

## 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.

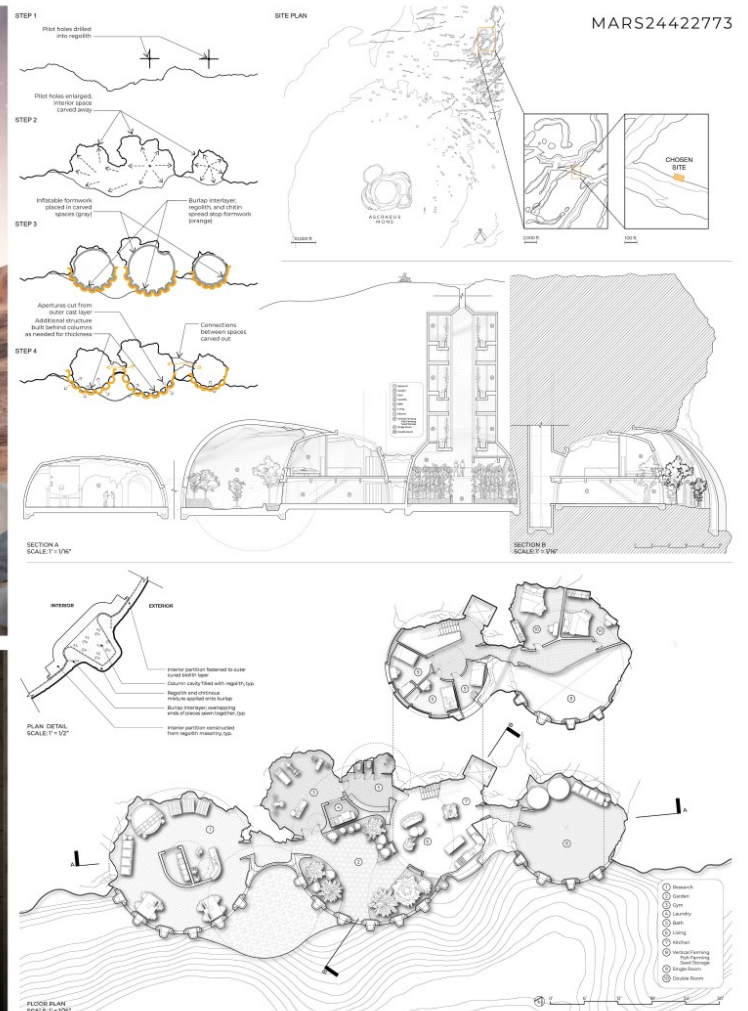
Volume Zero Competition thanks all the competitors for participating in this competition and for contributing to this competition's research.

