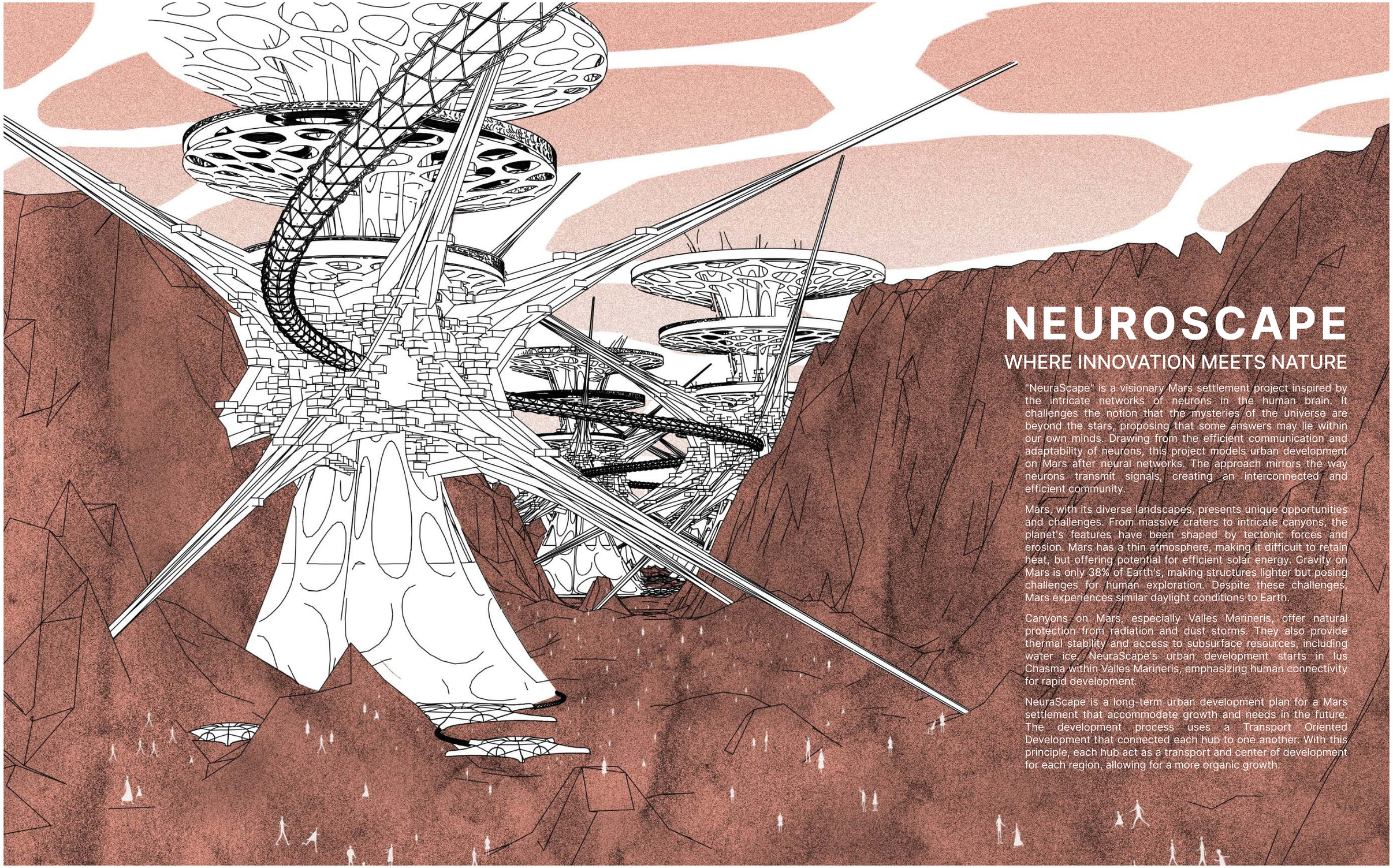

NEUROSCAPE

WHERE INNOVATION MEETS NATURE

"NeuraScape" is a visionary Mars settlement project inspired by the intricate networks of neurons in the human brain. It challenges the notion that the mysteries of the universe are beyond the stars, proposing that some answers may lie within our own minds. Drawing from the efficient communication and adaptability of neurons, this project models urban development on Mars after neural networks. The approach mirrors the way neurons transmit signals, creating an interconnected and efficient community.

Mars, with its diverse landscapes, presents unique opportunities and challenges. From massive craters to intricate canyons, the planet's features have been shaped by tectonic forces and erosion. Mars has a thin atmosphere, making it difficult to retain heat, but offering potential for efficient solar energy. Gravity on Mars is only 38% of Earth's, making structures lighter but posing challenges for human exploration. Despite these challenges, Mars experiences similar daylight conditions to Earth.

Canyons on Mars, especially Valles Marineris, offer natural protection from radiation and dust storms. They also provide thermal stability and access to subsurface resources, including water ice. NeuraScape's urban development starts in Ius Chasma within Valles Marineris, emphasizing human connectivity for rapid development.

NeuraScape is a long-term urban development plan for a Mars settlement that accommodate growth and needs in the future. The development process uses a Transport Oriented Development that connected each hub to one another. With this principle, each hub act as a transport and center of development for each region, allowing for a more organic growth.

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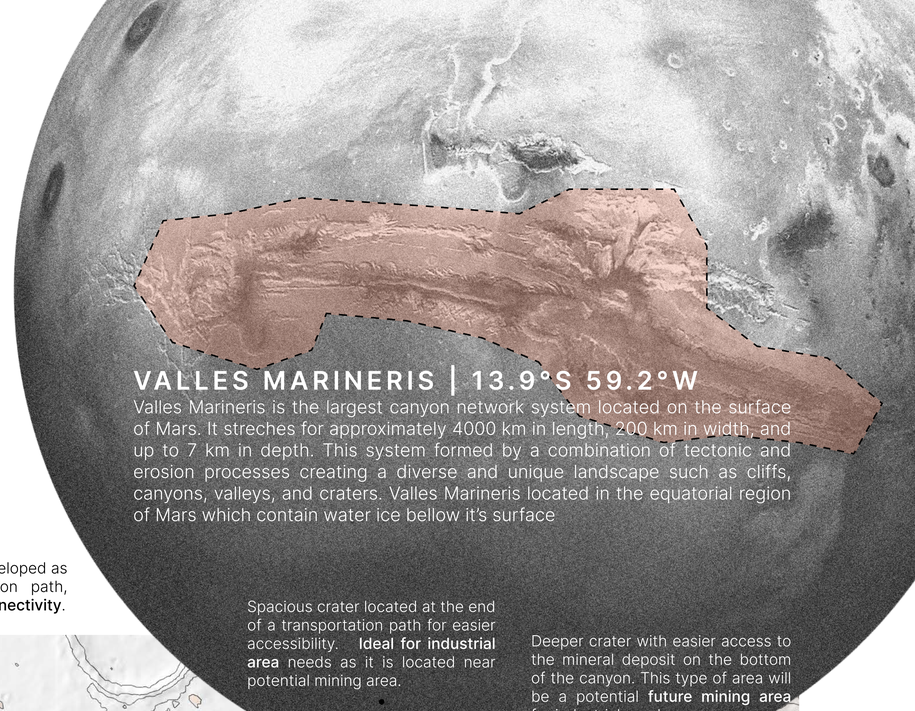
Deep Dive Into The Red Planet

Mars, the Red Planet, have unique sets of feature full of potential and challenges. Mars have diverse topological from a massive crater, canyon, valleys, to volcanoes each with contrast elevation difference. These feature are mostly formed by tectonic activities and erosion and weathering process such as dust storms from time to time. The air is cold and dry as Mars has temperatures range from 20 to -125 degree Celsius with some spikes during certain season. The thin atmosphere is primarily composed of carbon dioxide which makes it even harder to retain heat effectively. Thin atmosphere also makes Mars have low air pressures (0.6% of Earth's) and gives minimal solar and cosmic radiation protection. But, thin atmosphere makes it possible to rely on solar energy as it gives high effectiveness on solar power generator. Mars have lower gravity compared to Earth at 38% of Earth's gravity which make structures weight lighter but add challenges for human exploration. Mars have similar daylight conditions to Earth with days and nights last around 24.6 hours with reddish appearance view from the surface.

