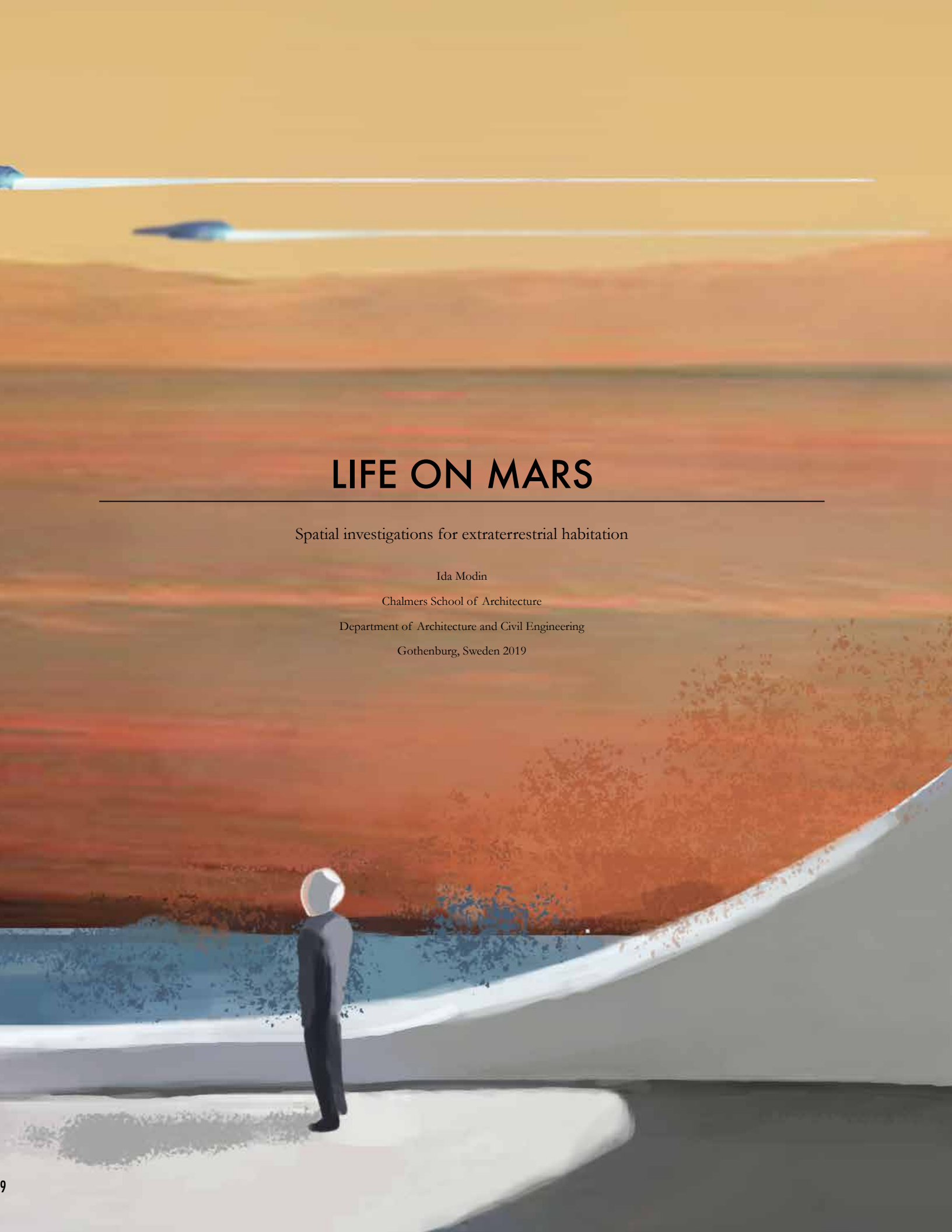

LIFE ON MARS

Spatial investigations for extraterrestrial habitation

Ida Modin

Chalmers School of Architecture

Department of Architecture and Civil Engineering

Gothenburg, Sweden 2019

LIFE ON MARS

Spatial investigations for extraterrestrial habitation

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Master Thesis Spring 2019
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ABSTRACT

Being nomadic as a people have made society and technology progress., Mars is the next step in exploring other planets (Aldrin, 2014). The physical step is believed to take place during our generation (Musk, 2018).

Mars doesn't have a forgiving environment. A cold desert climate with high radiation will force us to spend a lot of time indoors, and in space suits (Drake, 2009). Here Architecture will be vital in forming spatial environments where humans can thrive.

The purpose of this Master Thesis have been to explore the new needs of architecture that will arise when we are creating permanent societies and colonies on Mars. Through research by design: looking into the disadvantages and advantages of Mars: the design is meant to find the spatial qualities that can create a better physiological and psychological well being. In terms of light, tactility and sequences.

Specific techniques used to develop the thesis have been building up a future scenario as a context by creating a narrative of the life on Mars. The story is built up by visionary images and through time lines with ideas of how society will be constructed, developed and lived. In this the ideas of what role technology will play in the future life on Mars have been integrated. Speculative design references have been important in doing this, as well as concepts of Science Fiction.

THESIS STRUCTURE

“Life on Mars” is divided into five different parts.

I. The thesis starts with a description of the future scenario of Mars, a narrative set in year 2070. Here you get to follow the main characters journey from outer space to seeing the main spaces of the colony for the first time. Perspective drawings are used to show the architecture as a backdrop to the life and activities on the planet.

II. The introduction is placed after the Narrative and explains the background and basic conditions of Mars and the thesis. The introduction summarizes the important conditions that the thesis is based up on.

III. The third part of the thesis explains the design proposal. Moving into five special spaces in different level of detail.

IV. Following up the design proposal is the chapter called “Design investigations” it describes the process of the design work.

V. Last but not least is the chapter describing the references of importance.

Starts with a narrative, then follows the background, design proposal, process & references.

THESIS QUESTIONS

What does the first permanent structure of a space colony on Mars look like?

How do we deal with the extreme environmental pressures using material available on the planet?

What spatial qualities are needed in terms of: light, tactility, sequence and privacy?

What functions and program?

How can one explore future extra terrestrial habitats within the scope of a master thesis?

IDA MODIN, MPARC

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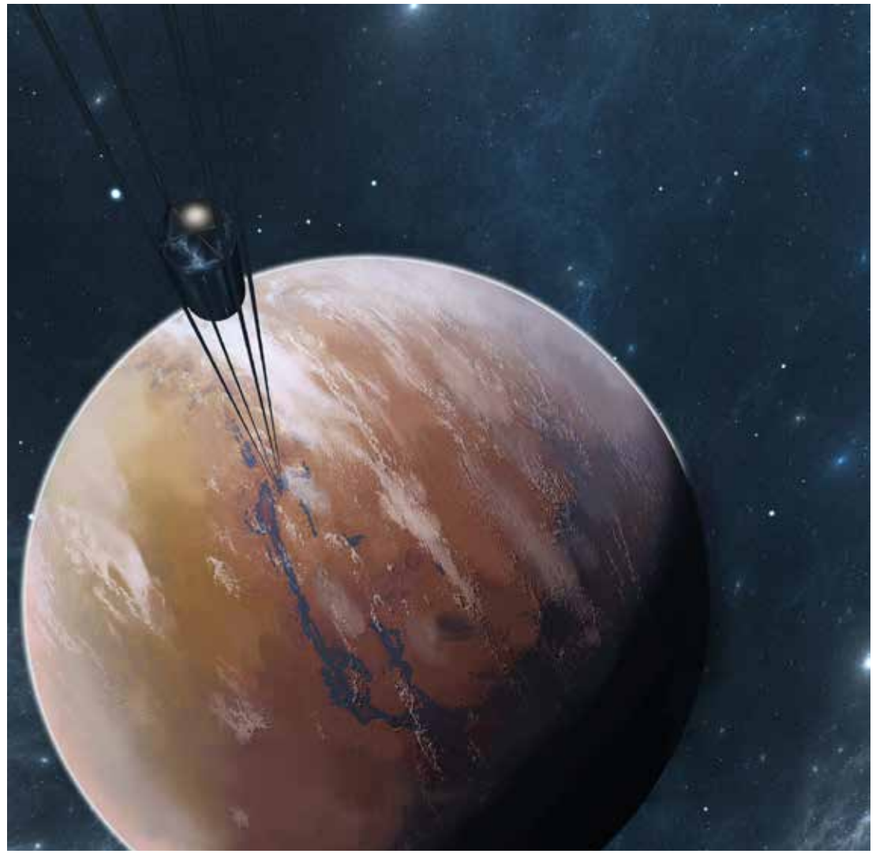
TABLE OF CONTENTS

01: LIFE ON MARS

So there is my brother. He is actually the only one not freaking out. But most of what he remember is living on a mars shuttle. He is the first generation with DNA modified genes, it makes him better protected against high radiation.