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

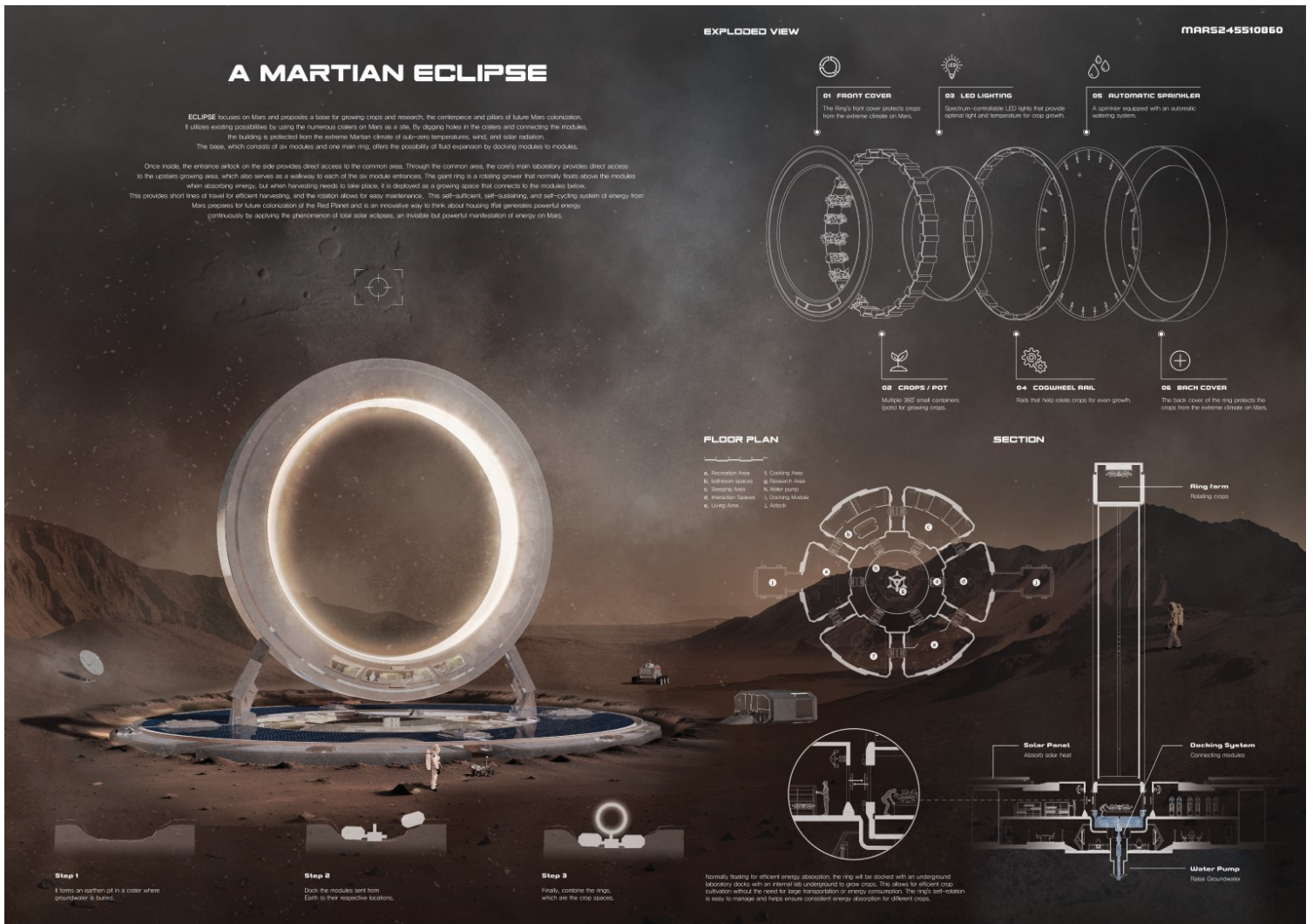


The Martian environment poses numerous challenges to habitation. Shelters designed on its surface must provide oxygen and warmth, block solar radiation, and source sufficient building material. Conversely, shelters created below Mars surface damage inhabitants psychological health by sealing them in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

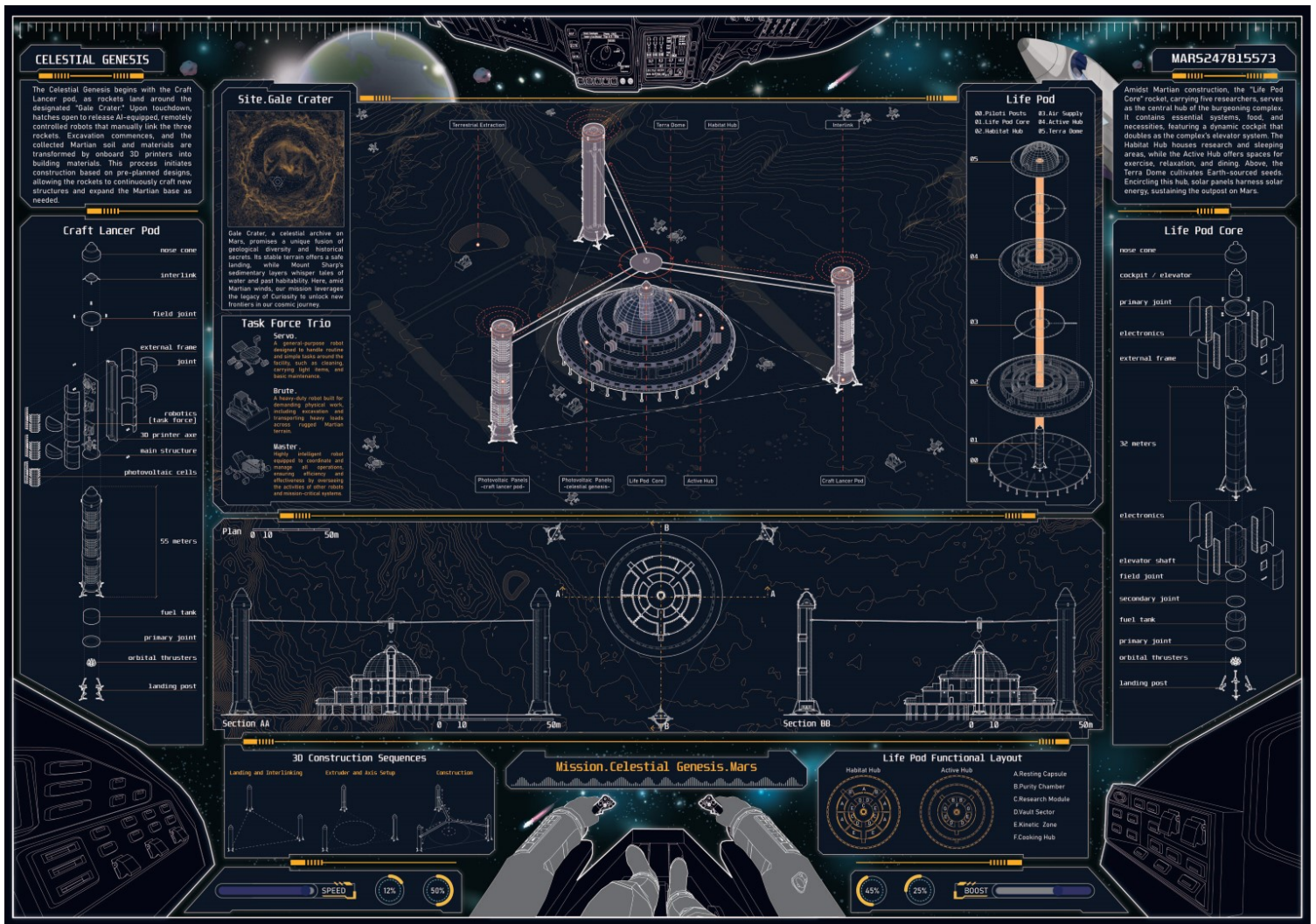


ECLIPSE focuses on Mars and proposes a base for growing crops and research, the centerpiece and pillars of future Mars colonization. It utilizes existing possibilities by using the numerous craters on Mars as a site. By digging holes in the craters and connecting the modules, the building is protected 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.