Canyons are on of the most dominating feature on the surface of Mars with complex network of interconnected networks. Canyon configuration offer natural shielding against cosmic radiation, solar radiation, and dust storm protection. The configuration also offers an envelope to maintain thermal stability. The depth offer ease of access to subsurface resources such as regolith, minerals, water ice, and more. This also enable geothermal heat for energy generator and more possibilities. Local resource access enables more exploration and adaptation to Mars rough and extraordinary condition. Canyons enable a multipath linear development to maximize efficiency and effectiveness.

Canyon comes with unique challenges as it created an envelope generate a closed space. If not designed properly, this closed space can create an isolated ambience which could affect human physic and phycological capabilities.



VALLES MARINERIS | 13.9°S 59.2°W

Valles Marineris is the largest canyon network system located on the surface of Mars. It streches for approximately 4000 km in length, 200 km in width, and up to 7 km in depth. This system formed by a combination of tectonic and erosion processes creating a diverse and unique landscape such as cliffs, canyons, valleys, and craters. Valles Marineris located in the equatorial region of Mars which contain water ice bellow it's surface

Area filled with steep-walled canyon characterized in a maze like pattern of interconnected canyons, this offers rich geological resource. Ideal for **future long term research, observation, and studies** of Mars.

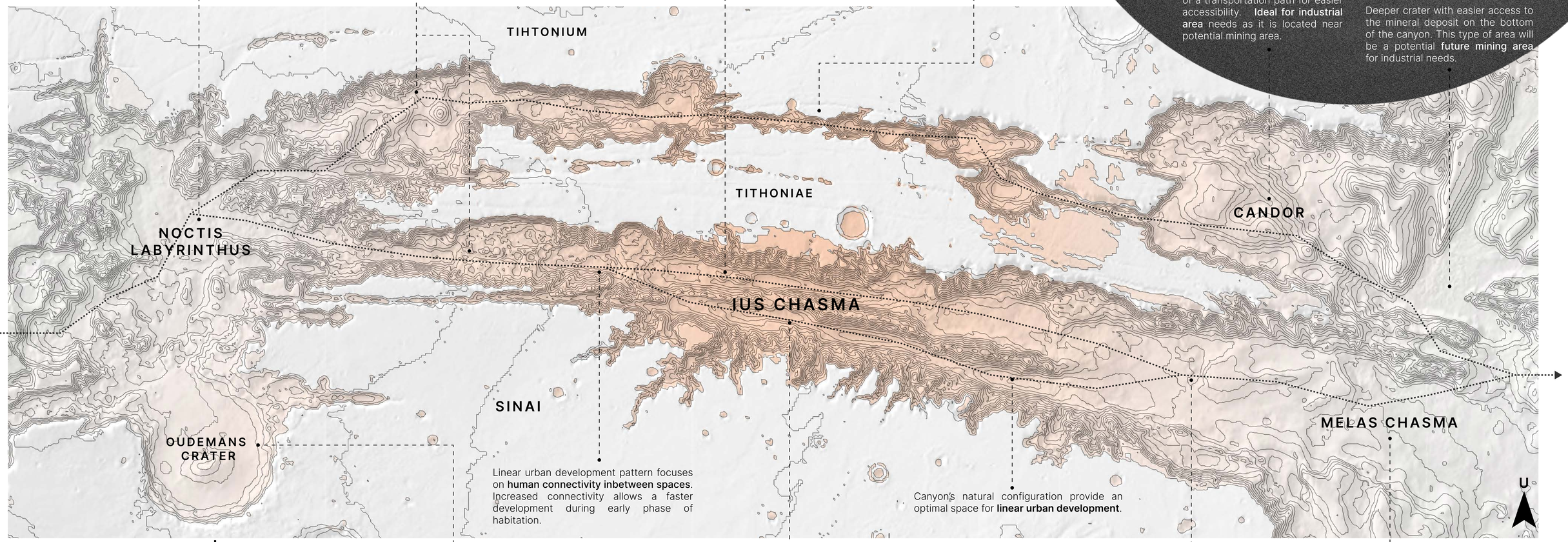
Valles Marineris provide valuable scientific insight into Mars history and geology. Makes it ideal **as a starting point and research** purposes.

Ius Chasma will be the first canyon used for urban development due to it's spacial proportion that can accomodate all needs for early phase of habitation.

Smaller canyon corridor developed as a long range transportation path, **increasing mobility and connectivity**.

Spacious crater located at the end of a transportation path for easier accessibility. **Ideal for industrial area** needs as it is located near potential mining area.

Deeper crater with easier access to the mineral deposit on the bottom of the canyon. This type of area will be a potential **future mining area** for industrial needs.



Linear urban development pattern focuses on **human connectivity inbetween spaces**. Increased connectivity allows a faster development during early phase of habitation.

Canyon's natural configuration provide an optimal space for **linear urban development**.

VALLES MARINERIS | 13.9°S 59.2°W

Development Path

Development Priority

High — Low

Center point of Ius Chasma will be the **Urban habitat development starting poin**t. Starts from the middle of the canyon move towards nearby crater which has a more spacious area.

Nodes combining two or more paths also act as a potential transport hub.

Melas Chasma is a spacious crater that allows future **urban radial development** within this area. This crater is connected to other geological features such as canyon and craters. Ideal starting point for **long term development plan to colonize Mars.**

