

## MARSCEPTION 2024

# Marsception 2024 | Νικητές Διαγωνισμού

Archetype team - 30/07/2024

International design competition platform Volume Zero Competition has announced the results of the Marsception 2024 Architecture Competition. The Marsception 2024 Architecture competition challenged participants to create a self-sustaining living space for the initial habitants, a group of five researchers, of the Red Planet. Participants envisioned a utopian tomorrow, transforming humanity into a multi-planetary species.

The participants had to select a location anywhere on the topography of Mars with interplanetary travel for humans, not a far-fetched idea and innovations made every day to make it a reality soon. Participants from over 32 countries came up with their creative and sustainable design solutions to cater to this spatially challenging Architectural problem.

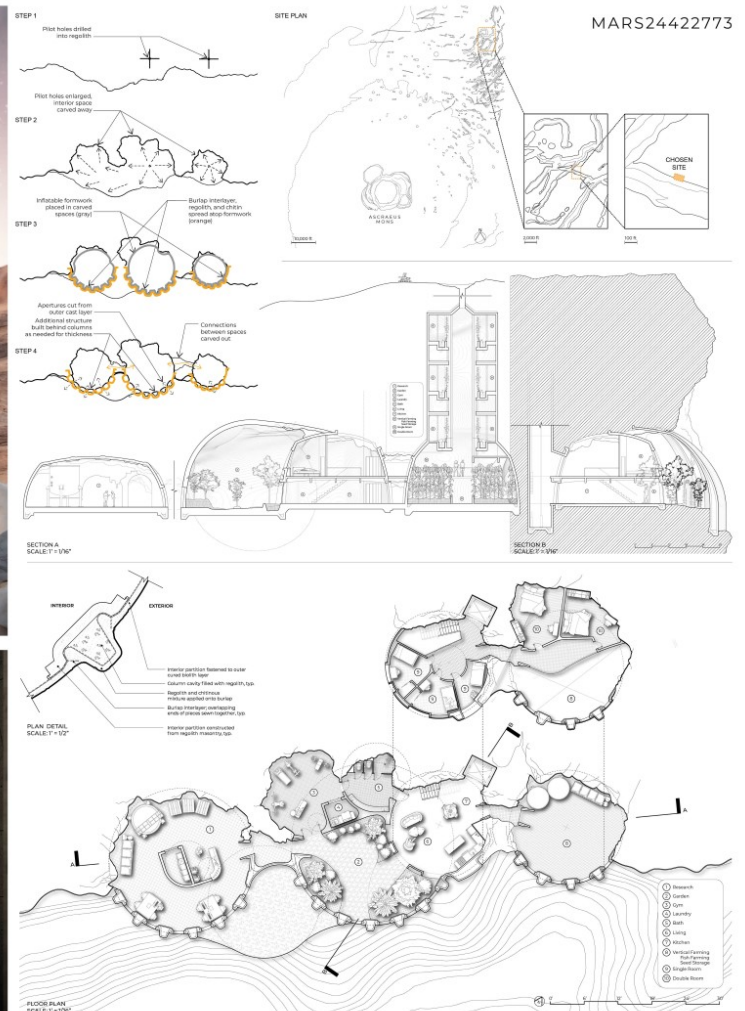
Volume Zero Competition thanks all the competitors for participating in this competition and for contributing to this competition's research.

The esteemed jury for judging this competition consisted of Arotty Panyang (Studio Aro), Carsten Primdahl (Cebra Architecture), Georgi Petrov (SOM), Sushant Verma (rat[LAB] Studio), YU Ting (Wutopia Lab), Yuko Sono (Clouds Architecture Office), Edouard Cabay (Institute for Advanced Architecture of Catalonia [IAAC]), Chenchen Hu (HCCH Studio), Eva Bo Geisler (SPACON & X).

The top three winners were awarded total prize money of \$4,000 while ten entries received HonorableMentions. Here are the winning entries.

## FIRST PLACE THRESHOLDS

Alec Naktin and Natalie Perri, United States

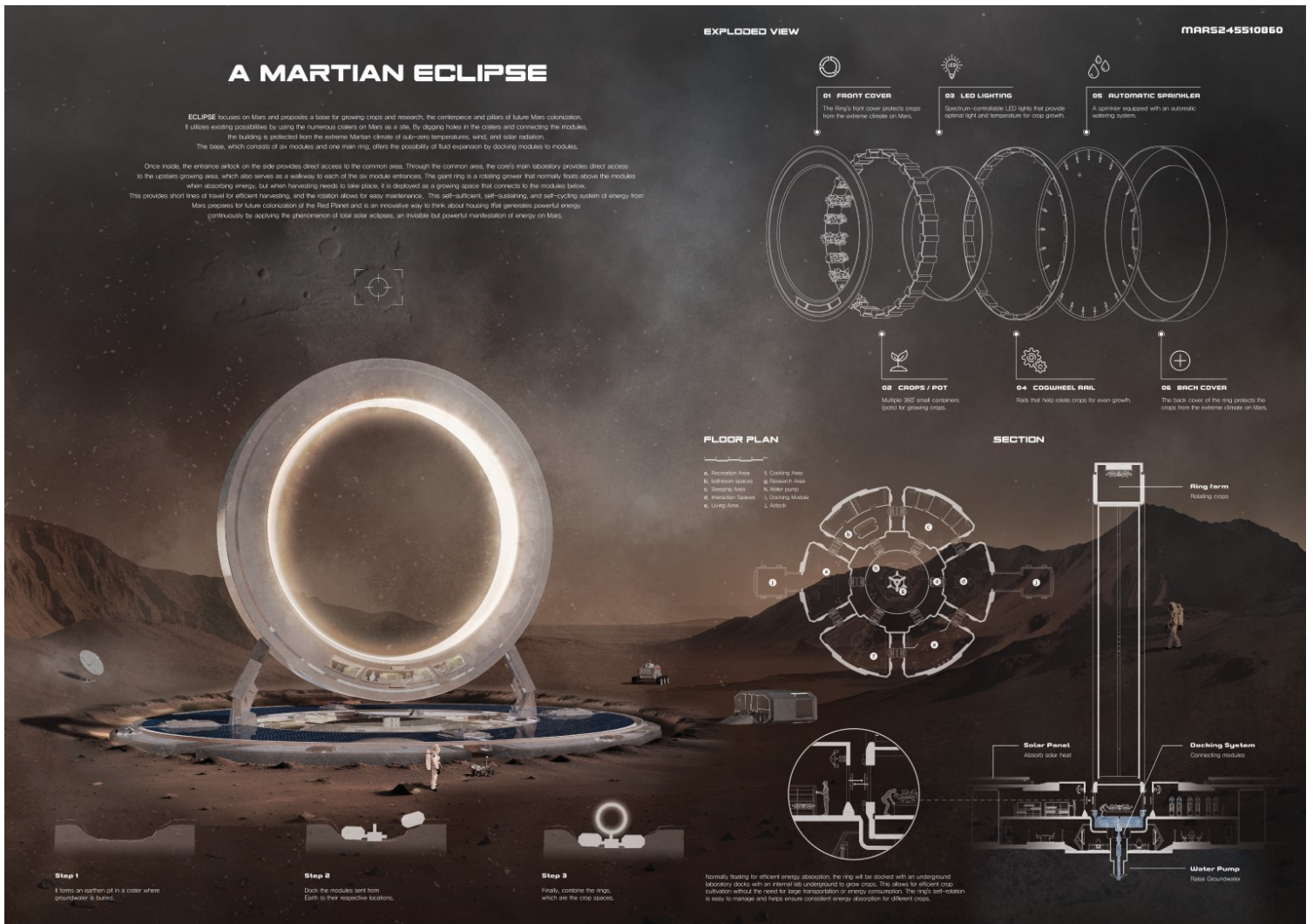


The Martian environment poses numerous challenges to habitation. Shelters designed on its surface must provide oxygen and warmth, block solar radiation, and source sufficient building material. Conversely, shelters created below Mars surface damage inhabitants psychological health by sealing them in confined, dark spaces.