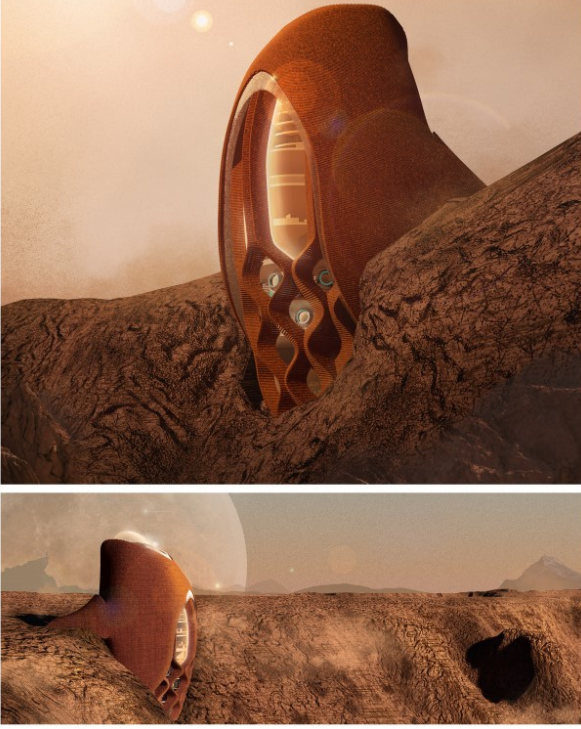
## Honourable Mentions:

### 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 proposed to ensure the safety and efficiency of lives on Mars. Self-sustainable base systems using renewable energy and fish farming act as food sources. With temperature data, more efficient solar panels, artificial light, distributing sunlight, geothermal energy, nuclear power system is used to generate energy.



Vallis Marineris is chosen to be the base for humans on Mars. Situated on equator, it is the warmest place 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 subsequent modules.



The laboratory researchers will reach Mars first and build the accommodation pods in the modular framework.



The first colony will develop a modular housing and build the first Martian Colony along Vallis Marineris.



As a basic food supplies are produced, individual protection and support will be support systems.



Controlled Farming



## 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 safe bases from radiation yet allowing sunlight and view. Vertical living spaces with central airways, vertical air ducts, built-in plants to provide natural oxygen to them. It will then implement local objects in them to help their mental health, allowing social interaction also killing original privacy needs.



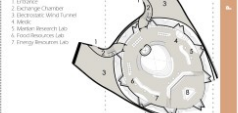
## To Execute

To ensure resources transportation, scalability and timely 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 objects in them. It will then implement local objects in them to help their mental health, allowing social interaction also killing original privacy needs.