Your first sight of mars is a bliss. I'm actually 225 million km away from home. Pretty insane if you ask me. Can't believe it took us 6 months to get here.

We've been at this big space station now for weeks. In the beginning it was cool leaving the shuttle. But I'm done doing medical testing. It will be amazing to finally go to mars.

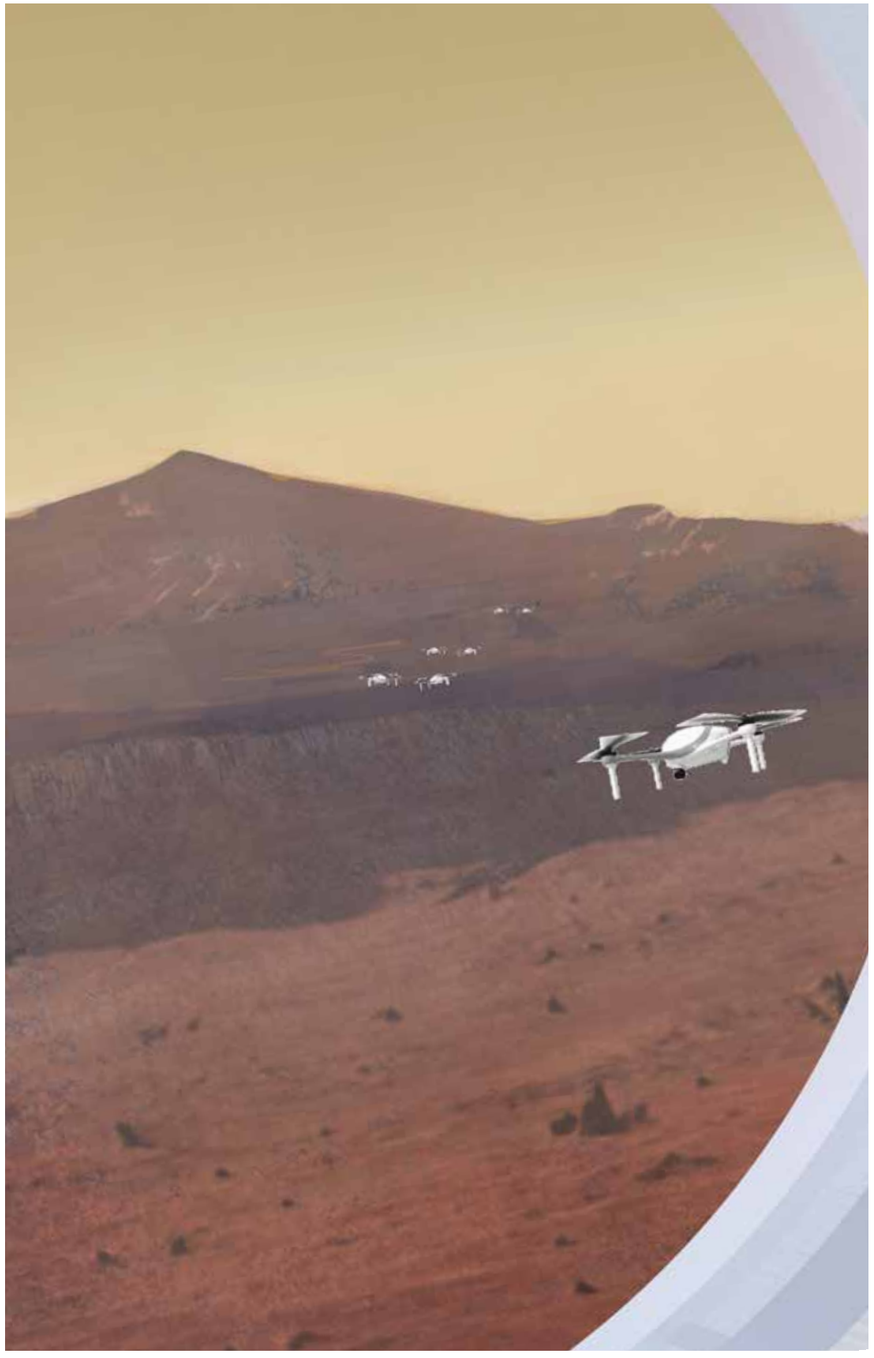


My mom is a scientist so she is beyond excited. I just hope there will be some cool people at Mars. It feels so strange that Earth life is behind us now.

I just want to get a view to the outside. I know these elevators are made by nano technology with cables made of carbon nanotubes and they should be ultralight and mega resistant but we are 10 000 miles up- what if they brake?

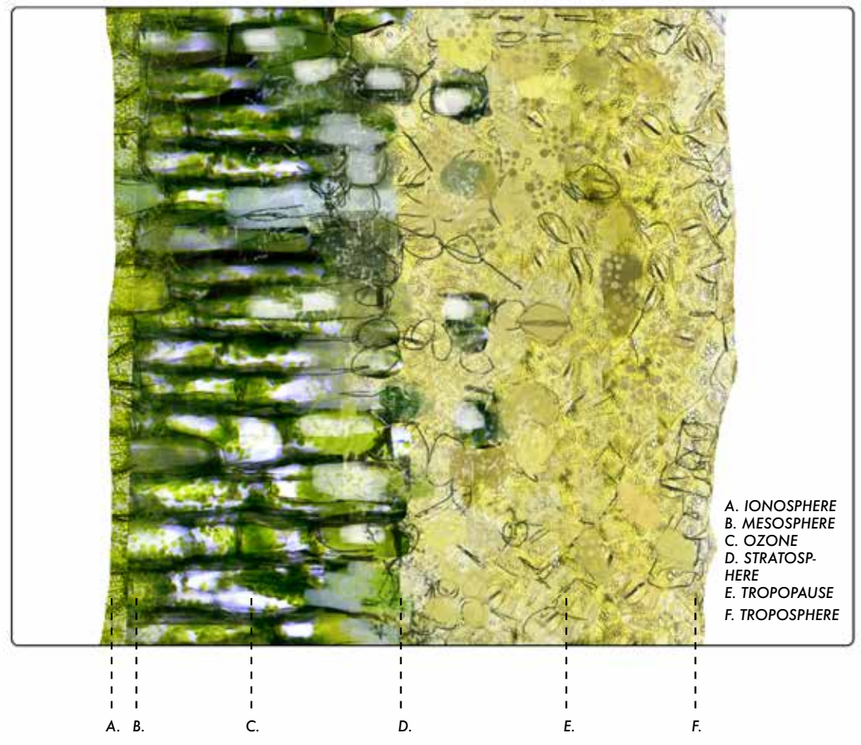
There are so many things I'm looking forward to see on Mars. I got to update my VR feed with stories from the largest volcano in our solar system (Olympus mons), largest canyon (Valles Marineres) and the largest impact crater (Hellas basin).