Our proposal utilizes novel building techniques developed by researchers at the University of Pennsylvania to draw upon both solutions best qualities. Situated within a lava tube northeast of the volcano Ascreaus Mons, THRESHOLDS sits half in and half out of the Martian Landscape, partially exposed to the outside world through the side of the lava tube's wall. The volcano's softer basaltic regolith can be easily excavated and reused to form a structure at the cliff face that maintains outside views while shielding solar radiation.

## SECOND PLACE A MARTIAN ECLIPSE

Park Seo-an and Ju Yeon Hong, Korea South

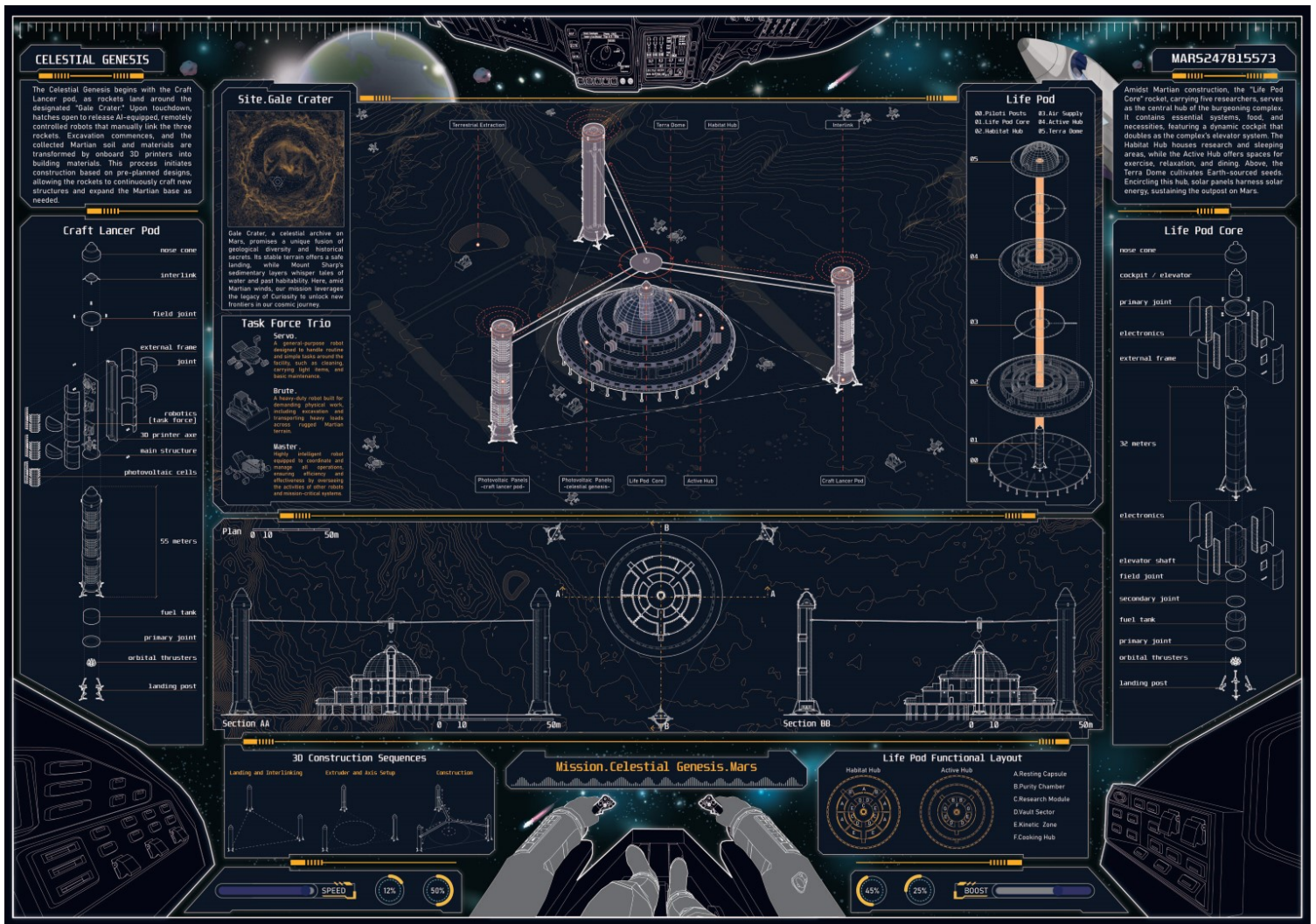


ECLIPSE focuses on Mars and proposes a base for growing crops and research, the centerpiece and pillars of future Mars colonization. It utilizes existing possibilities by using the numerous craters on Mars as a site. By digging holes in the craters and connecting the modules, the building is protected from the extreme Martian climate of sub-zero temperatures, wind, and solar radiation. The base, which consists of six modules and one main ring, offers the possibility of fluid expansion by docking modules to modules.

Once inside, the entrance airlock on the side provides direct access to the common area. Through the common area, the core's main laboratory provides direct access to the upstairs growing area, which also serves as a walkway to each of the six module entrances. The giant ring is a rotating grower that normally floats above the modules when absorbing energy, but when harvesting need to take place, it is deployed as a growing space that connects to the modules below. This provides short lines of travel for efficient harvesting, and the rotation allows for easy maintenance. This self-sufficient, self-sustaining and self-cycling system of energy from Mars prepares for future colonization of the Red Planet and is an innovative way to think about housing that generates powerful energy continuously by applying the phenomenon of total solar eclipses, an invisible but powerful manifestation of energy on Mars.

## THIRD PLACE CELESTIAL GENESIS

Alp Arda, Italy



The Celestial Genesis begins with the Craft Lancer pod, as rockets land around the designated “Gale Crater”. Upon touchdown, hatches open to release AI-equipped, remotely controlled robots that manually link the three rockets. Excavation commences, and the collected Martian soil and materials are transformed by onboard 3D printers initiate construction based on pre-planned designs, allowing the rockets to continuously craft new structures and expand the Martian base as needed.