## Community Space



## Laboratory



## Family Area



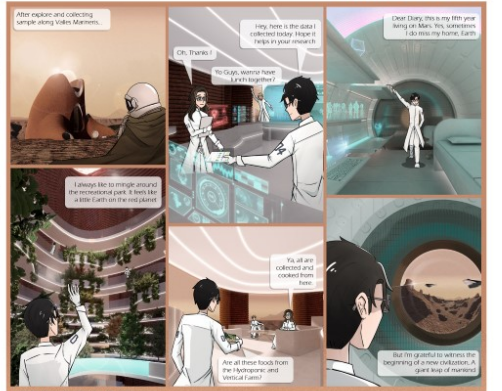
## Controlled Farming



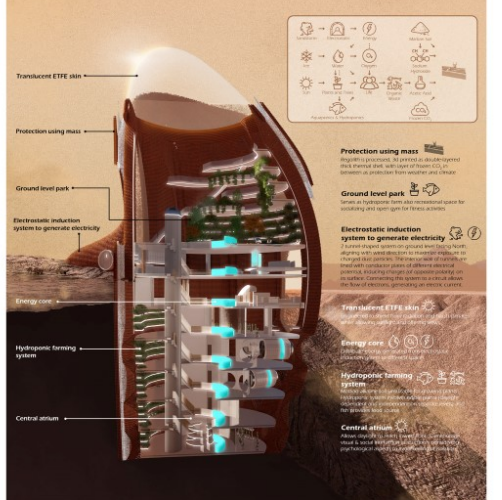
## Accommodation



## Controlled Farming

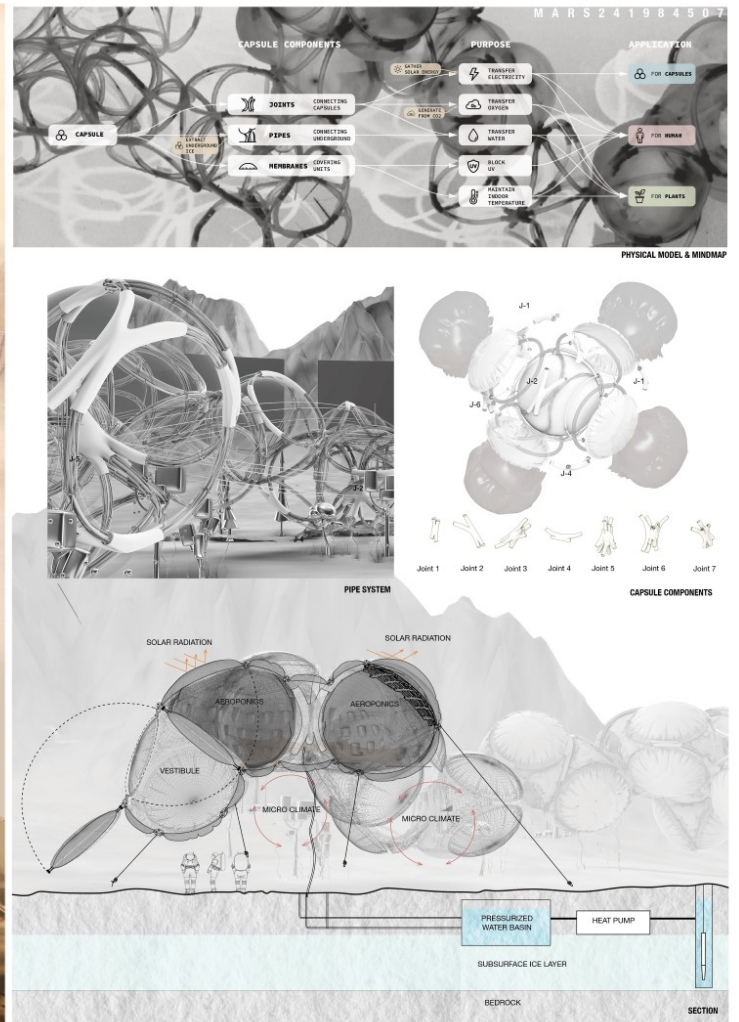
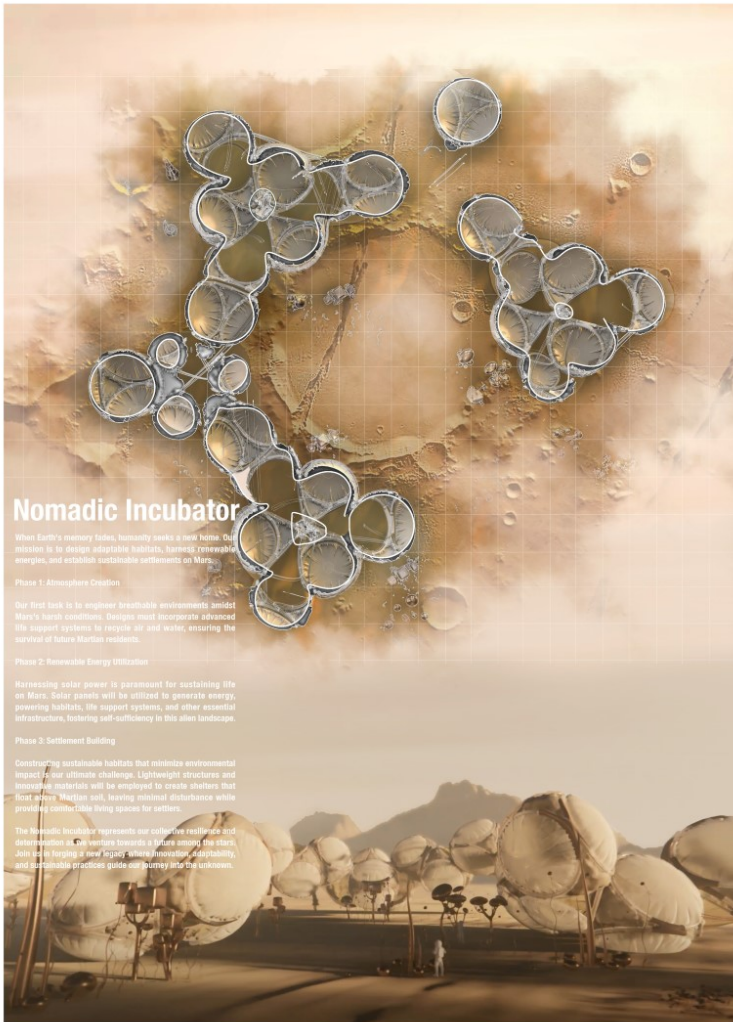


## HOW TO GO TO MARS 101



# Honourable Mention 2: Nomadic Incubator

Jiaqi Kang, Jiamin Huang and Lejia Li, United States



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

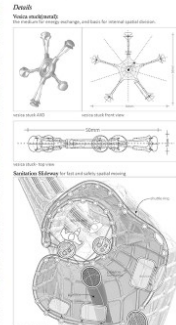
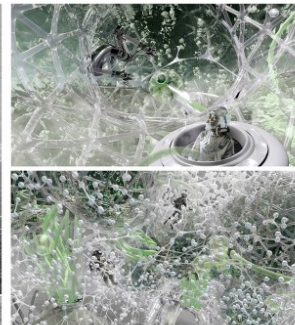
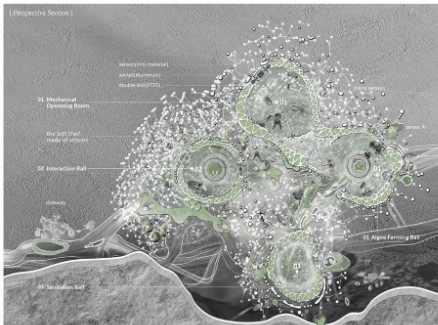
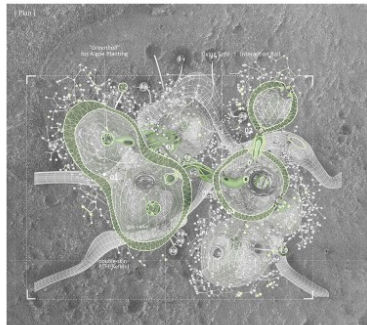


# Osmosis

Osmosis renews a sustainable environment as just as green biology will on Mars, implies a circular and dynamic with the Mars' here we delve into the level of Biodiversity, a form of dynamic and fluid response to the time dynamics, an image of Osmosis with the Mars and concepts.