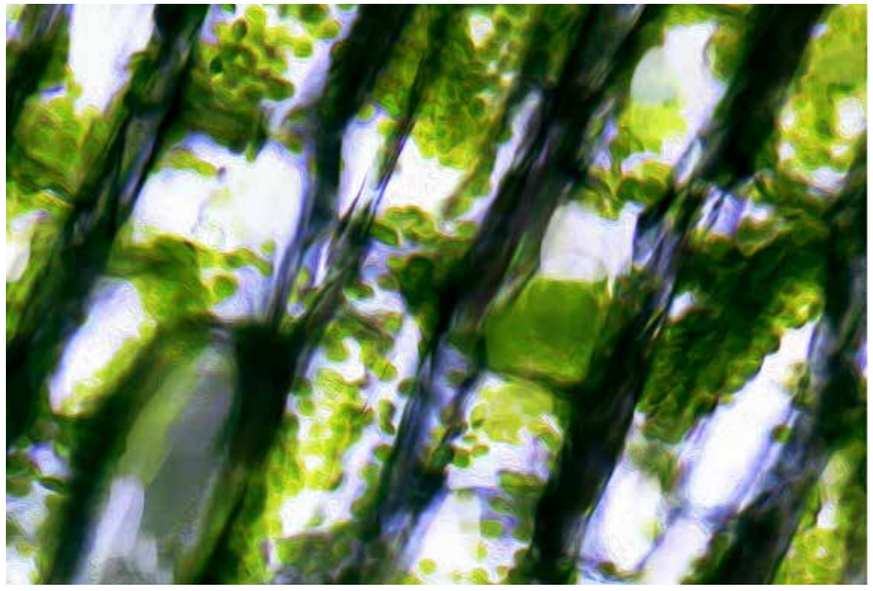
Something that is super cool is this space suit. Mom talks about it as the second skin. But it is called the smart suit. It controls body temperature, creates pressure, recycle fluids & produce energy through photosynthesis. Electronic membranes attached to it can track exercise and vital signs/ UV exposure.



So this is where we will live. It's the Melas Chasma area in Valles Marineris. Quite amazing how quickly the drones are establishing new habitats. Robotic helpers are a big part of work and life here. I heard the architecture of the colonies are complex. Mom tells me all about this great grandma of mine that worked on the extra terrestrial habitats earth have established. But I think that profession is ancient and outdated. I want to study robotics, that is the future.

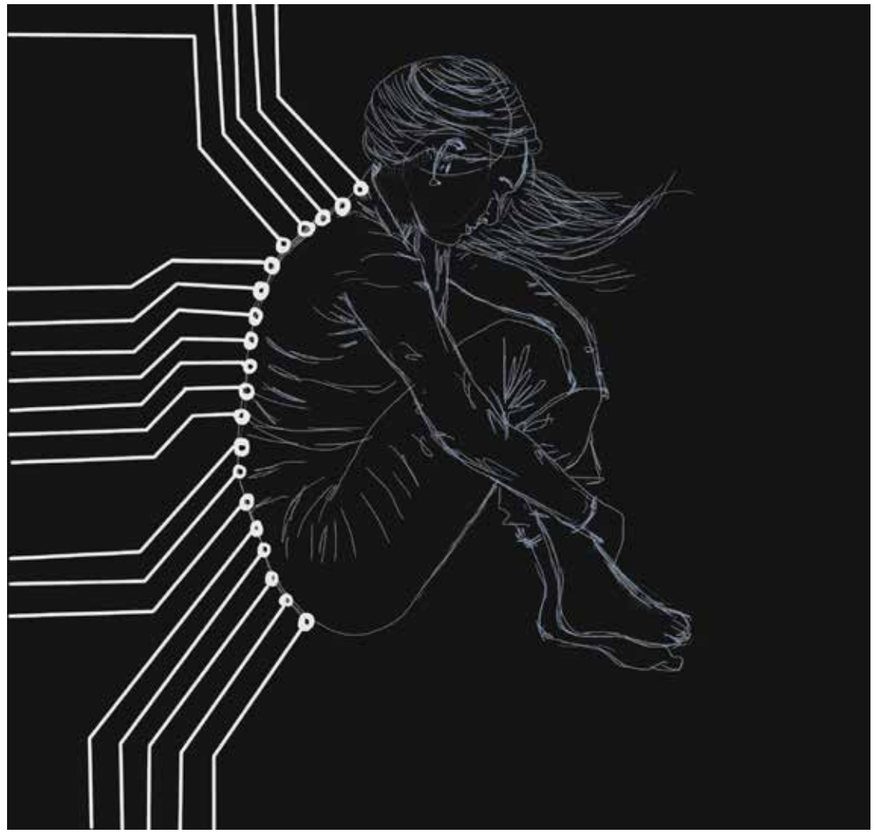
Something freaky is the section of the colony envelope. I heard that the wall actually is a model of Earths atmosphere.





Artificial photosynthesis cycle keeps water, heat and energy recyclable. A technology developed at earth that started with the first artificial leaf by David Wendell (Beckman, 2010) and photosynthesis by bacteria in an artificial foam housing by Daniel Nocera (Bernstein, 2011).

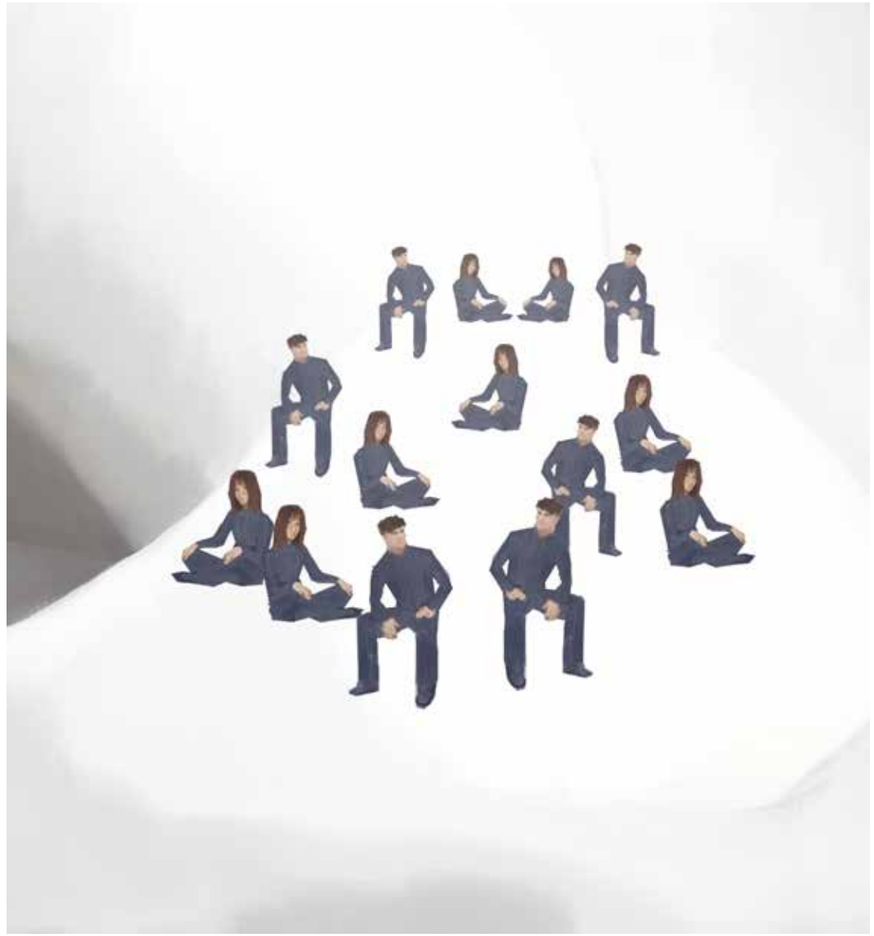
The cavemen never set out looking for a two bedroom apartment and same goes for Martian Habitats. They have been developed through trial and error. In an additive manner spaces have been carved out and printed depending on need. That method have created the dimensions and preferences for the life here.