Amidst Martian construction, the “Life Pod Core” rocket, carrying five researchers, serves as the central hub of the burgeoning complex. It contains essential systems, food, and necessities, featuring a dynamic cockpit that doubles as the complex’s elevator system. The Habitat Hub houses research and sleeping areas, while the Active Hub offers spaces for exercise, relaxation, and dining. Above, the Terra Dome cultivates Earth-sourced seeds. Encircling this hub, solar panels harness solar energy, sustaining the outpost on Mars.

## Honourable Mentions:

### Honourable Mention 1: Ever-Grow

Goh Zheng Rong and Loy Xin Yi, Malaysia



# Ever - Grow

The beginning of a new exploration.  
A giant leap of mankind

## To Survive

On Mars, you have to be prepared to handle with radiation, dust storms and scarcity of material. Survival strategies are prepared to ensure the safety and efficiency of lives on Mars. Self-sustainable base system using renewable energy and fish farming act as food sources. With temperature data, we create more than 2000 different types of distributing sunlight, electric and nuclear power system is used to generate energy.



Vallis Marineris is chosen to be the base for humans on Mars. Stead on equator, it is the warmest part and has less change in temperature throughout the day and season. With the frequent dust storms and strong radiation threatening various facilities, the sleep capsule system acts as an excellent shelter for humans from the toxic Martian environment.

## Phasing Strategy



The construction of the core will be carried out on Mars first before the modular modules later.



The labor and resources will reach Mars first and build the accommodation pods to the modular framework.



The Ever-Grow will become a mobile housing and built on the Martian Crater along Vallis Marineris.



Accommodation Pods: A mobile food pods are produced along with all support systems.



Controlled Farming: A mobile food pods are produced along with all support systems.



Accommodation Pods: A mobile food pods are produced along with all support systems.

## To Thrive

With Mars located in the scorching second home, poor habitat will bring a crucial consideration. The setting is based out of Martian soil with most part of building constructed along as well as a safe haven from radiation yet allowing sunlight and view. Vertical living spaces with central airways, vertical air ducts, built-in plants to provide natural oxygen in the air with their integrated light systems, allowing social interaction also killing original prey needs.



## Community Space

Community Space: A mobile food pods are produced along with all support systems.



Community Space: A mobile food pods are produced along with all support systems.



Laboratory: A mobile food pods are produced along with all support systems.



Family Area: A mobile food pods are produced along with all support systems.



Controlled Farming: A mobile food pods are produced along with all support systems.



Accommodation: A mobile food pods are produced along with all support systems.



Controlled Farming: A mobile food pods are produced along with all support systems.



Accommodation: A mobile food pods are produced along with all support systems.



Controlled Farming: A mobile food pods are produced along with all support systems.

## To Execute

To ensure resources transportation, self-sustainable and readily available materials, liquidity is preferred. A combination of 3D printing for the steel, framework, and prefabricated materials for the interior. The design considers the future population, including modular framework left opened for future projects in the air with their integrated light systems, allowing social interaction also killing original prey needs.



## HOW TO GO TO MARS 101

HOW TO GO TO MARS 101: A mobile food pods are produced along with all support systems.



Customize: A mobile food pods are produced along with all support systems.



Transportation: A mobile food pods are produced along with all support systems.



Installation: A mobile food pods are produced along with all support systems.

After explore and collecting sample along Vallis Marineris.

Why here is the ideal collected rocky fragment? It's in your research.

Oh, Thanks!

No, Guys, sorry here I'm not together!

Dear Diary, this is my 10th year living on Mars. Yes, sometimes I do miss my home, Earth.

I always like to stroll around the incubator park. It feels like a little city on the red planet.

Yes, all are collected and cooked from here.

Not all those foods from the Hydroponic and vertical farms!

But, it's joyful to witness the beginning of a new life on Mars. A giant leap of mankind.

HOW TO GO TO MARS 101

Customize: 1. 3D Print, 2. 3D Print, 3. 3D Print

Transportation: 1. Rocket, 2. Rocket, 3. Rocket

Installation: 1. Rocket, 2. Rocket, 3. Rocket

Translucent ETE skin

Protection using mass

Ground level park

Electrostatic induction system to generate electricity

Energy core

Hydroponic farming system

Central atrium

Controlled farming

Protection using mass: A mobile food pods are produced along with all support systems.

Ground level park: A mobile food pods are produced along with all support systems.

Electrostatic induction system to generate electricity: A mobile food pods are produced along with all support systems.

Energy core: A mobile food pods are produced along with all support systems.

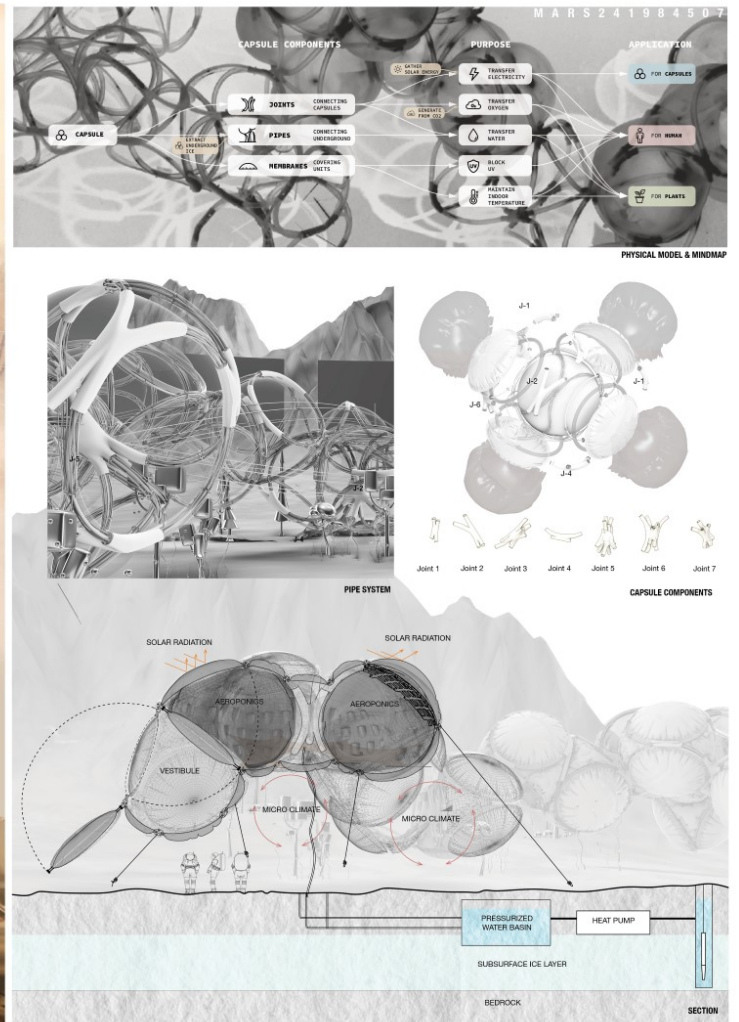
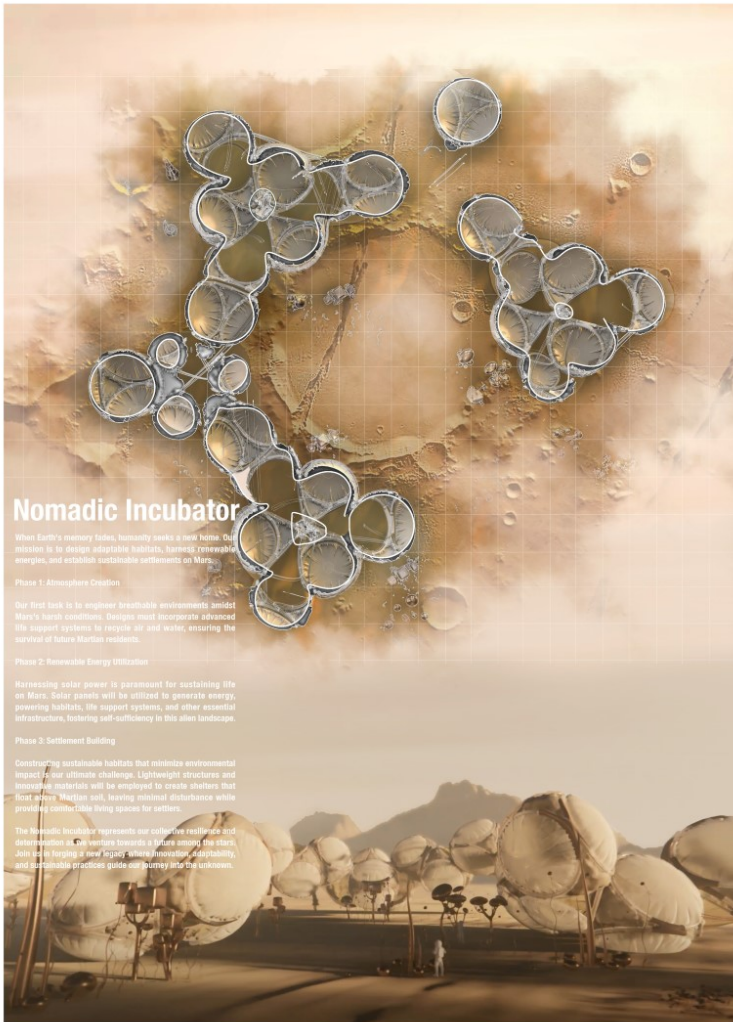
Hydroponic farming system: A mobile food pods are produced along with all support systems.