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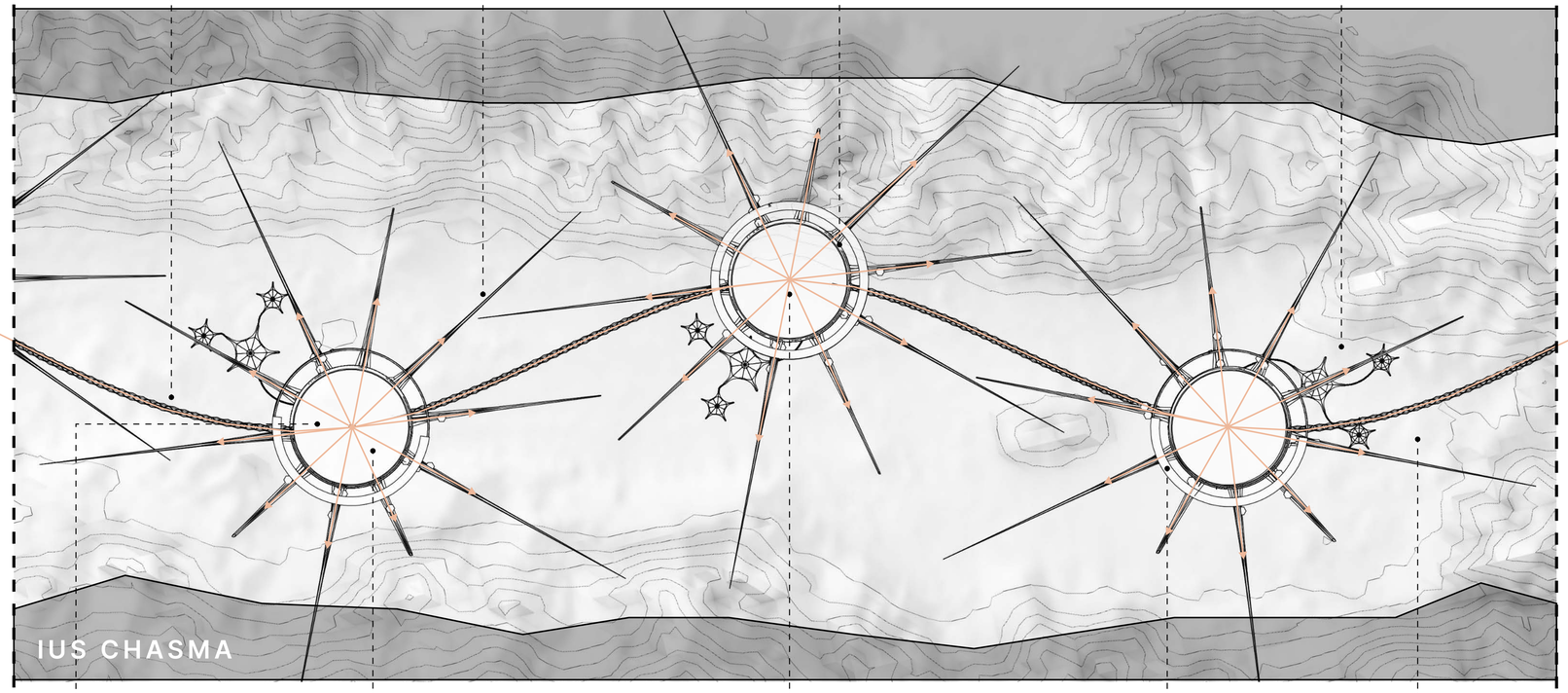
The Ma(r)sterplan

Axon, Transportation Path connecting central hub as the main body horizontally.

Dendrite, branches act as the main supporting structure with residential modules attached on it.

Nucleus main body as a place for humans to live. This structure consist of residential, communal space, and transport hub.

Industrial Area designed for mining, fabrication, and developtment of local resources for early habitation needs.



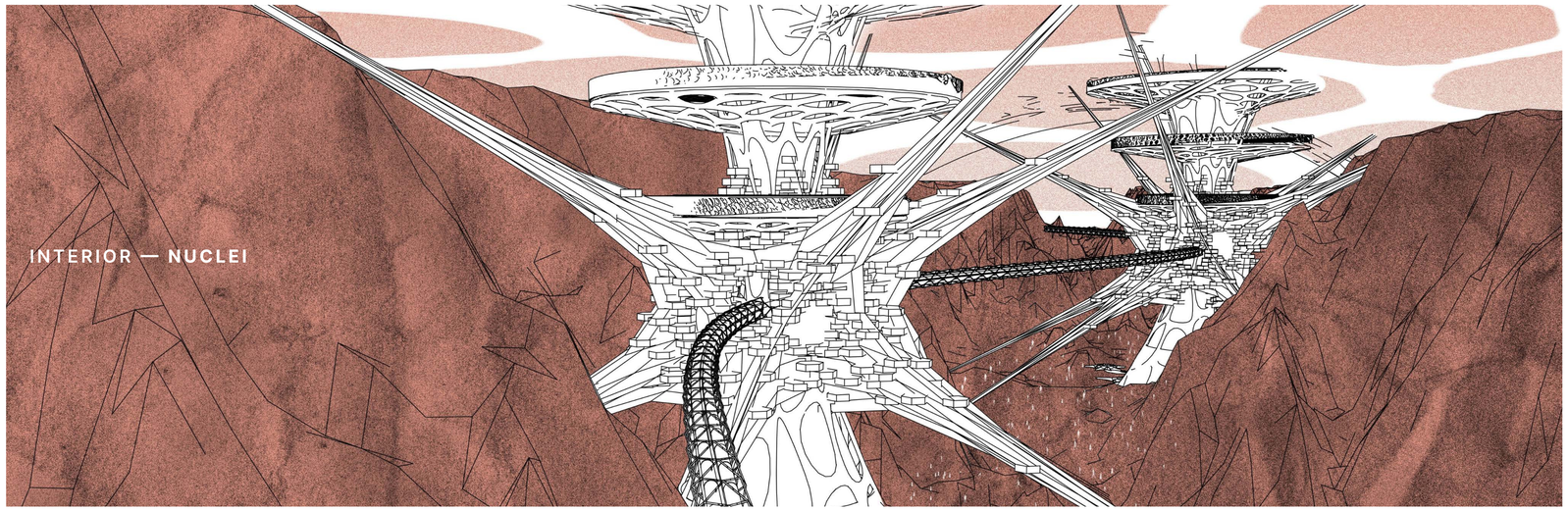
The structure is designed to be a mass produce product, it will connect spaces and fill it with lifes.

Tornado Tower serves as the main vertical connection between places with different level of needs.

Movement pattern within the structure and urban area resemble the flow of information on neurons. Humans move on the transportation path to reach other central hub then move to it's destination on one of it's branch.

Hierarchy of Needs consist of 3 rings filled with human needs to adapt and thrive in a new condition.

Potentital local **resource mining area** located near industrial area for easier accesibility.