- a Five Model**  
 Model structure (Overall form) - Model for real time monitoring and air filter - Cycle
- 01 Key Levels of Three Elements**  
 Cycle - Water - Energy
- 02 Activated Path for Minimal Concentration**  
 Water - Energy - Air
- 03 Sector-anner Cells/Units caused by Sector Expansion**  
 Sector expansion - Sector contraction - Sector adaptation
- 04 Self-forming in Results of Cells/Units**  
 Self-forming - Self-organizing - Self-replicating



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

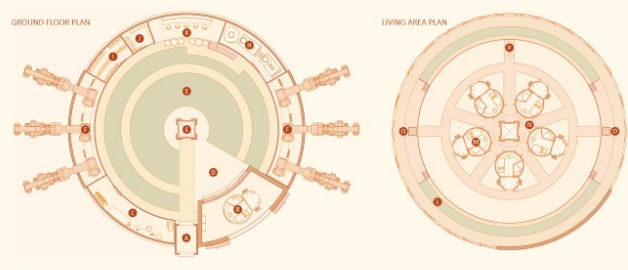
Xueyan Wang and Jiahao Du, Australia

# 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.

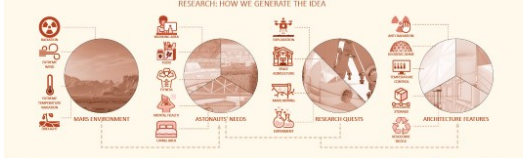
Agricultural sustainability is prioritized, with astronauts conducting experiments to cultivate crops within the habitat's confines. Specialized "mini greenhouses" aid in this endeavor, fostering plant growth and supplementing their diet with homegrown produce. Our habitat embodies sustainability and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



- A. AIRLOCK
- B. GARAGE
- C. HARBOR
- 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 the habitat and modules.</p>	<p><b>3. GARAGE:</b> Space used 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 the system.</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> An elevated space between "interior" and "exterior" that combines most of the habitat's landscape through a semi-transparent shell and a high-contrast 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 "feet" at the end of the mechanical legs or gas. When the building legs, the close contact with a central shape to the entire structure into the ground.</p>	<p><b>9. ENTERTAINMENT SPACE:</b> Living in the suburbs, monitoring, and automatic measurement of data, allow recreational games, sports, watching 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 chambers.</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 gases and wastewater are also collected and recycled 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 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>14. ROBOTIC PLATFORM:</b> A platform that rotates 360 degrees around 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>