Central atrium: A mobile food pods are produced along with all support systems.

Controlled farming: A mobile food pods are produced along with all support systems.

# Honourable Mention 2: Nomadic Incubator

Jiaqi Kang, Jiamin Huang and Lejia Li, United States

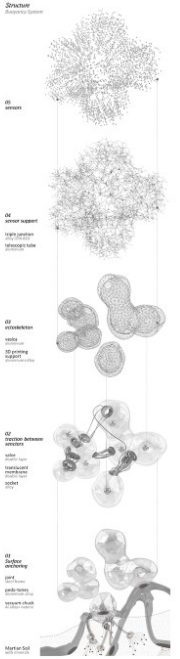


**Honourable Mention 3: Osmosis**  
Wan Zilin and Ren Yinghui, China

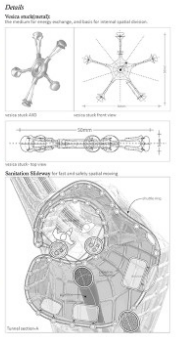
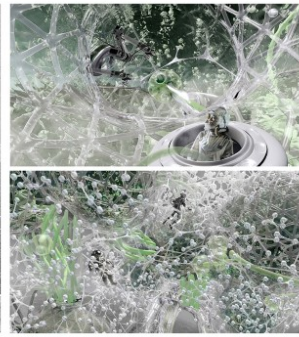
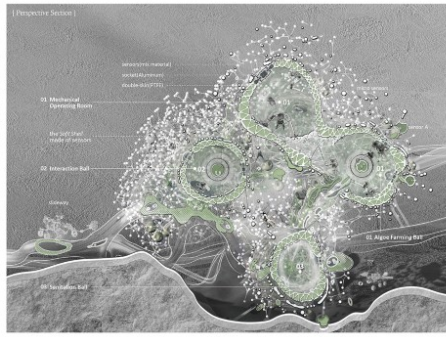
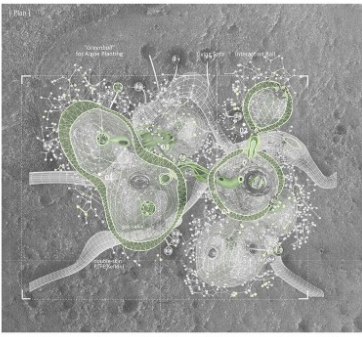


# Osmosis

Osmosis renews a sustainable environment by using green biology on Mars, providing a circular food system with the Mars' local resources. A series of organic and metal structures are designed to support the growth of Osmosis with the Mars' local resources.



- a Five Model**
- 01 Key Layers of Three Elements**
- 02 Absorbed Path for Mineral Concentration**
- 03 Sector-anner Cellulose caused by Sector Expansion**
- 04 Self-Joining as Result of Cellulose**



## Honourable Mention 4: Nomadica: The Mobile Haven on Mars

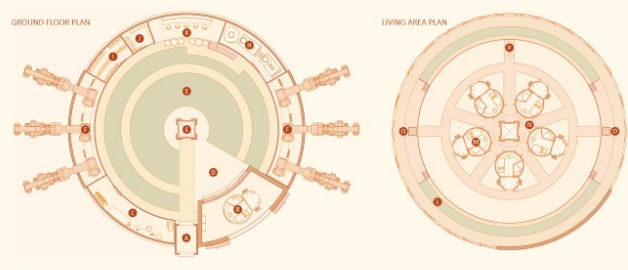
Xueyan Wang and Jiahao Du, Australia

# Nomadica: The Mobile Haven on Mars



The Nomadica is a habitat who offers a lifeline for astronauts, providing vital atmospheric support, temperature regulation, and radiation shielding in Mars' harsh conditions. Designed for five researchers, it's a self-sustaining sanctuary equipped with living quarters, research labs, and recreational areas. A massive Geodesic Dome shields the habitat while structurally supporting its interior. Spread across four levels, it includes formation spaces, living quarters, recreational zones, and research facilities. Mobility is key, facilitated by six mechanical legs enabling exploration across the Martian terrain.

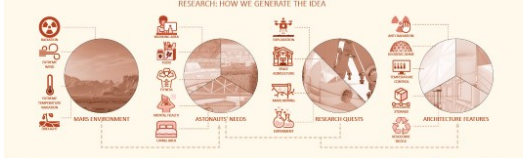
Agricultural sustainability is prioritized, with astronauts conducting experiments to cultivate crops within the habitat's confines. Specialized "mini greenhouses" aid in this endeavor, fostering plant growth and supplementing their diet with homegrown produce. Our habitat embodies sustainability and adaptability, serving as a beacon of innovation for humanity's expansion into the cosmos.