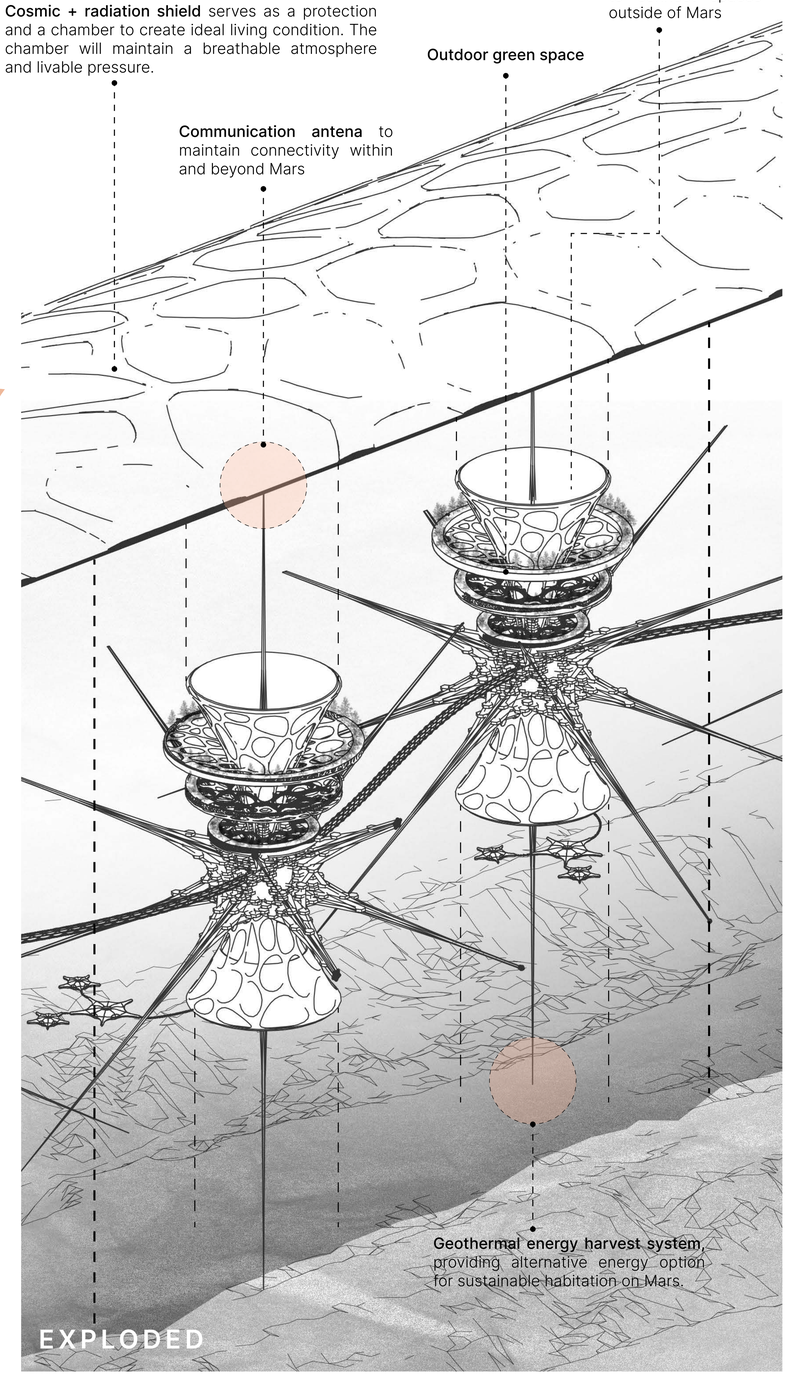


Cosmic + radiation shield serves as a protection and a chamber to create ideal living condition. The chamber will maintain a breathable atmosphere and livable pressure.

Launch system port to connect spaces outside of Mars

Outdoor green space

Communication antena to maintain connectivity within and beyond Mars



Geothermal energy harvest system, providing alternative energy option for sustainable habitation on Mars.

EXPLODED

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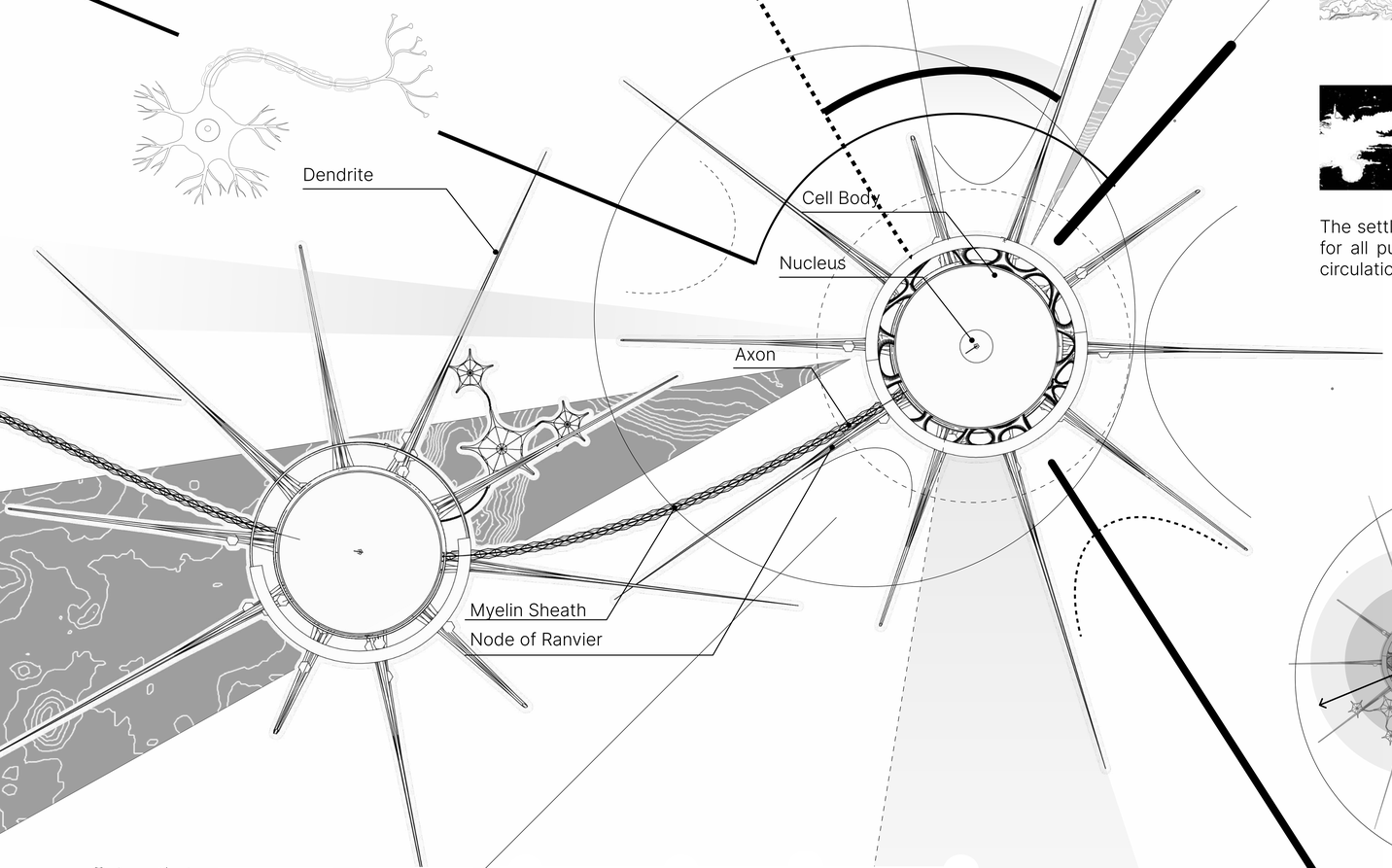
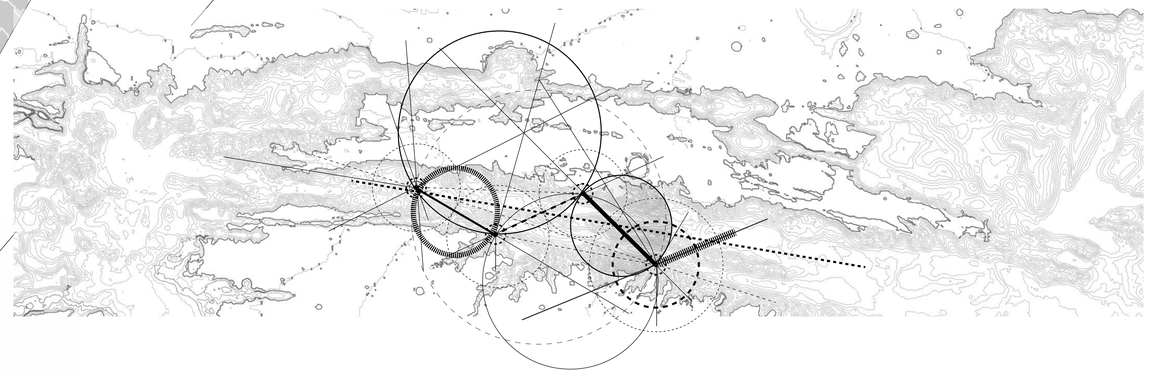
Neuron As Pathway

Human's brain are a some of the most complex structure we discovered so far. In our time of space exploration, we seek to the stars trying to figure out our value in this vast universe. What if? Those mysteries that lies beyond the stars is just all in our head? Stars, planets, black holes, meteor are all the product of our brain's perception of the universe, while the key to unlocking in is hidden in our own brain.