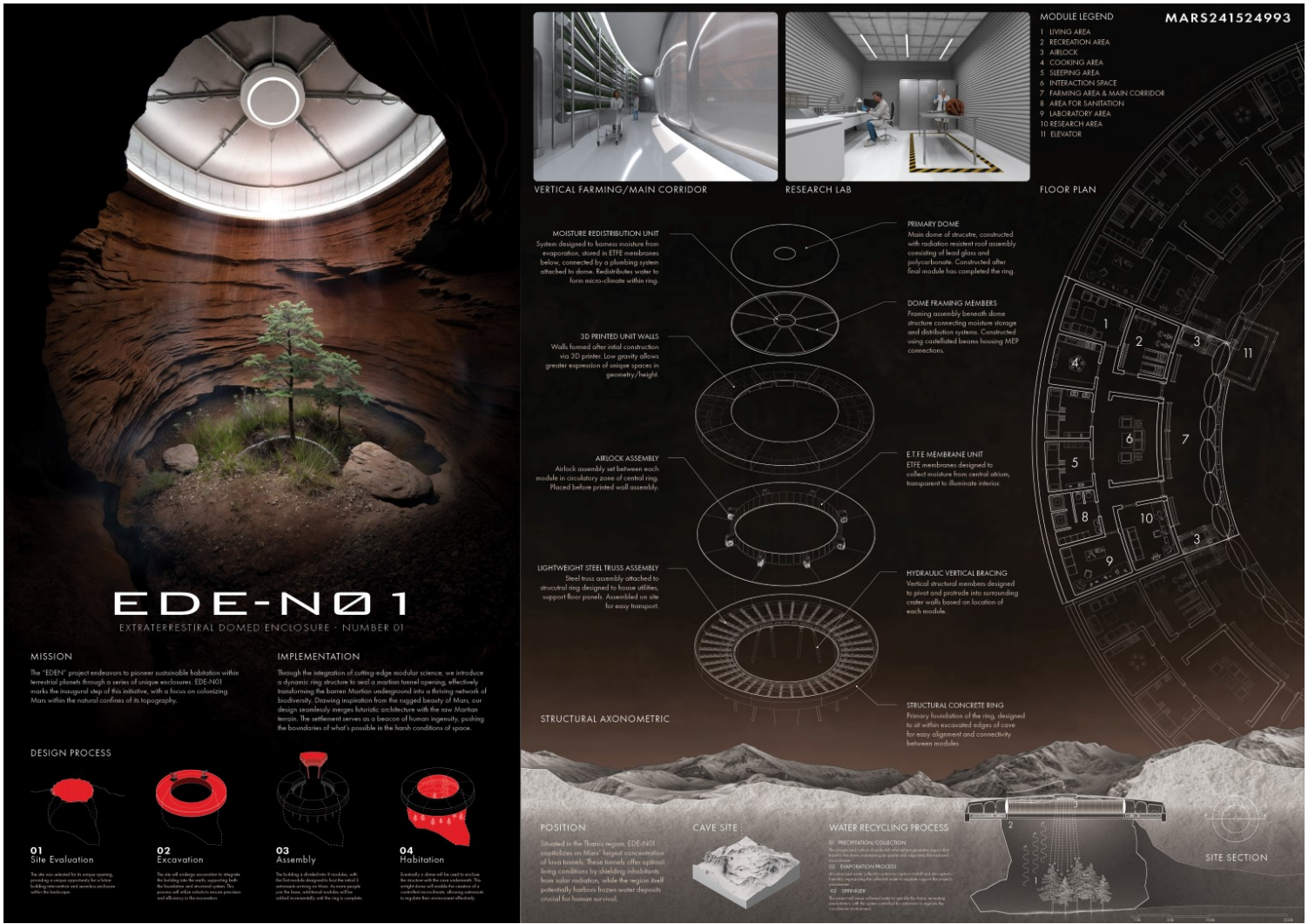


### OPERATIONAL CONFIGURATION



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





# Honourable Mention 6: AEON

Kush Nitesh Bhansali, Aryan Samudre and Mohit Prakash Ingle, India



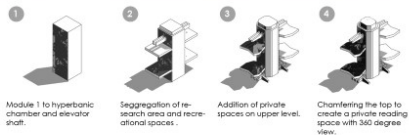
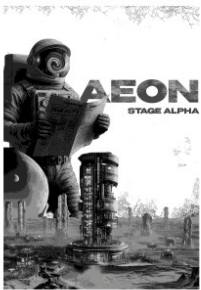
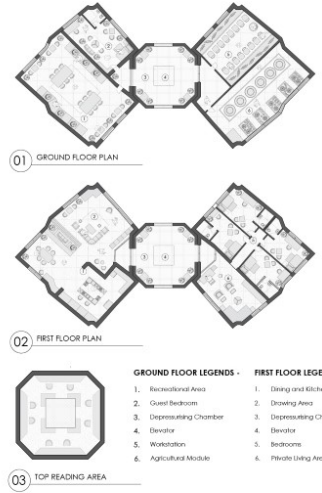
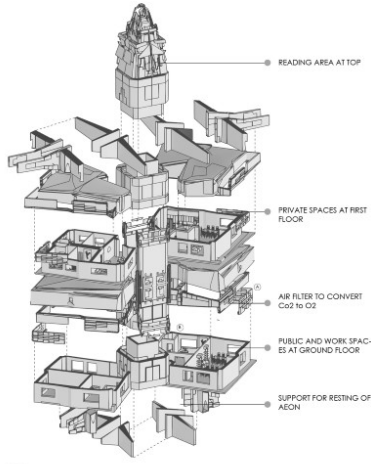
LIVING ROOM DEPICTING HARMONIOUS BLEND OF COMFORT AND STYLE.



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

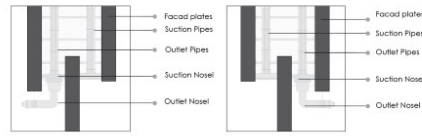


RESEARCH WORK STATION FOR RESEARCH AND DEVELOPMENT.

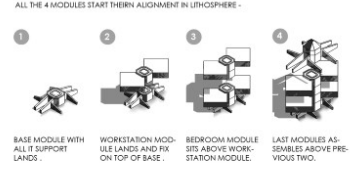


**THE CONCEPT -**  
 Named "AEON" this dwelling unit embodies a culmination dreams of visionaries, scientists, and dreamers alike. Inspired by the timeless works of Isaac Asimov. Providing ideal spaces to cater to one's personal and research-oriented lifestyle. Here, the bedrooms and living spaces have been separated from the workspaces to ensure privacy and undisturbed environment for both. Constructed at 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 -**



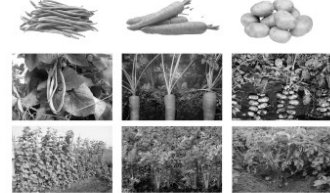
**ASSEMBLING OF MODULES -**



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

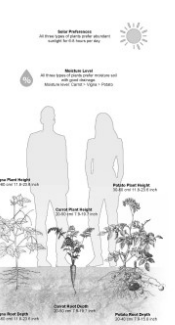


GREENHOUSE PLANT TYPES

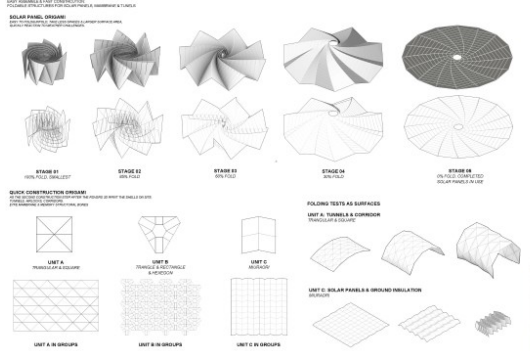


TYPE A:	TYPE B:	TYPE C:
<i>Vigna unguiculata</i>	<i>Carrot</i>	<i>Peas</i>
TEMPERATURE: 18-24°C (64-75°F) PRODUCTION: 11-13.5-23.8kg	TEMPERATURE: 18-20°C (64-68°F) PRODUCTION: 8-8.5-12.8kg	TEMPERATURE: 15-20°C (59-68°F) PRODUCTION: 8-8-12.8kg
GROWING PERIOD: 55-60 days	GROWING PERIOD: 65-70 days	GROWING PERIOD: 75-120 days
NUTRIENTS: Proteins, Carbohydrates, Dietary Fiber, Vitamins (Vitamins C, Vitamins A, Vitamins K), Mineral/Potassium, Magnesium, Iron, Zinc	NUTRIENTS: Carbohydrates, Dietary Fiber, Vitamins (Vitamins A, Vitamins C, Vitamins K), Mineral/Potassium, Zinc, Magnesium, Iron, Phosphorus	NUTRIENTS: Carbohydrates, Dietary Fiber, Vitamins (Vitamins A, Vitamins B9, Vitamins K), Mineral/Potassium, Magnesium, Iron, Phosphorus