- A. AIRLOCK
- B. GARAGE
- C. WORKSHOP
- D. LIVING AREA
- E. ELEVATOR
- F. MECHANICAL ROOM
- G. SUPERMATERIAL FIELD
- H. WATER & OXYGEN STORAGE
- I. PLANT BREEDING ROOM
- J. FOOD STORAGE
- K. KITCHEN
- L. GREENLAND
- M. "NOMAD"
- N. ROBOTIC PLATFORM
- O. MECHANICAL ROOM ENTRANCE
- P. ISSUES

### ANNOTATION

<p><b>1. THE NOMAD:</b> The Nomad serves as private quarters for the astronauts when they are inside the main building. It contains all facilities necessary for personal living. The Nomad is connected to the main building through a series of pipe networks and is secured to the rotating platform. It can rotate independently around the central axis.</p>	<p><b>2. AIRLOCK:</b> A central mechanical space for astronauts to enter and exit vehicles and modules.</p>	<p><b>3. GARAGE:</b> Open space for vehicle maintenance and repair of the Nomad. Also serves as a vehicle chamber for the Nomad's entry and exit.</p>	<p><b>4. GARAGE DOOR:</b> When the garage door opens, a ramp will extend from the ground down to facilitate the Nomad's entry and exit.</p>	<p><b>5. CELLS ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM:</b> While the rotating air and water within the facility, the main circle (due to environmental conditions) will support.</p>	<p><b>6. LABORATORIES:</b> Four laboratories are available for astronauts to conduct various types of space experiments and Martian research.</p>	<p><b>7. BALCONY:</b> A panoramic view of the Martian landscape through a semi-transparent shell and a high viewing light.</p>
<p><b>8. ROBOTIC LEGS:</b> Used for moving the whole building on the Martian surface. It is driven by hydraulic rods. When the building moves, the "Nomad" at the end of the building through the garage airlock. The robot's wheels it provides support for the astronauts to control target exploration mission near the base.</p>	<p><b>9. ENTERTAINMENT SPACE:</b> Living in the solitude, monotonous, and strenuous environment of Mars, diverse recreational spaces greatly enrich astronauts' living environment, meeting their entertainment needs and helping maintain their psychological health.</p>	<p><b>10. ENTERTAINMENT FIELD:</b> Used for space agricultural research. If the crop successfully cultivated, they would become a vital food source for astronauts. Experiments about growing on outdoor Martian surface will also be conducted in a cultivation planting chamber.</p>	<p><b>11. SERVICE PIPE:</b> The building's service pipes, along with the life support system, are responsible for ventilating, supplying water, and delivering electricity to the building. Water pipes and wastewater pipes are reinforced and expanded through corresponding pipe systems.</p>	<p><b>12. DOME:</b> The geodesic dome provides a stable structure for the building. The center of the dome is coated with a radiation-resistant paint and the structure is filled with a radiation-resistant material. It provides thermal insulation and protection against radiation.</p>	<p><b>13. ROBOTIC PLATFORM:</b> A platform that rotates 360 degrees around the building. The center of the platform is used to move the Nomad to the designated drop-off location for the garage.</p>	