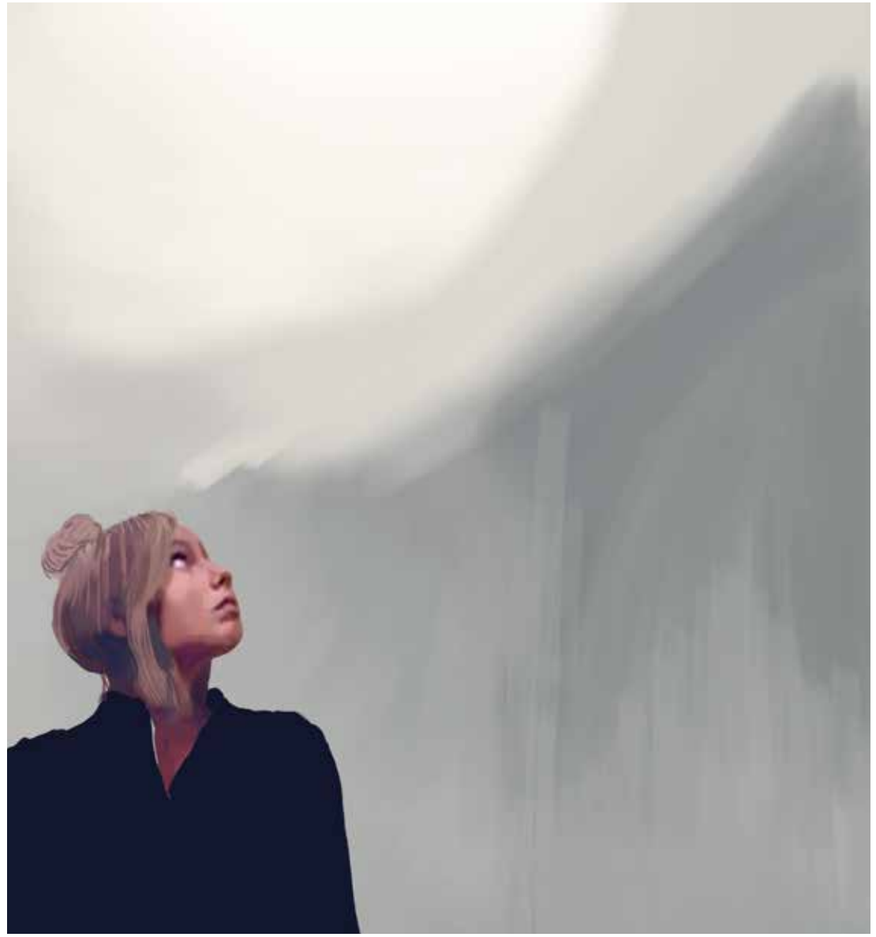
Everything in the settlement runs on the central AI. We are using technologies to improve ourselves and our surroundings and AI is something that we connect to. Scientist are looking into DNA modifications that could make it possible for us to adapt better to the planet, like the one my brother had.

“Okay, this is where the tour of the Melas Chasma colony starts. Welcome to the entrance hall of the colony. This is one of the spaces that have real sky-lights. But the big one you see there is monitored to be protected with a cover during the sand storms we get here. They turned worse since we started the terra forming process”.

"Here we have the square. At mars we have an open attitude about sharing everything that is going on. Otherwise we would not be able to survive here. Everything is democratic and everybody can join in to vote on important decisions. Right now we have a big debate about ecological economy and the role of Mars now when the mining production is running efficiently."



"This is where the colony is situated on the map. The communication systems in the canyon is planned to be connected with a fast speed train."

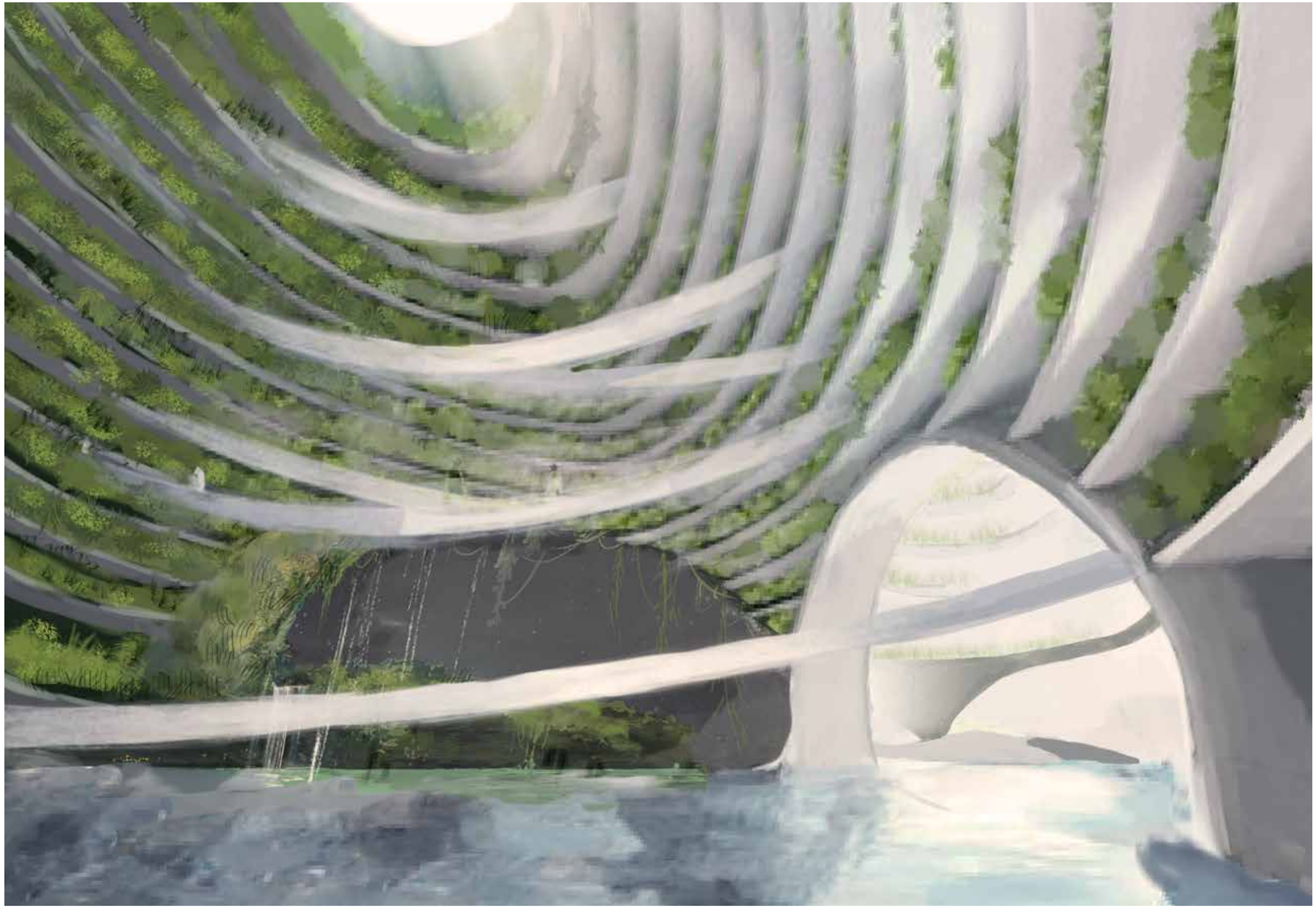


"We have established the colony underground because of the high levels of radiation outside. Although here at mars there is less daylight than we were used to at earth. For that reason our architects and engineers have worked very hard dealing with light design for the colony. As a strategy we use a lot of skylights. And smaller outlooks."