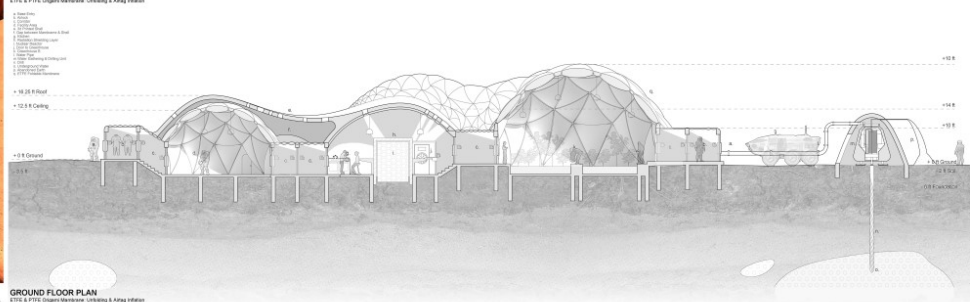
GROWING ENVIRONMENT REQUIREMENTS



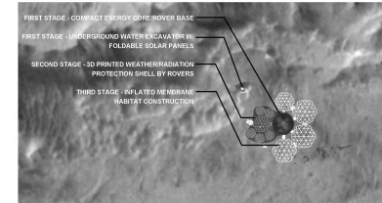
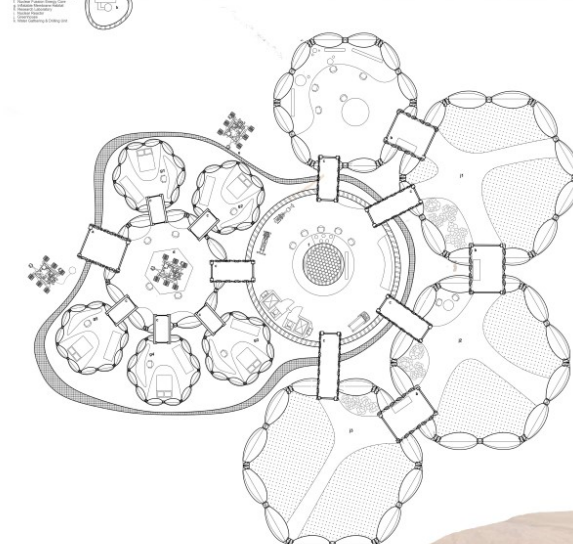
ORIGAMI IN THE PROJECT



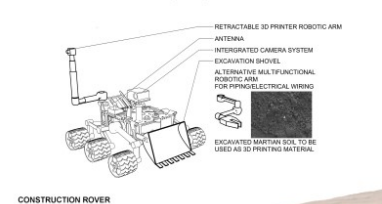
LONGITUDINAL SECTION



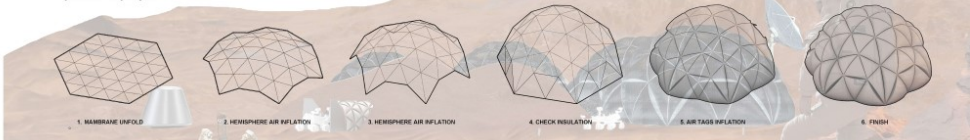
GROUND FLOOR PLAN



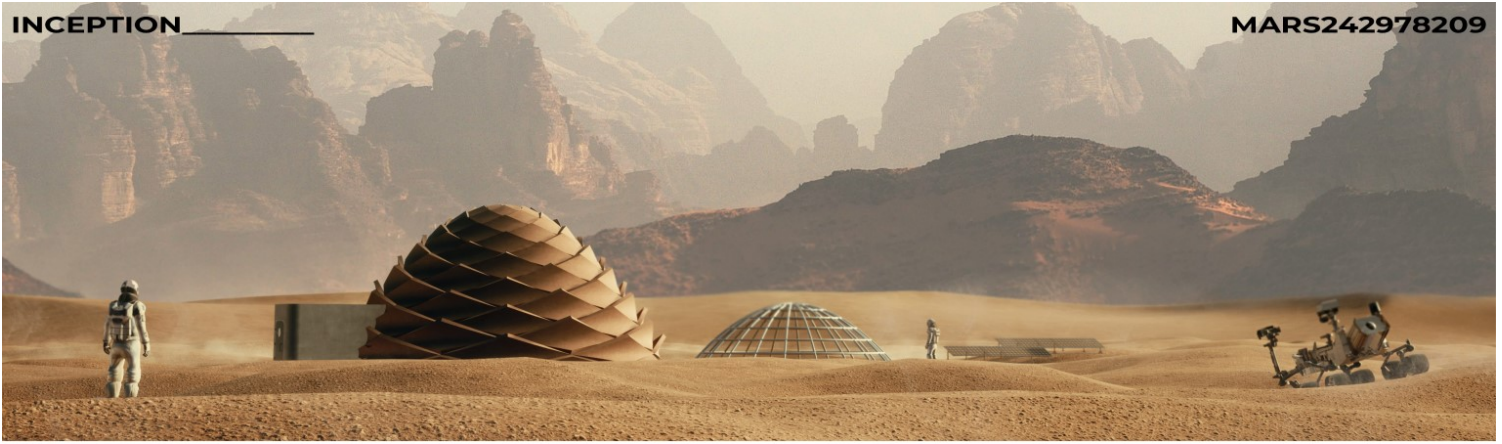
LANDING SITE LOCATION: LAT-12.20748°, LON-86.07287°



Membrane Unit Construction Process



Honourable Mention 8-INCEPTION  
Mayur Mehta, India

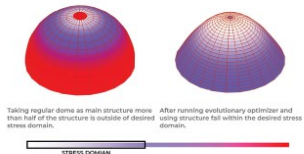


Mars, an empty, red planet, where every breath is a battle against the unrelenting elements. In this endeavor, our task is to fashion a world within a world—a sanctuary where humanity can establish its foothold, exploring the boundless possibilities of a new frontier. Architecture stands as a linchpin, 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.