This become one of our main principle in human's space exploration, especially building a habitat in a foreign planet, Mars. We look into the fundamental component of how a brain works, which is the neuron. Neuron can be seen as a hub that transfer information and data throughout the brain. We use this principle as the base for our Mars' urban development using a TOD approach (Transport Oriented Development). We mimic how neuron works and applied it into how we can create a more efficient way of building a Mars settlement.

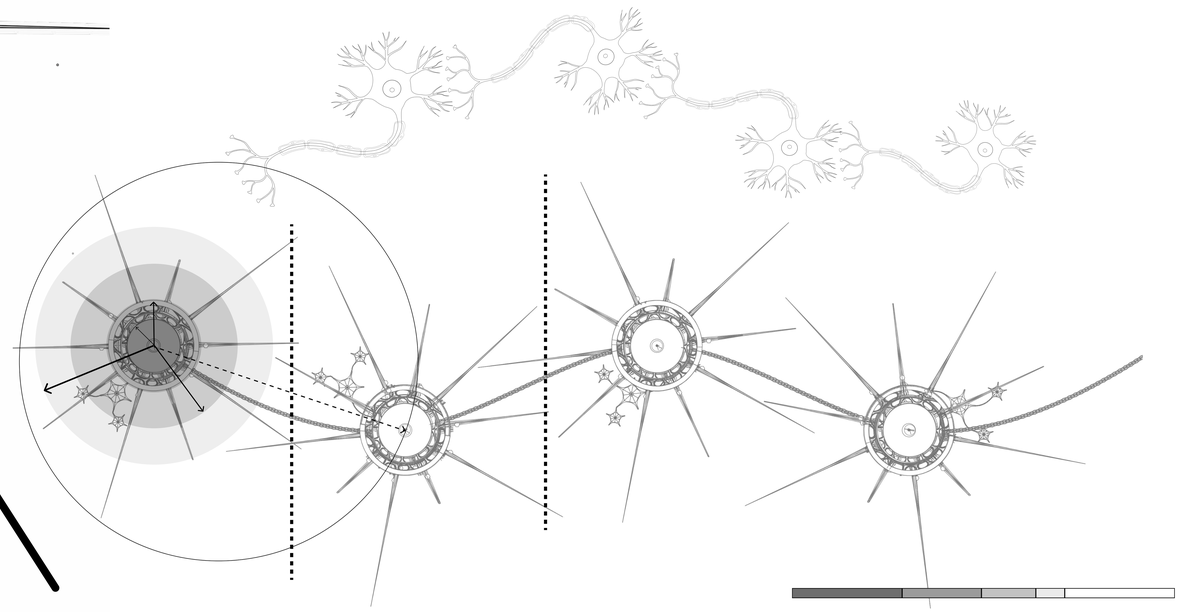


From existing research regarding the visualization of the axon's branches in the brain, the pattern produced from the research resemble the pattern of canals or canyons that is also found in Mars. This become the starting point for our settlement development based on how neuron creates branches and transfer data throughout the brain.



Both Mars's Site (Valles Marineris) and the morphological rewiring of axonal connectivity after laser transection in different brain regions has similar silhouette. This become one of the interconnected factor between the neuron based settlement in mars and how our brain transmit electricity.

The settlements are structured with the nucleus as the center that act as a transportation hub, research center, and also the center for all public spaces and activities. Each main hub (Nucleus) are connected by transportation tube (Axon) that act as the main circulation of people, energy, and information with station in each one (Dendrite).



How we develop our TOD based settlement, by using a gradual approach. Every tower that resembles Nucleus will be the central of development and living center. Each hub act as its own entity without needing the support of other tower. Just like a neuron, each towers merely act as a station or transit for transferring information / data. In this case, not not only information that is being transferred, but also people, resource, and energy, through circulation path of Axon.

The duration for developing each hub is very gradual, from the longest period of developing its main core structure and outward towards the residential structure around it. After completing the steps outward, begin the process of creating the bridge that ultimately going to connect each tower to one another. This gradual development is visualized through pulses, similar to how neuron fire electricity and leaves residual pulse radially.

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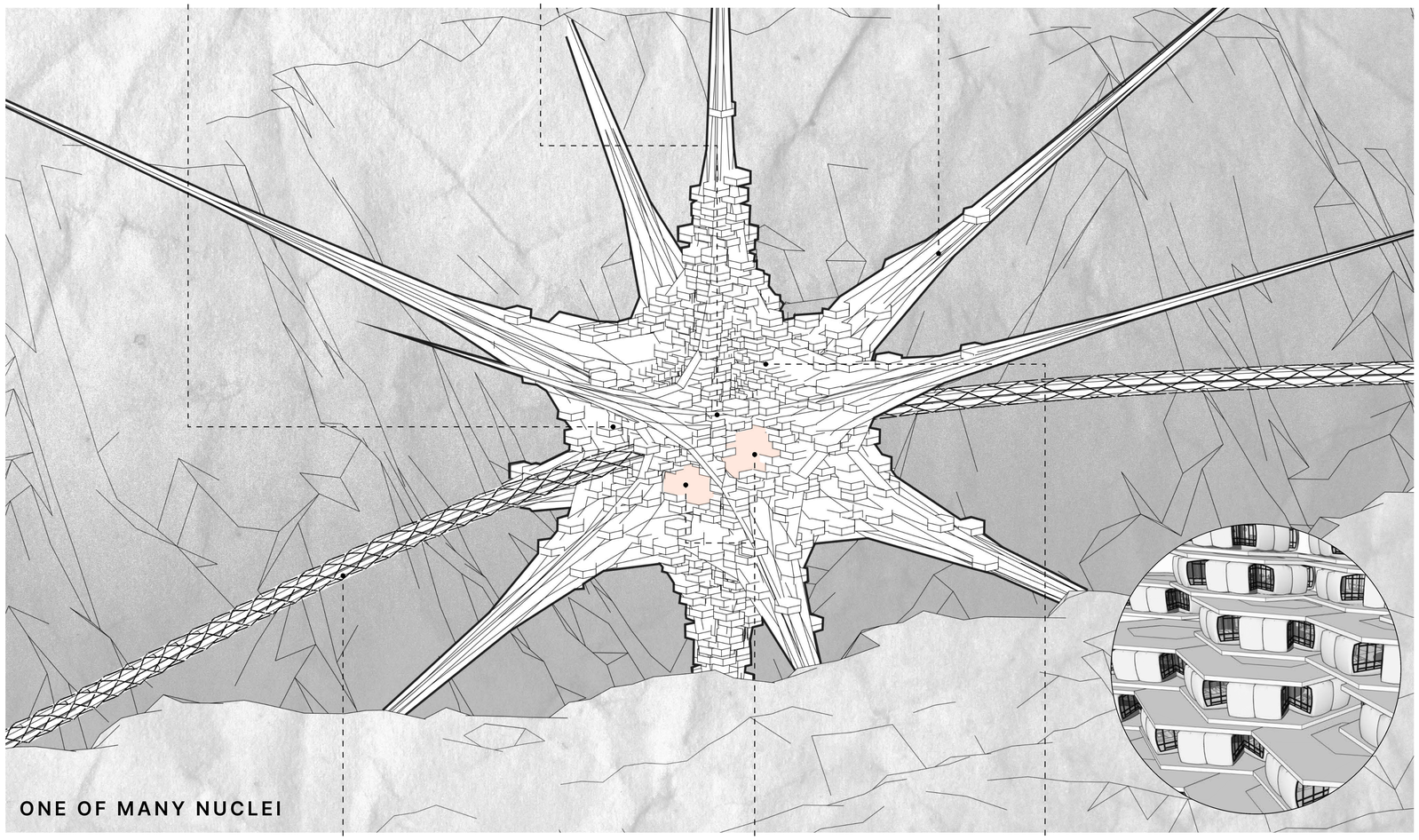
Nucleus — The Main Body

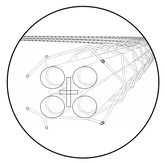
Nucleus has become much more than just a settlement; it's a thriving activity and lifestyle center that defines the first generation's experience. This bustling hub represents the culmination of human ingenuity and adaptability on the Red Planet. From state-of-the-art research facilities to innovative urban farms and energy-efficient living spaces, nucleus embodies the very essence of living. Residents engage in daily activities that combine work and leisure, with communal gardens, virtual reality entertainment, and collaborative scientific ventures. The center's unique design fosters a tight-knit community where the pursuit of knowledge and sustainability go hand in hand with an adventurous lifestyle. Nucleus isn't just a place to live; it's a testament to humanity's resilience and aspiration to thrive on another world.