"This deep passage takes you to the production areas that are big parts of the every day life here. Furthest away from the colony is the nuclear reactor that ensures our energy supply. But to go there you need to take a train."

"The hydroponic gardens is a place for food production but also leisure. It is one of the most appreciated spaces in the colony. The water is extracted from water ice buried in the sand layers under the colony. This space here is not sufficient for all the food we need. In addition we get energy from our second skin, artificially produced food and the private growing areas in our homes."

"Lets head upstairs to the studio areas. The work areas here are closely connected to our community center. Studios are calmer areas away from the production. It is where I go if i want to upload new discoveries in my research to our public network. Kind of like our own Mars internet."

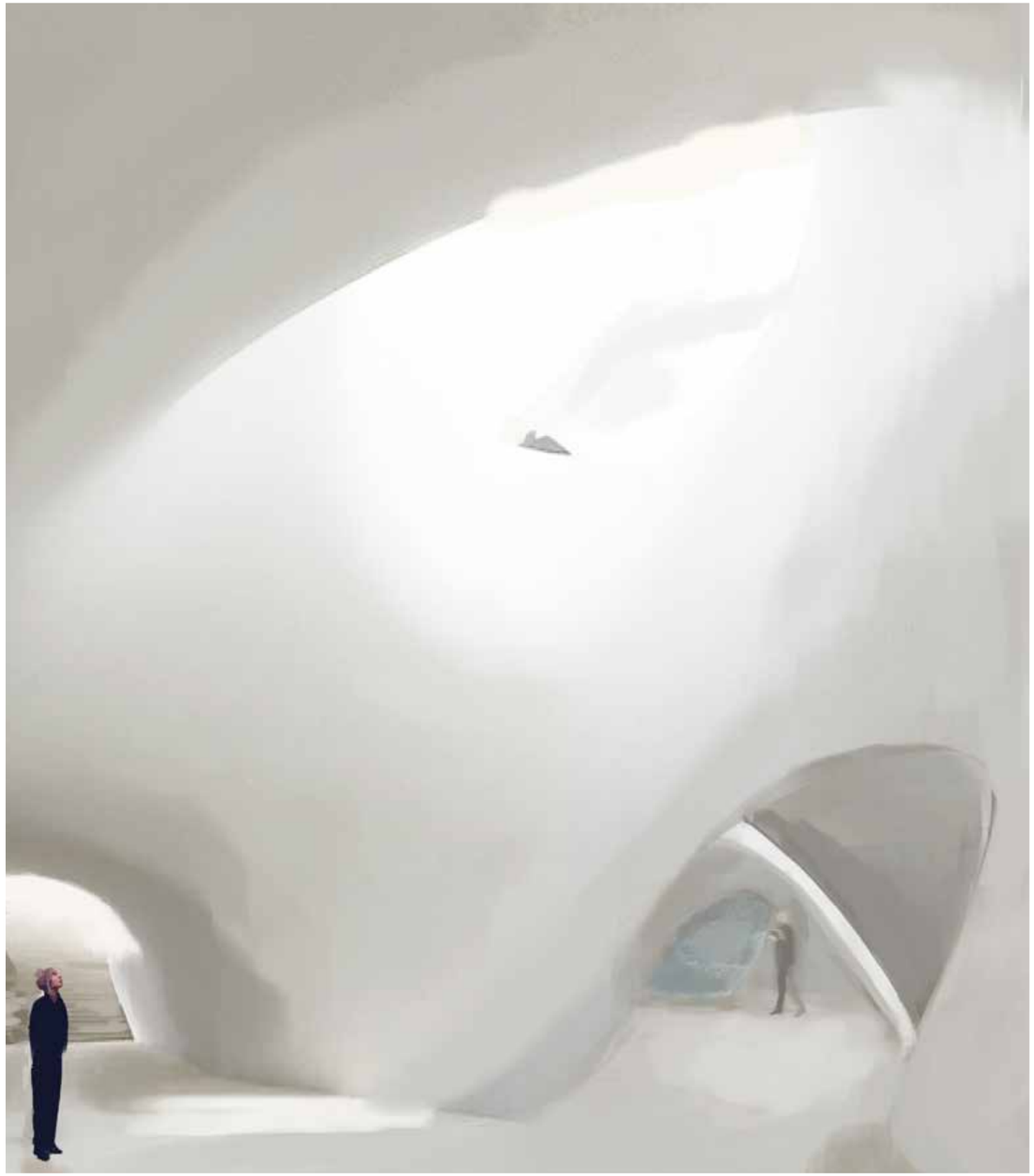


"In the studio rooms light is artificial light. We use lamps that recreates an experience of daylight coming from a skylight. They where invented by Coelux at earth long ago, I think it was 2014 (Beckman, 2010). But we have developed them now. Further in we have all the servers for our AI network."

"Even though everything has to be efficient and our colony is a smaller machine keeping us alive...We all agree that dealing with a harsh climate demands sanctuaries in our habitat. Highly comfortable environments where we can relax together. This is one of those spaces."

"The excavated regolith here have a cover of what we call the perfect mesh. It changes to fit your body resting. It's a textile like material that has electrodes integrated. It monitors brain waves and sleeping patterns. Collecting data to customize our lives."

"With the low gravity at mars the habitat environment can be more changeable according to our needs and for that reason the sectional plane have been more developed. We can have twice as high steps in a stair than what would be needed at earth. Furthermore the less gravity makes us physically taller and psychologically it fells better to be underground in a space that isn't cramped."



"The pathways going to the habitat areas have another typology. A lot softer."

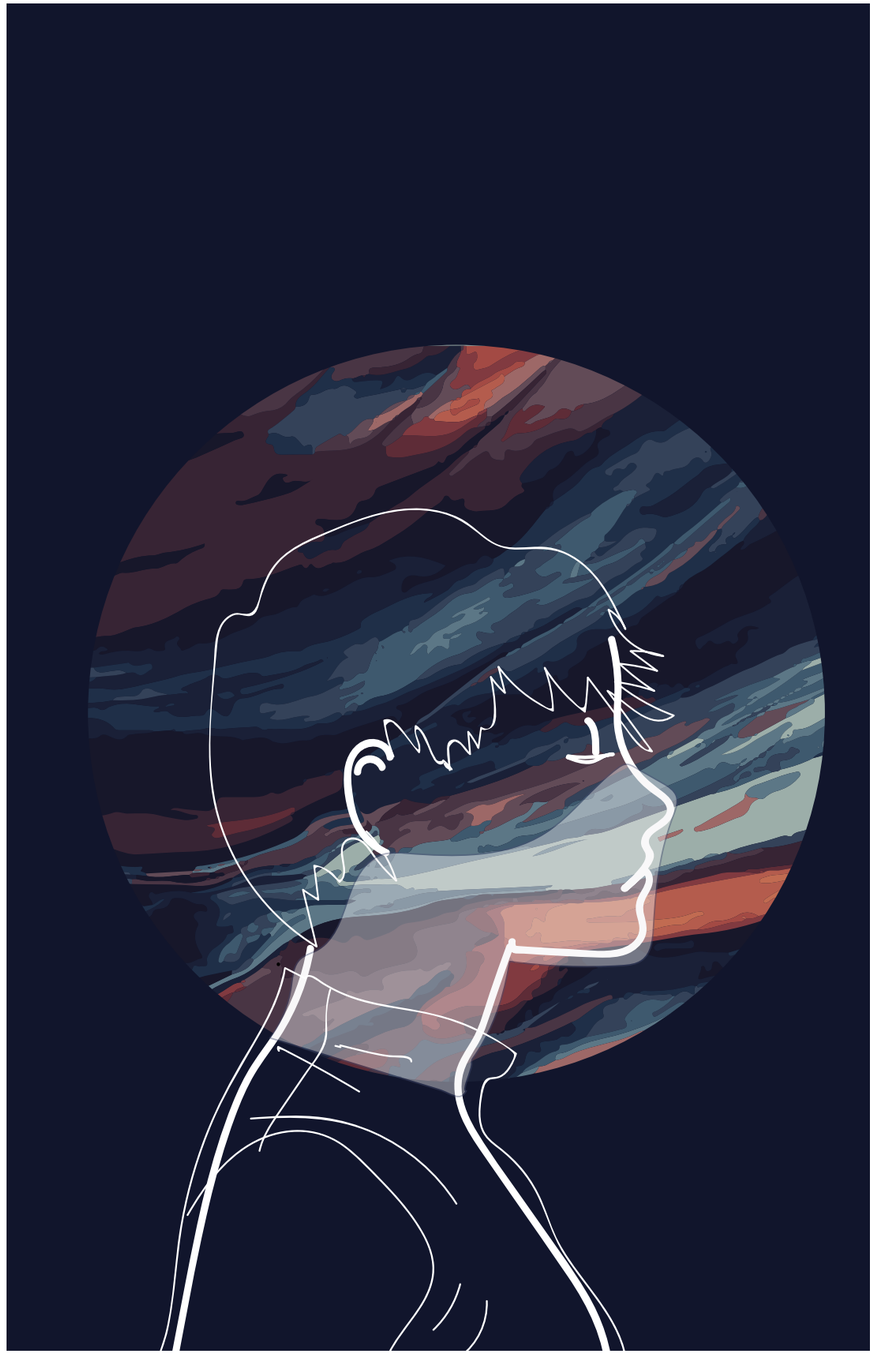
Everything is recycled and re-used here at mars. Excavated regolith is 3D printed to become structure and used materials are re-used in printers as well. For that reason mars has no waste. Can't wait to 3D print some new furniture and clothes.