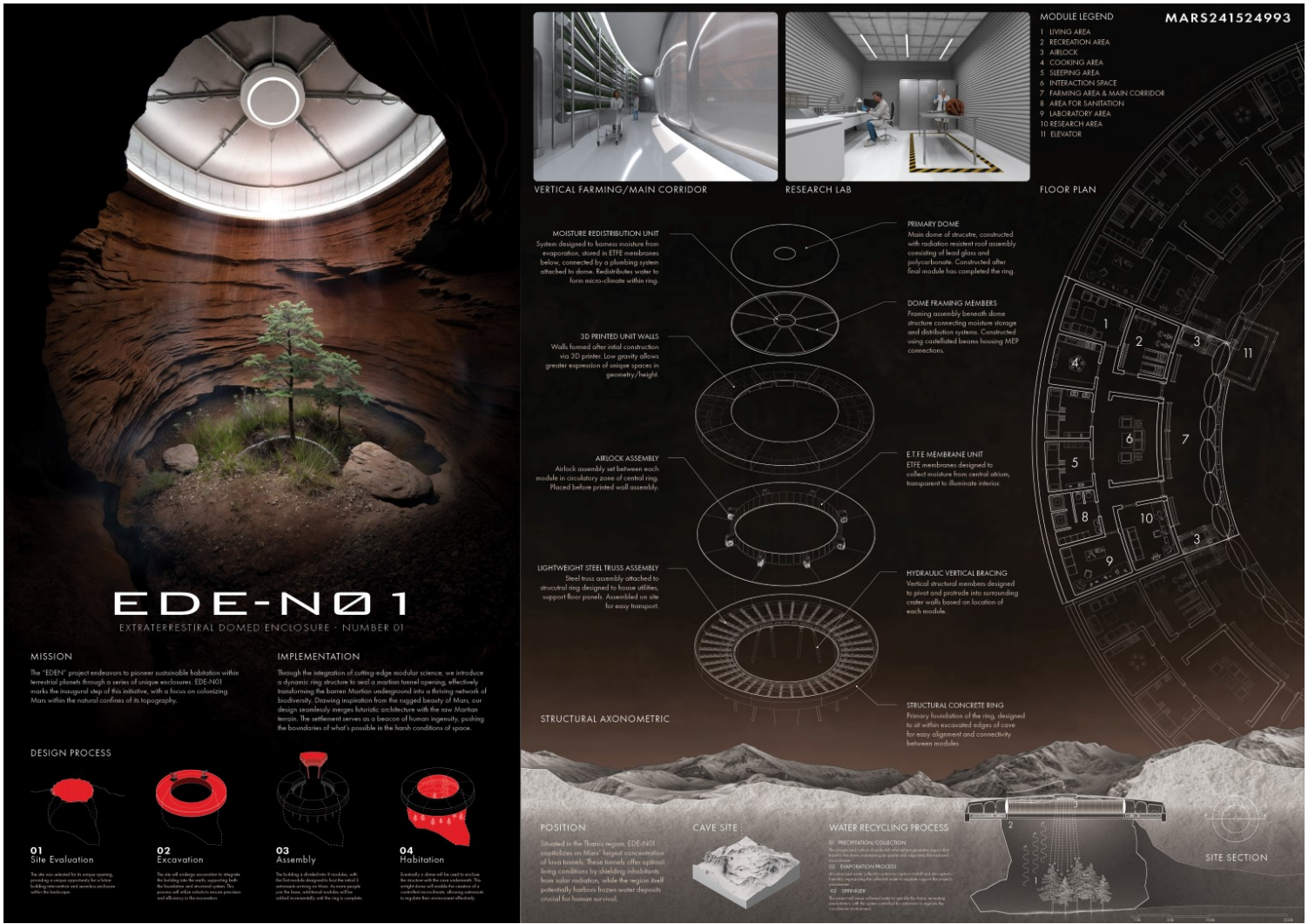


### OPERATIONAL CONFIGURATION



**Honourable Mention 5: EDE-NO 1**  
Jeffery Moisant, Ian Simon and Simon Chiquito, United States





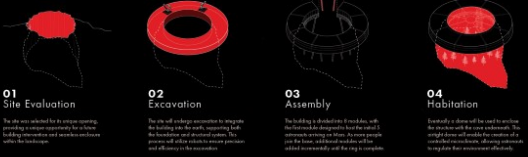
# EDE-N01

EXTRATERRESTRIAL DOMED ENCLOSURE - NUMBER 01

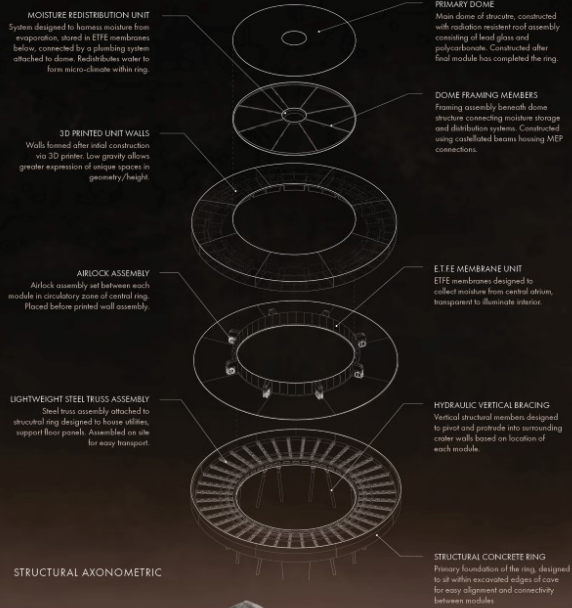
**MISSION**  
The "EDEN" project endeavors to pioneer sustainable habitation within terrestrial planets through a series of unique enclosures. EDE-N01 marks the inaugural step of this initiative, with a focus on colonizing Mars within the natural confines of its topography.

**IMPLEMENTATION**  
Through the integration of cutting-edge modular science, we introduce a dynamic ring structure to seal a wondrous tunnel opening, effectively transforming the barren Martian underground into a thriving network of biodiversity. Drawing inspiration from the rugged beauty of Mars, our design seamlessly merges futuristic architecture with the raw Martian terrain. The settlement serves as a beacon of human ingenuity, pushing the boundaries of what's possible in the harsh conditions of space.

**DESIGN PROCESS**



- MODULE LEGEND**
- 1 LIVING AREA
  - 2 RECREATION AREA
  - 3 AIRLOCK
  - 4 COOKING AREA
  - 5 SLEEPING AREA
  - 6 INTERACTION SPACE
  - 7 FARMING AREA & MAIN CORRIDOR
  - 8 AREA FOR SANITATION
  - 9 LABORATORY AREA
  - 10 RESEARCH AREA
  - 11 ELEVATOR



**Honourable Mention 6: AEON**  
Kush Nitesh Bhansali, Aryan Samudre and Mohit Prakash Ingle, India



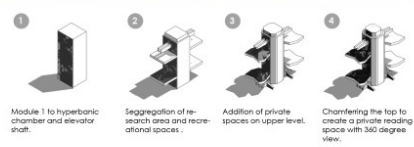
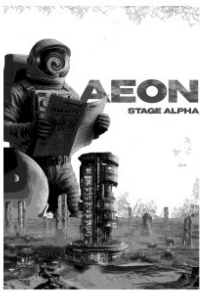
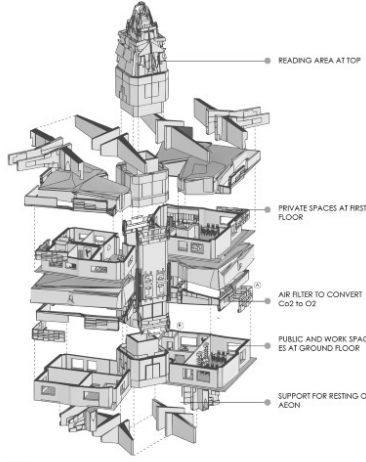
LIVING ROOM DEPICTING HARMONIOUS BLEND OF COMFORT AND STYLE.



GREEN HOUSE MODULE ELEVATED FROM GROUND AND DIRECTLY CONNECTED TO WORKSTATION.

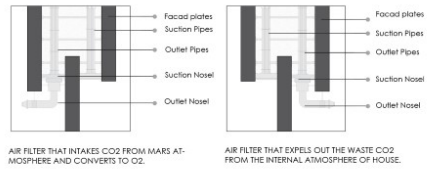


RESEARCH WORK STATION FOR RESEARCH AND DEVELOPMENT.

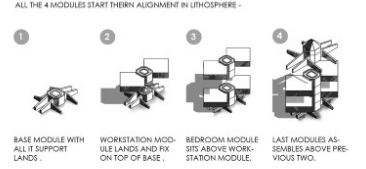


**THE CONCEPT -**  
 Named "AEON" this dwelling unit embodies a culmination dreams of visionaries, scientists, and dreamers alike. Inspired by the timeless works of Isaac Asimov. Providing ideal spaces to cater to one's personal and research-oriented lifestyle. Here, the bedrooms and living spaces have been separated from the workspaces to ensure privacy and undisturbed environment for both. Constructed of two levels the first floor, deals with research and development along with recreational spaces next to it. The second level, has bedrooms, kitchen and a living room. This is followed by a 3 and much smaller private lounge that also serves a 360 panoramic view of Mars with utmost quiet suitable for one's own "me-time". This unit comes in as a set of detachable modules dropped from the space station, aligning mid-air landing on top of each other directly to the desired coordinates. This is followed by an air locking system within the modules, that locks itself with each other. This also triggers the "heart" of the dwelling, that is, the air filter to kick in right after.