Every each one of nucleus will act as **the center of life**. Nucleus offers all essential life needs making it the center of activities during early habitation.

Transportation hub located in the center of the nucleus. The position of the hub is designed to increase connectivity between places.

Nucleus branch act as the main structure. Mars low gravity allows structure to be built with less support compared to Earth. The branch tension system support the structure in 3 dimensional axis to ensure stability. It also acts as an expansion area for additional modules in the future. The structure are made from 3D printed regolith combination with segmented surface for high precision adjustment during it's usage.

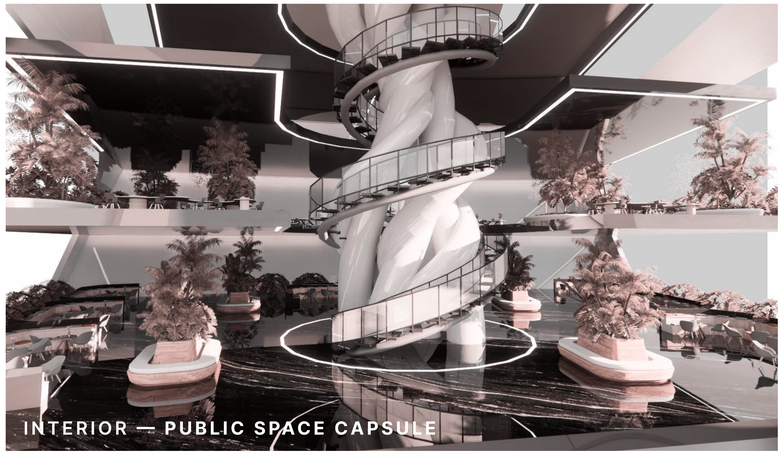




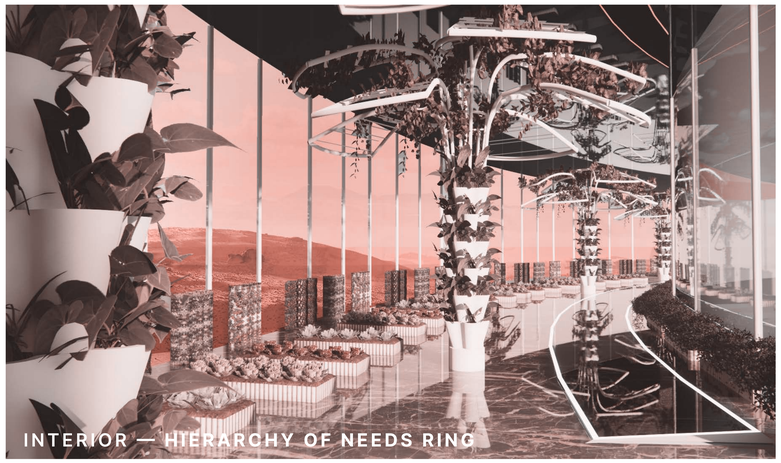
Transportation path to increase mobility for humans and resources transport during early stage of habitation. The path consist of 4 transparent vacuum tubes for 2 way travel. High velocity trains will be moved using magnetic propulsion inside the vacuum tubes. The path structure will be supported by a metal exoskeleton structure.

Public space capsule surrounded by residential modules with direct access from the transport hub that's located in the center of the nucleus.

Residential module takes shape as a hexagon attached on the outer skin of the nucleus. The modules area fabricated on Mars using 3D printed local resources. The modules are attached and stacked organically to the nucleus and each other to increase social connectvity.