Bedroom is furthest into the mountain in the apartment. So there are no real windows. The reason for this is that we have to be able to sleep protected against radiation and the extreme weather conditions.

The bathroom here is similar to the one at earth. It keeps track of your health. Toilet analyzing your excrete to see if our nutrition is good enough and mirrors reading vital signs with radar.

Good night Melas Chasma. Lets see what new adventures awaits tomorrow.

02: INRODUCTION



Interpretation from Green Mars. The author predicts a time when humans only breath with a filter at Mars (Robinson, 1993).

AIMS

Visionary

The aim was to design with the freedom and possibilities of being visionary. Through a combination of digital exploration and physical exploration and achieving a design process that addresses the human centered experience of architecture. A focus on light, materiality and atmosphere. Instead of focusing on the technical issues. This while addressing the thesis questions.

Speculative design process

Looking into a possible future is something that I believe has a great value. A speculative design project can be both a projection and a critic. But this thesis aim to lean towards the latter.

The history of speculative design within architecture have some clear references. Early examples such as architects like Giovanni Battista Piranesi (1720-1778) predicting future cities, prisons and ruins in his drawings and Étienne-Louis Boullée (1728-1799) creating dreamy and monumental drawings of architecture such as the Cenotaph for Newton.

But also later in time, the megastructures of Paolo Soleri exploring his idea of Archology a fusion of architecture and ecology (Soleri, 1969). The 60s were characterized by experimental and open ended approaches. Archigram created their own graphics and the members found arguments for their architecture in other industrial fields, such as their re configurable structures (Runberger, 2012).

Systems of technology was used by the Archigram as something that could provide freedom for the individual and in that freedom to set conditions for a new society. Superstudio was another group using architectural drawings to provoke. But to Superstudio the purpose was to make a continuous critique of architecture as a discipline, of normative values and society (Runberger, 2012).

What all these examples have in common is how they have created an architectural debate through creating imaginary worlds, illustrated with outstanding graphics.

Concepts of Science fiction

The concepts of Science Fiction (SF) are relevant because SF is explored through a narrative as well and engages with the reader through a constructed world. Both cultural, social and through technology.

One of these concepts are ***cognitive estrangement*** that deals with the experience of reading and watching SF, familiar elements are combined with unfamiliar elements to create a plausible scenario. Cognitive talks about what can be understood and estrangement points to what is different and new. ***Extrapolation*** is a concept of basing speculations on what is known today, using that knowledge to look into probable futures (Runberger, 2012).

A speculative future scenario. Looking into spatial aspects such as:

Light & dynamics
Tectonics
Narrative
Gravity
Radiation
Architecture of the future
Materials on site
Technology

BACKGROUND

Colonizing Mars is interesting in many aspects. It could be essential for us to explore because of what we could learn. Catastrophic climate change made Mars the way it looks today. Early Mars was earth like with thick atmosphere and half of its northern hemisphere used to be covered with water (Levin, 2009).

Mars could help us deal with our own climate change and it could also give us clues to the origin of life (Cabrol, 2015). Furthermore Mars host interesting phenomena like the largest volcano in our solar system (Olympus mons), largest canyon (Valles Marineres), largest impact crater (Hellas Basin).

Possible?

There is plenty of water on Mars, but it's frozen. There are theories of how to terraform the planet in a 20 year span. The temperature of Mars can be 23 C during daytime but during nighttime it goes down to -73 C. This could be changed to a less extreme switch if the planet where to be terraformed. It would also lead to rain/snow on Mars, running water and create an atmospheric pressure on Mars. What it wouldn't solve is the possibility to breath the air, that will take many more years to achieve (Petranek, 2015).

Architecture

Space architecture is a unique area with opportunities for development (Kennedy, 2002). Most of it have been glimpses through movies, books and cartoons.

When it comes to a future of humanity inhabiting space, we know how to get there and how to make the necessary systems for our Survival. Looking into the architecture designed for Mars, most is focused on the first phases of colonization: temporary structures and small habitats. The design looks very practical. But these spaces, like the ISS, are made for highly motivated people doing scientific experiments. People that are used to accept a simple environment (Nyström & Reuterswärd, 2013).

Connecting to that, it will be necessary that we also allow ourselves to go one step further into the future. Looking at a permanent colony. Making a permanent structure, spatial qualities and good designed environments become even more stressed.

Radiation will make colonizers bound to indoor environments for extended periods. This will be explored in the Thesis and could perhaps also give useful design input to earth on the subject. Today we spend 90% of our time in static indoor environments (AD, 2016).

"Buildings are the template of society, Arkady said. They're rooms, Sax Russel pointed out. But rooms imply the social organization inside them. Arkady looked around/.../The arrangement of a building shows what the designer thinks should go inside./.../ Buildings express values, they have a sort of grammar, and rooms are the sentences." - Robinson. S .(2009) *Red Mars, p. 78*

"I think the human race has no future if it does not go into space"
- Hawking. S. The Daily Telegraph. October 16. 2001

Summary: Exploring architecture within the realm of speculation. Human based, artistic and sequence based atmospheric investigations. Spatial design from different scales and approaches in a challenging environment. Mixing disciplines of science with research and data on one hand and fictional ideas on the other hand. Partly abstract partly concrete.

METHOD

The design method has been research by design. Research based investigations and references mixed by experiments through sketching and 3D modeling. The base of the design proposal comes from the findings of the experiments combined with a set of assumptions taken from theoretical research and fictional sources.

The thesis question have been explored through design experiments and iterations. The purpose of the experiments was to understand the essence of how to be satisfied spatially in the extreme environment of Mars. Looking into light & reflection, shadow, gravity and transparency - in relation to materiality through texture and shape. Results have been evaluated and discussed in relation to literature and sources found during preparatory work.

Narrative

The narrative has firstly been a way of setting up a speculative scenario of the life in the future colony on Mars. Creating a context was a good starting point for the design of the project. The approach have been productive in the way it kick started the whole creative process of the thesis design work. It also resulted in material that was possible to examine and evaluate. Experiencing both ideas and facts into one story.