**DETAILS AT A AND B -**



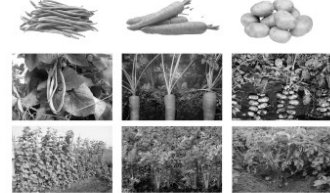
**ASSEMBLING OF MODULES -**



**Honourable Mention 7**  
 Muzhi Wang and Ruoxuan Hu, United States

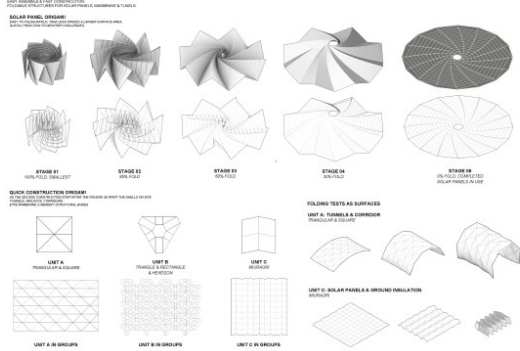


GREENHOUSE PLANT TYPES

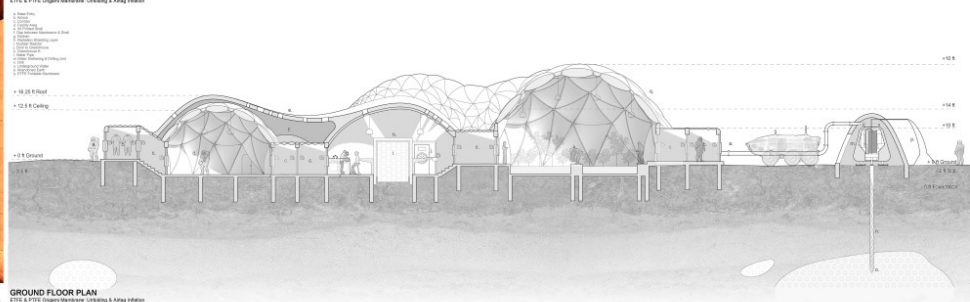


TYPE A:	TYPE B:	TYPE C:
<i>Vigna unguiculata</i>	<i>Carrot</i>	<i>Tomato</i>
TEMPERATURE: 18-24°C (64-75°F) PRODUCTION: 1.1 x 10.3 x 3.8m GROWING PERIOD: 55-60 days	TEMPERATURE: 18-20°C (64-68°F) PRODUCTION: 1.8 x 1.2 x 3.8m GROWING PERIOD: 65-70 days	TEMPERATURE: 15-20°C (59-68°F) PRODUCTION: 1.8 x 1.2 x 3.8m GROWING PERIOD: 75-120 days
NUTRIENTS: Proteins, Carbohydrates, Dietary Fiber, Vitamins (Vitamins C, Vitamins A, Vitamins K, Manganese/Potassium, Magnesium, Iron, Zinc)	NUTRIENTS: Carbohydrates, Dietary Fiber, Vitamins (Vitamins A, Vitamins C, Vitamins K, Manganese/Potassium, Zinc, Manganese, Iron)	NUTRIENTS: Carbohydrates, Dietary Fiber, Vitamins (Vitamins A, Vitamins B5, Vitamins K, Manganese/Potassium, Magnesium, Iron, Phosphorus)

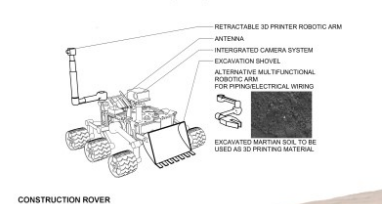
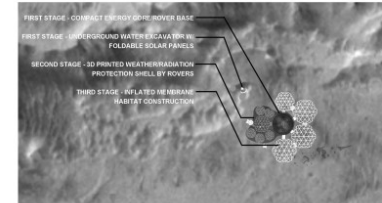
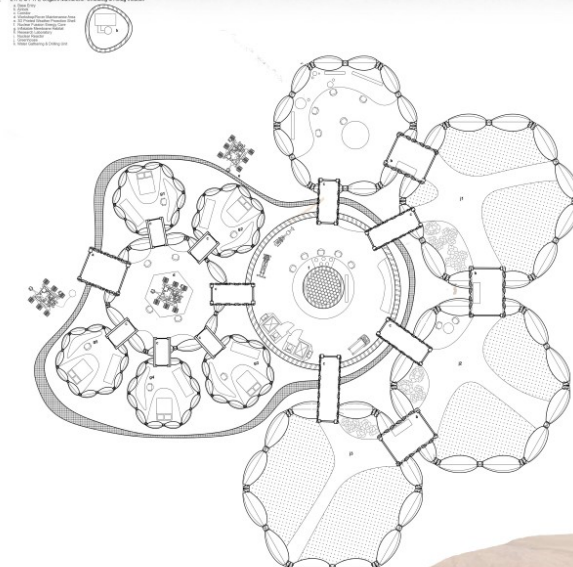
ORIGAMI IN THE PROJECT



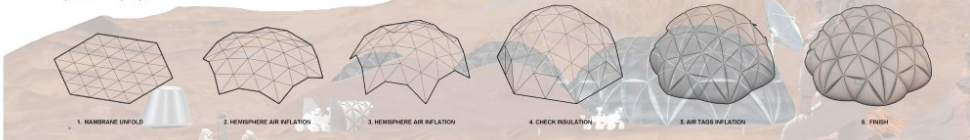
LONGITUDINAL SECTION



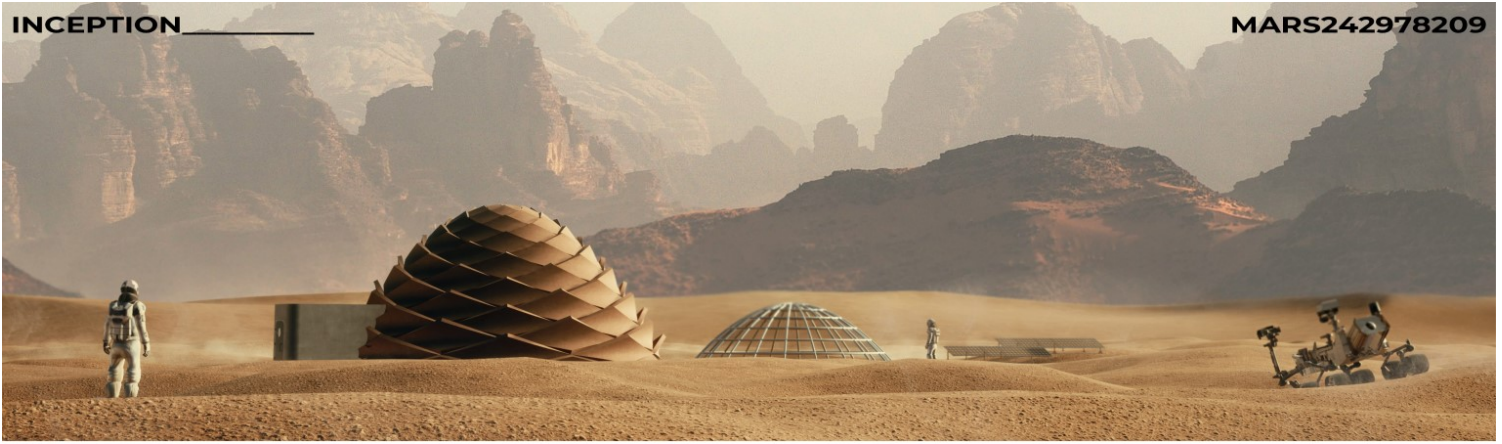
GROUND FLOOR PLAN



Membrane Unit Construction Process



**Honourable Mention 8-INCEPTION**  
 Mayur Mehta, India

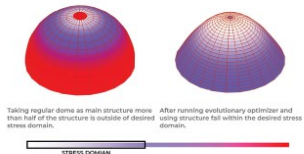


Mars, an empty, red planet, where every breath is a battle against the unrelenting elements. In this endeavor, our task is to fashion a world within a world—a sanctuary where humanity can establish its foothold, exploring the boundless possibilities of a new frontier. Architecture stands as a linchpin, a bastion of support for those embarking on this odyssey. With this vision in mind, we embarked on our journey, first identifying the constraints and challenges that await us upon the surface of Mars.

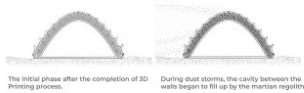
Our primary objective is to conceive a structure capable of enduring with the limited natural resources afforded by Mars. The design features double walls with a cavity in between, strategically perforated to allow Martian regolith to infiltrate, naturally reinforcing the structure against the rigors of the Martian environment and shielding internal areas from the relentless barrage of radiation. To enhance structural integrity, the inner wall incorporates *Aspergillus nidulans*—a biogenic crack-repairing fungus.