INTERIOR — PUBLIC SPACE CAPSULE


INTERIOR — RESIDENTIAL MODULE


INTERIOR — HIERARCHY OF NEEDS RING

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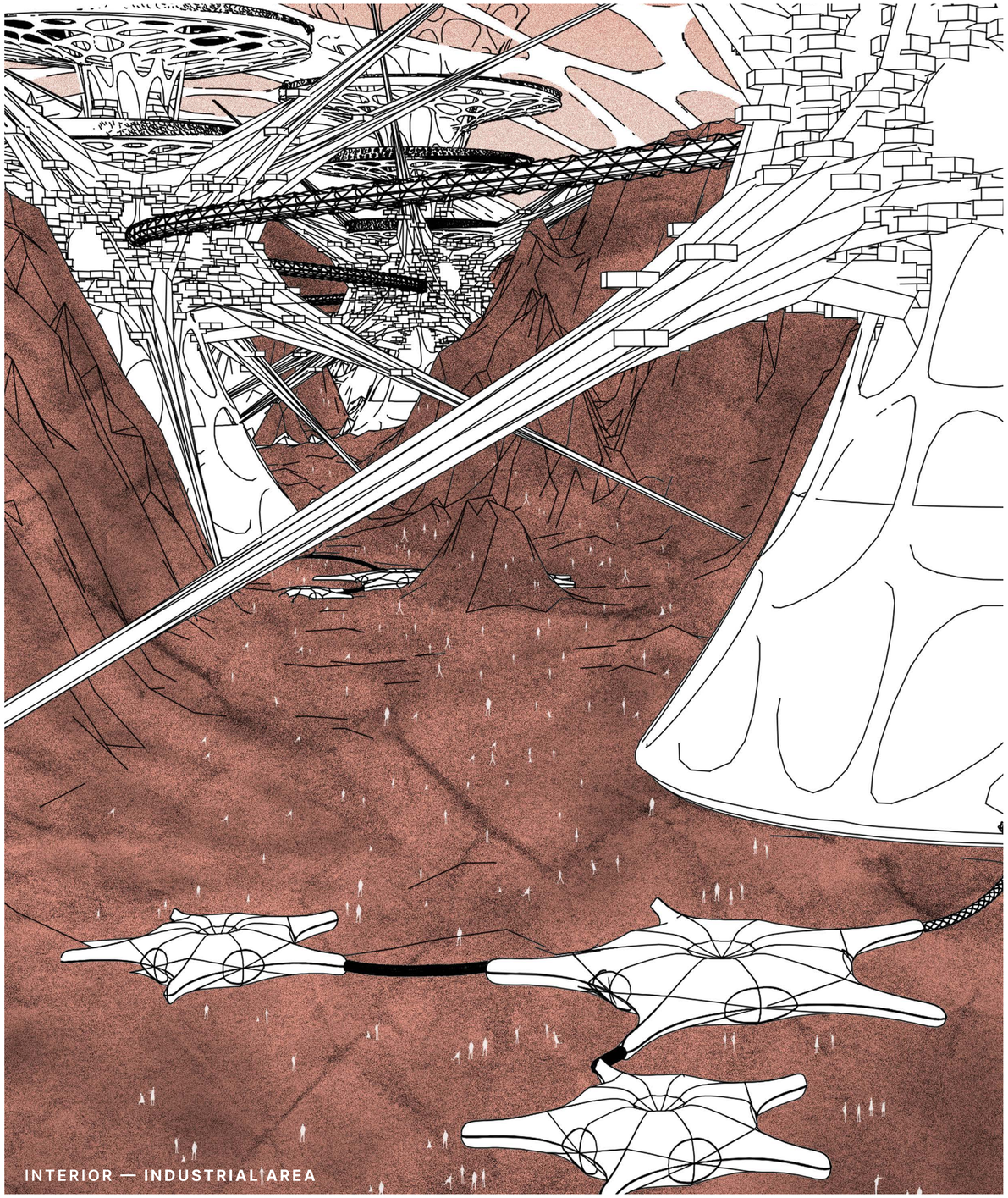
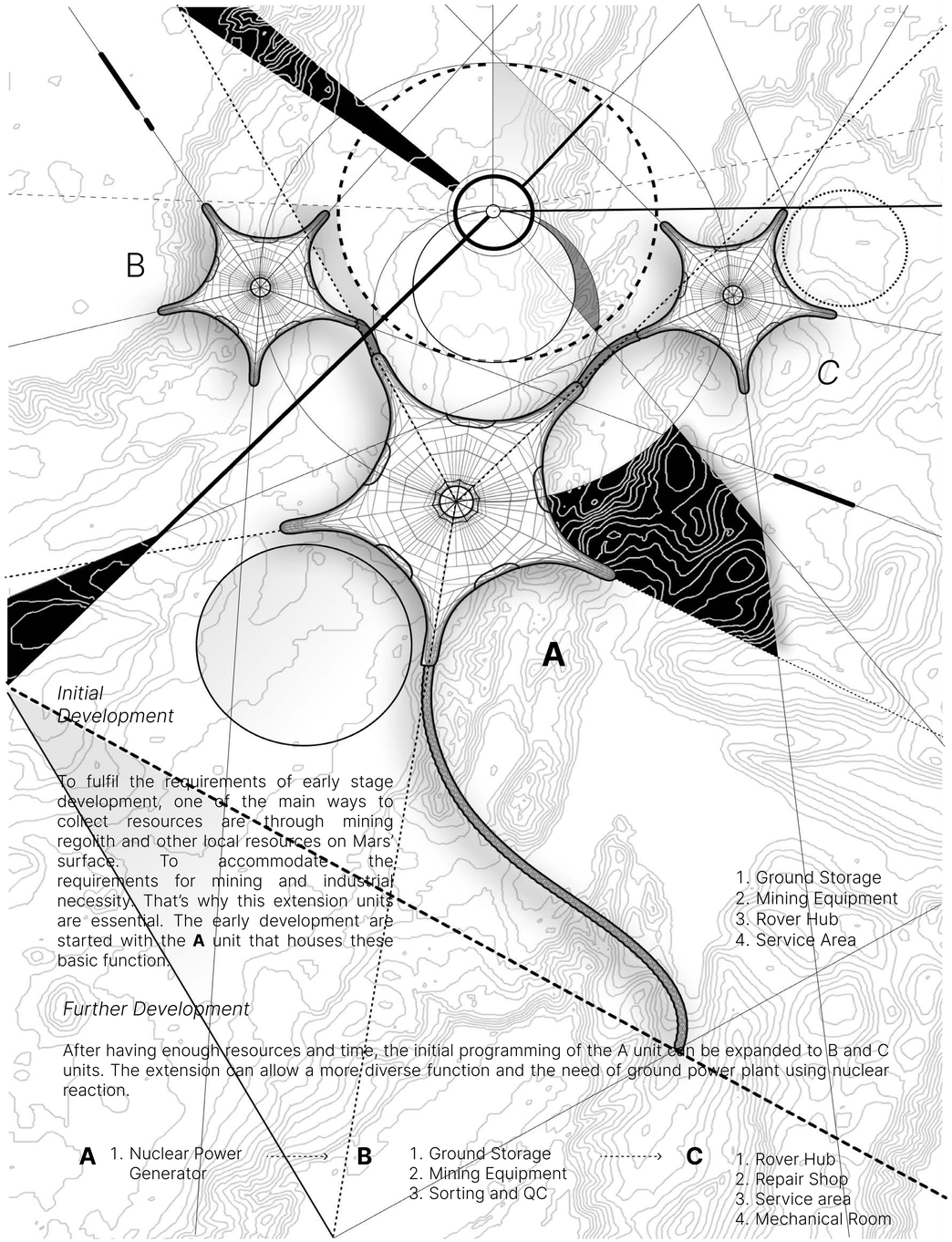
Industrial Area