Visionary

To use a method that is visionary but uses already established facts as a foundation.

Conceptual thinking

As a way of framing ideas and push innovation.

Design & model

Sketching as an important part of the process. Working with digital 3D modeling techniques, digital sketching and collages. Working with different scales and detail level.

Site & user

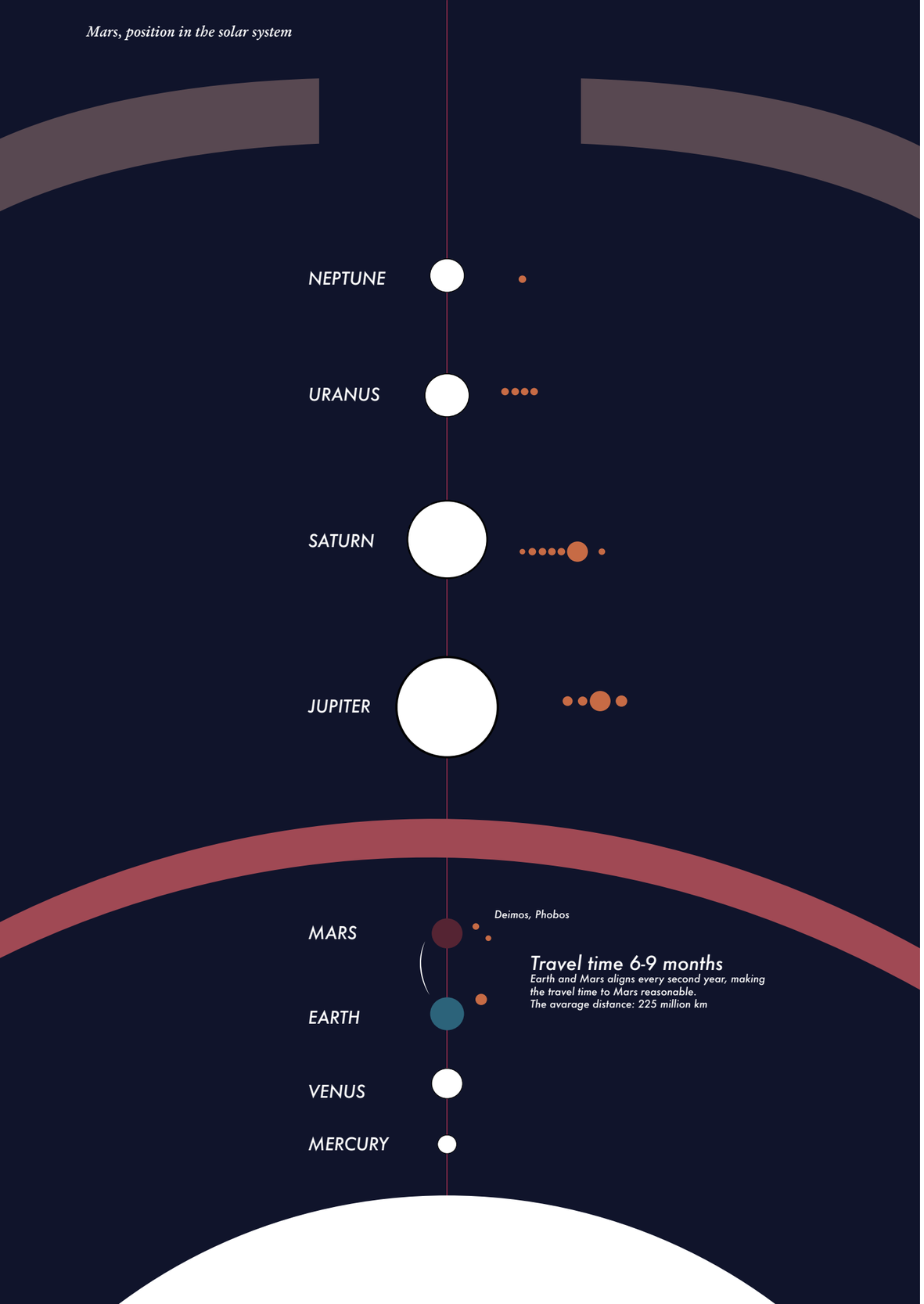
Starting point of departure is the user and the context. Surroundings and environment becomes essential in this projects where extreme climate conditions have to be taken into consideration for survival.

Reorganization

Keeping some fragments of known architectural elements from earth, introducing it into the Martian context and bringing something new architecturally into the discussion.

Extrapolation

Based on current technology the idea of fabrication and materials have been developed in line with the design and site of the project. But also the idea of what future life can be and how it will be lived.



DELIMITATIONS

The thesis have explored the future scenario of 2070. Assuming that the first human took a step onto Mars in 2030. Inflatable and temporary structures have been used to do the first man made explorations and research on the planet.

In the process of traveling around there have been several possible environments targeted as potential sites for the first permanent colonies. This thesis have looked at one of those sites developing a strategy for the first permanent structure on Mars.

The design investigations have focused on a settlement for 150 people within the same structure that will host the functions to sustain these people.

Many technical issues arises when the notion of the shelter stretches to provide and produce for our basic needs of survival. The architecture itself needs to become a machine that keeps us alive. But the focus of this thesis will not be on how to draw these system in detail. The focus will be on the human needs and experience of the spatial environment, the program will be developed connected to that. Looking through the architects "glasses" on what opportunities Mars can provide.

Program

Permanent structure of the first building in the space colony likely to be used as the habitats of a first generation of researchers and explorers. Sequence of different functions ranging from the dwellings to public spaces, production and water extraction. An interior focus - light (reflections & dynamics) & tactility

Material

Using on site materials exploring the possibilities of the gravity - section/structure

Environmental struggles

Radiation, extreme climate

Possibilities

Gravity, amazing landscapes, terraforming

"Space exploration needs engineers, physicist, mathematicians, geologists and astronomers. But it also needs poets, thinkers and drawers" - Espinoza. A. (2017) Mars the pristine beauty of the red planet. p. 11

REFLECTIONS

What does the first permanent structure of a space colony on Mars look like? How do we deal with the extreme environmental pressures using material available on the planet? What spatial qualities are needed in terms of: light, tactility, sequence and privacy? What functions and program? How can one explore future extra terrestrial habitats within the scope of a master thesis?

Answering my first two thesis questions would be that it can look different depending on where on Mars you will build this permanent structure. I could say that it probably is built by regolith or ice with a certain thickness to get the right protection against radiation, and that structures on Mars are a lot about safety and living systems.

When it comes to the third part of my thesis question, which I believe to be the most important one, I thought it would be a pure architecturally answer to what architecture can do in an extra terrestrial situation. But what architecture can do on Mars is tightly linked to technology and survival. Even though I by delimitations tried to stay out of the deeper details of these systems, one cannot build on Mars without having the technical issues into consideration. They go hand in hand, architecture and technology becomes intertwined.

Technology also creates a positive argument for the potential role of a certain architecture. Some parts of the architecture created in this thesis would not have been possible without extrapolation of the technology levels we have on Earth today.

Choosing to work in the realms of speculations is an interesting process. Conditions created will go beyond scientific data. The narrative of the thesis set the time line for the colonization and the context. It helped gather and describe the activities and routines of the everyday life for the colony inhabitants. It also helped in making design choices and defining the program. It also lead me into subjects I had not planned to go into, like social values and political aspects. This is of course important because social structures effects how we live and by that the architecture.

Looking at the architecture created, it derives from a wish of making something new. From the beginning the idea have been to add another layer to the development of extraterrestrial habitations. To focus on a human based design and experience. In doing this it became important to create a sanctuary, an oasis. A reaction to all the time that need to be spent indoors on Mars. Using the fantastic possibilities of architecture as something more than a basic shelter.