In pursuit of structural stability, evolutionary optimization techniques were employed, resulting in the elegant form of a catenary-shaped dome. To facilitate agricultural endeavors on Martian soil, a combination of sunlight and aeroponic systems will be implemented, providing solution for farming in this extraterrestrial habitat.

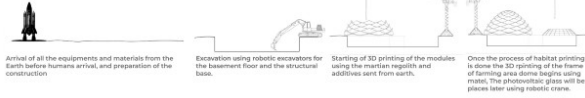
**STRUCTURAL STRESS ANALYSIS**



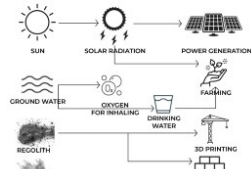
**CAVITY FILLING**



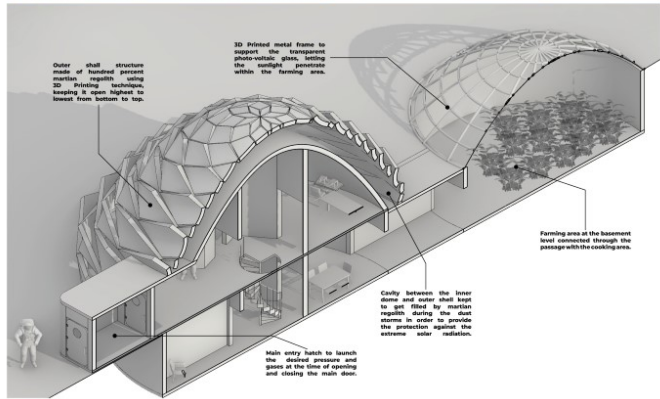
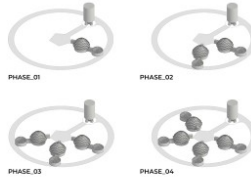
**CONSTRUCTION PHASES**



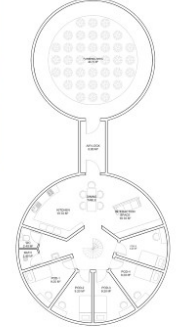
**RESOURCE MANAGEMENT**



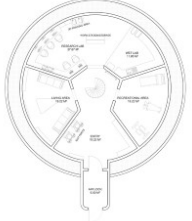
**FUTURE EXPANTION**



**BASEMENT LAYOUT**



**GROUND FLOOR LAYOUT**



**Honourable Mention 9-INTERLOCK**  
 Sylvania Kam, Jayden Chan and Moxiao Guo, Canada

# INTERLOCK

Perfection may seem impossible for a project with an infinite number of details and potential mishaps. The Interlock however, fosters limitless growth potential, expanding with modular pods in accordance to foreseeable needs. Situated in the Jezero Crater, a location scouted by past missions, it was chosen for its historical traces of life. The pilot mission has five unique pods, each designed to fit specific programming. The base is equipped with the tools and resources to repair, expand and improve, allowing for complete independence from our home planet. The form itself takes inspiration from nature, mimicking the efficient honeycomb patterns of bees nests, and truly being infinitely expandable. The pods themselves are manufactured with a combination of printable, high-density composite, insulative materials, and sealant. Most new parts can be directly created within the pod, while any other specialized parts can be delivered by future Mars endeavors.

Its name, Interlock, shows that the individual pods connect with one another to create a larger ecosystem. However, another feat achieved was that they interlock vertically as well, allowing for not only efficient expansion, but a breakthrough way of living in the pod, whilst voyaging through space towards its final destination.



JEZERO CRATER



- 1. BATHROOM
- 2. BEDROOM

SECOND FLOOR PLAN 1:100



- 3. AIRLOCK
- 4. RECREATIONAL
- 5. RECH.
- 6. COMMAND
- 7. LIVING
- 8. KITCHEN
- 9. RESEARCH
- 10. FARM

GROUND FLOOR PLAN 1:100



AIRLOCK/STORAGE POD



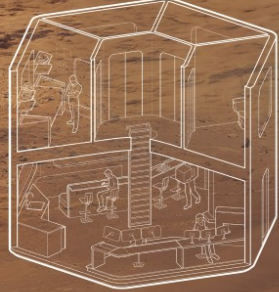
RESEARCH POD



FARMING POD



RECREATIONAL POD



REST/KITCHEN/MAIN POD



MODULAR DIAGRAM



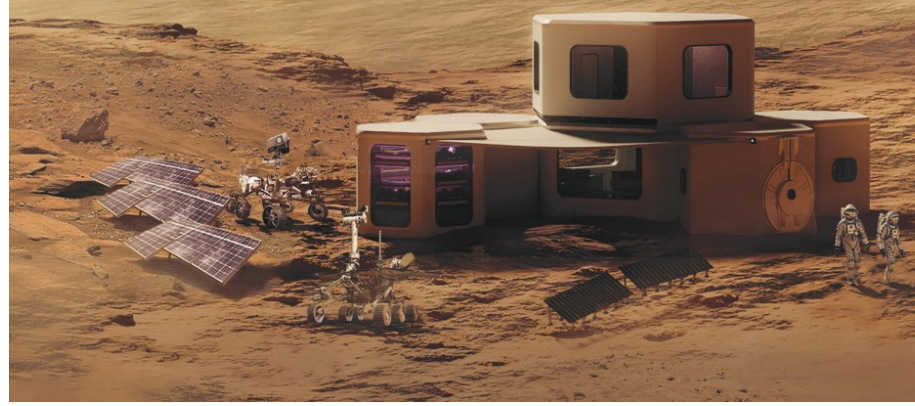
PARTI DIAGRAM



SECTION 1:100



ELEVATION 1:100



**Honourable Mention 10-CIRCLE OF LIFE**  
Lorenzo Bavelloni, Italy

# CIRCLE OF LIFE

MARSCEPTION 2024



The Circle of Life project on Mars harnesses large-scale 3D printing and Earthworks to craft a sustainable habitat from Martian regolith, reflecting life's perpetual cycle. This endeavor is structured around four grand pillars: Human Sustainability, Scientific Research, Infrastructure, and Technology, and Communication and Exploration, each featuring essential laboratories.

The habitat's architecture, designed with three radial arms, embodies flexibility to adapt to Mars' challenges. These arms segregate the habitat into zones for habitation, research, and agriculture, allowing efficient space utilization and operational flexibility. The underground design (cutaway) mitigates exposure to Mars' harsh radiation, enhancing crew safety. Powered by solar panels, nuclear, and geothermal renewable resources and designed with passive features, the ecosystem operates sustainably and autonomously. The use of renewable energy sources and an inflatable structure for pressurization and thermal insulation underscores a commitment to sustainability and resilience.

The underground space, divided into concentric rings, accommodates research, living quarters, and equipment for efficiency and community well-being. On the upper floor, a sustainable farming system integrates vertical, hydroponic, farming, and insect incubation. A robotic arm tends to crops, optimizing resources for sustainable food production and ecosystem balance, encapsulating the Circle of Life's commitment to a self-sustaining, harmonious existence on Mars.



-1 Floor  
Circle 2: Terrace / radiation protection