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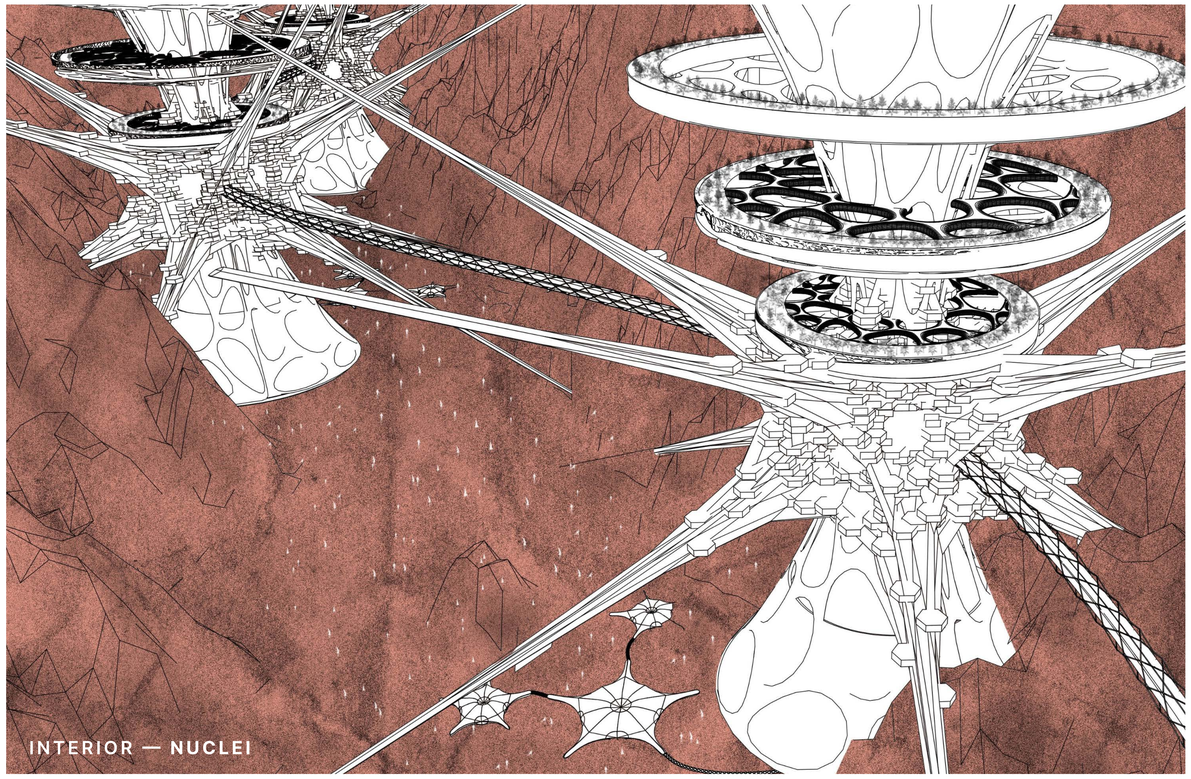
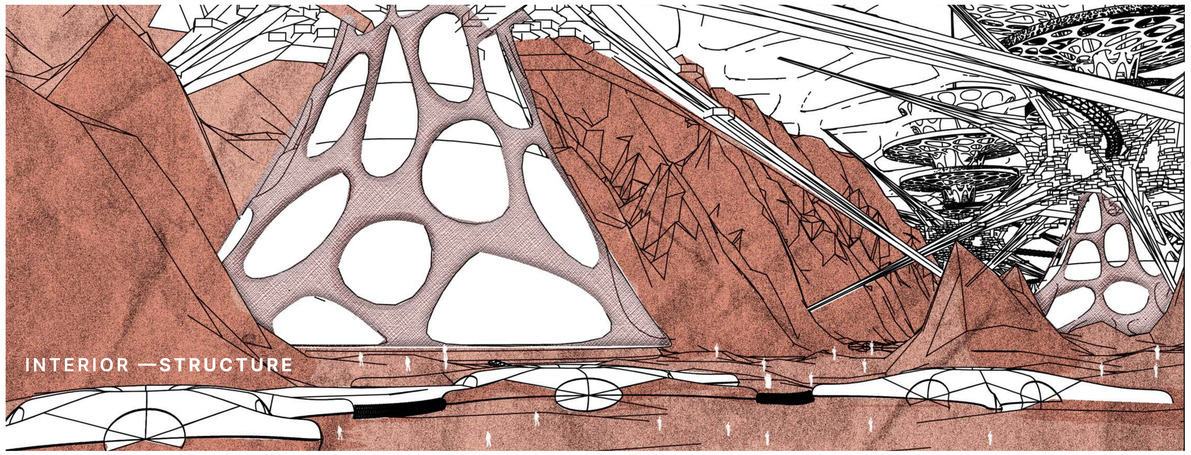
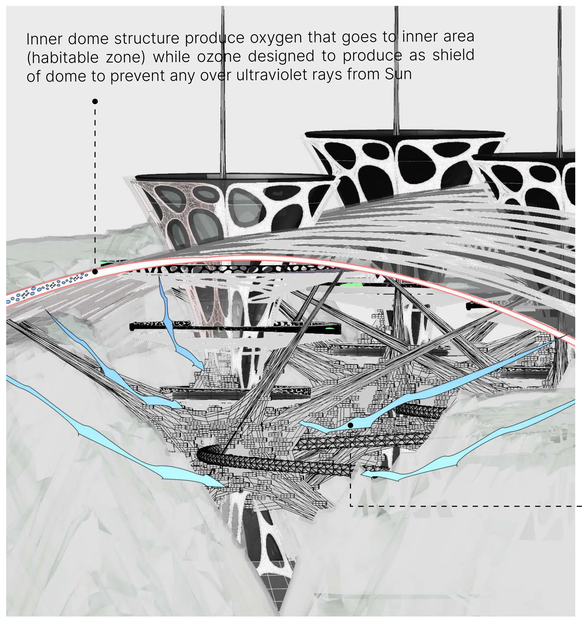
Source of Life





Main structure of Mars use the sustainable materials which can produce on the Mars itself. Current technology support 3D printing of regolith -- The abundant materials in Mars's planet. 3D printed lunar regolith simultan structure could reached 110 celcius degree and 91.13 MPa. In addition, 3d printed was designed to maximizing the force distributions through various simulations to find the best shape and force load capacity.

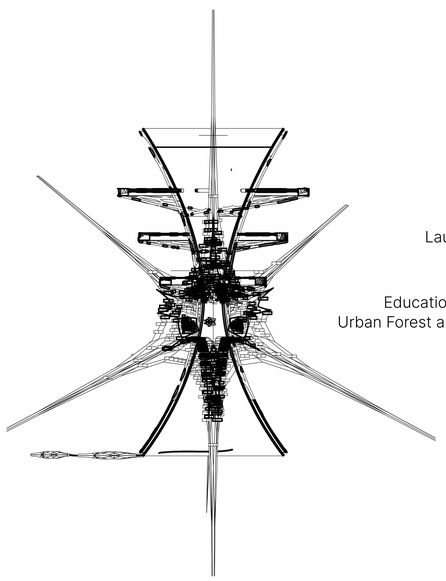
Neuroscape also provide integrated launch port of rocket. The tornado tower act as center building and also as launchpad at the top of tower. The launchpad seems as airport transportation to connect people and other region (such as others tunnel of Mars and also Earth). Thus, Mars Martians has never feel isolate or spreadiing out depression.

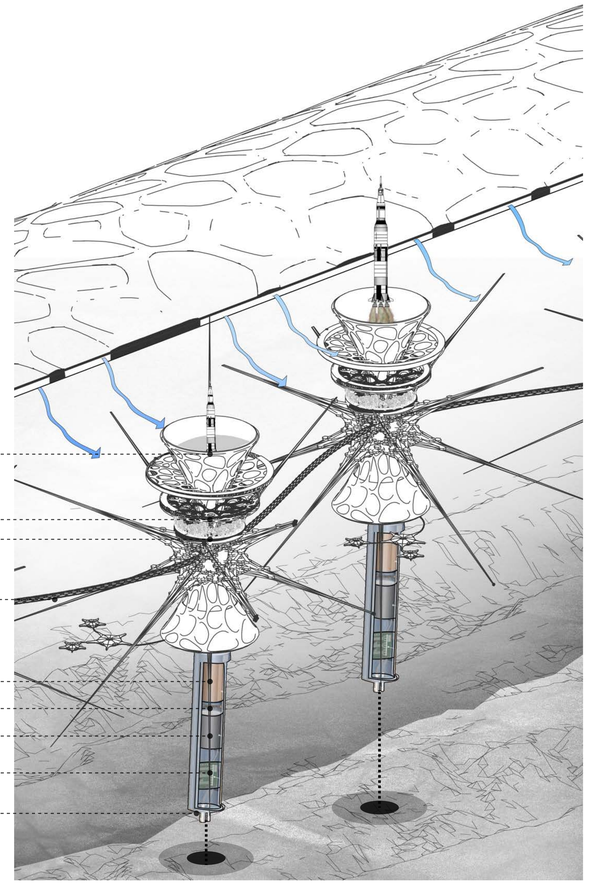


The materials of dome were created by Chitin and 3D print of Regolith. Chitin could has possibility to substitute glass of Earth. Chitin created from insects which could be produce by artificial ecosysten on Mars. The extraction of chitin would be a byproduct of the crew's food supply and consumption.

In other hand, 3D print of Regolith act as main structure of dome. Regolith is loose, rocky materials that cover surface of Mars. One of the approach that could use Regolith as materials is to create through 3D printing. In addition, regolith could be huge potential due to the basalt fiber has possibility to extracted from regolith.

Mars Oxygen In-Situ Resource Utilization Experiment (MOXIE) is an instrument onboard the Perseverance rover that is designed to produce oxygen from the Martian atmosphere for burning fuel and breathing 1. It is a technology demonstration that aims to test a way for future explorers to produce oxygen from the Martian carbon-dioxide atmosphere 1. MOXIE is located inside the rover (front, right side) and weighs about 37.7 pounds on Earth 1. It has a power of 300 watts and can produce up to 0.022 pounds of oxygen per hour (up to 10 grams per hour) 1. MOXIE has just finished its 16th and final oxygen-producing run aboard NASA's Perseverance rover





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