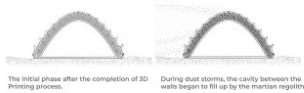
Our primary objective is to conceive a structure capable of enduring with the limited natural resources afforded by Mars. The design features double walls with a cavity in between, strategically perforated to allow Martian regolith to infiltrate, naturally reinforcing the structure against the rigors 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.

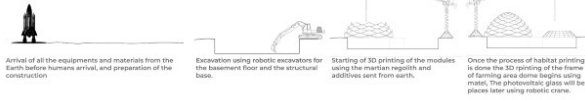
STRUCTURAL STRESS ANALYSIS



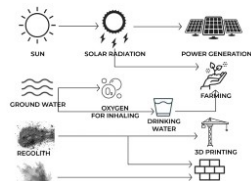
CAVITY FILLING



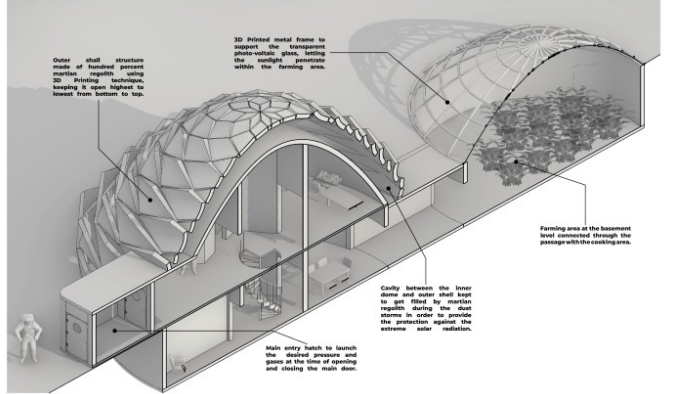
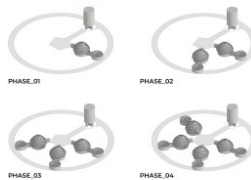
CONSTRUCTION PHASES



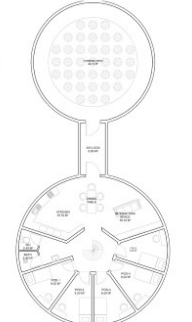
RESOURCE MANAGEMENT



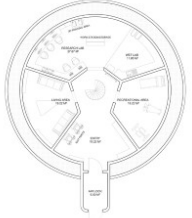
FUTURE EXPANTION



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



SECOND FLOOR PLAN 1:100



GROUND FLOOR PLAN 1:100

- 1. BATHROOM
- 2. BEDROOM
- 3. AIRLOCK
- 4. RECREATIONAL
- 5. NECH
- 6. COMMAND
- 7. LIVING
- 8. KITCHEN
- 9. RESEARCH
- 10. FARM



AIRLOCK/STORAGE POD



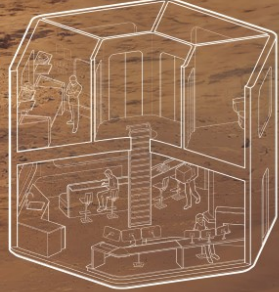
RESEARCH POD



FARMING POD



RECREATIONAL POD



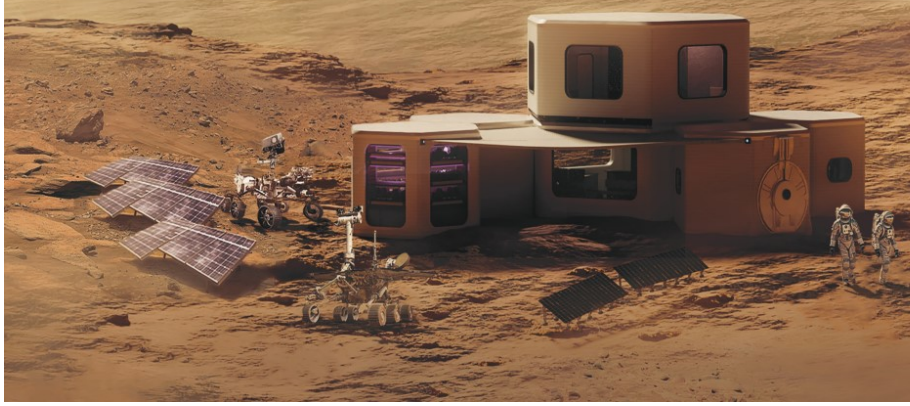
REST/KITCHEN/MAIN POD



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 shields the crew from 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 core 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. Earthworks



## 2. Tunneling



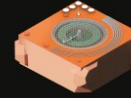
## 3. 3D printing



## 4. Inflatable



## 5. Farm



## Elysium Planitia

Elysium Planitia is the most fertile and deepest low-lying area on Mars, making it an ideal location for the habitat. The region's flat terrain and proximity to water ice make it a prime location for the habitat.



## 2 Floor Scale 1:100



### Radial Program

The radial program is designed to maximize the use of space and resources, ensuring a sustainable and efficient habitat.

## Ground Floor Scale 1:100



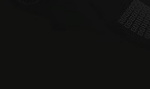
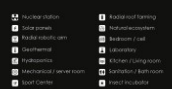
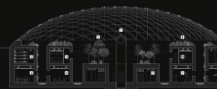
## Radial Farm Scale 1:100



### Radial Farm

The radial farm is designed to maximize the use of space and resources, ensuring a sustainable and efficient habitat.

## Section Scale 1:100



- Radial station
- Star panels
- Radial station arm
- Hydroponics
- Hydroponic server room
- 3D Printer
- Radial roof farming
- Radial greenhouse
- Radial cell
- Radial station
- Radial living room
- Radial kitchen
- Radial incubator

Northpoint Scale 1:100