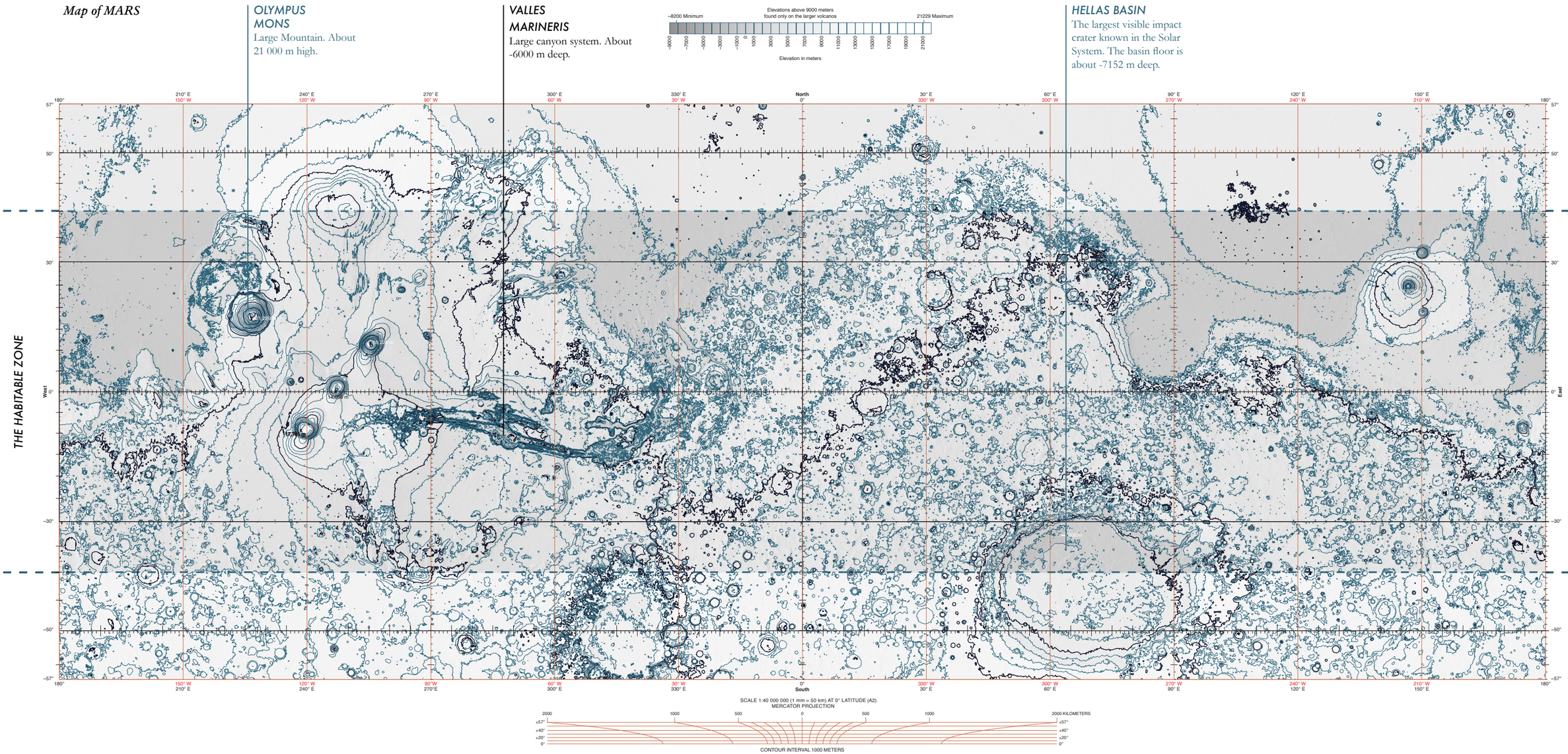
03: DESIGN

Map of MARS

OLYMPUS MONS
Large Mountain. About 21 000 m high.

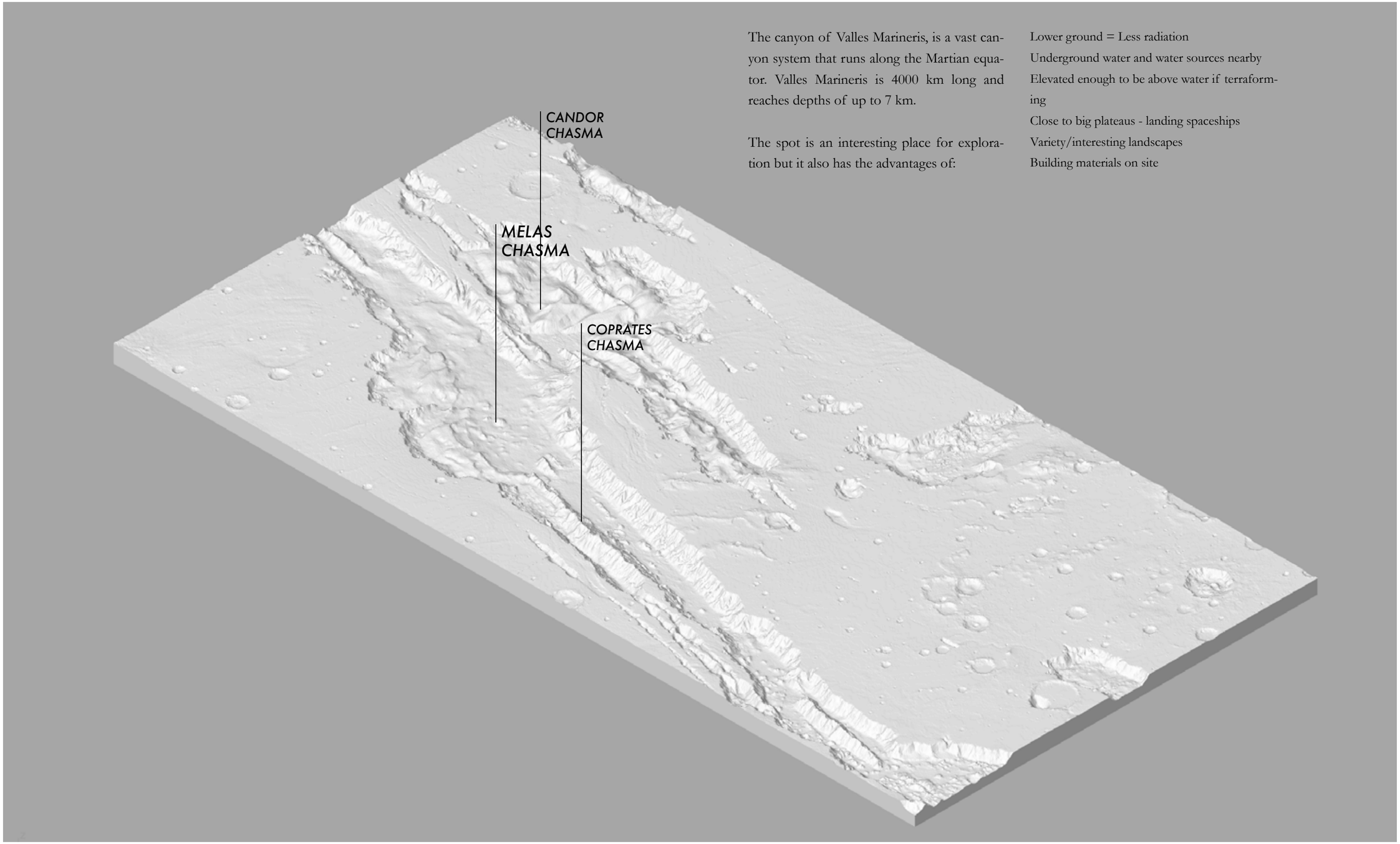
VALLES MARINERIS
Large canyon system. About -6000 m deep.

HELLAS BASIN
The largest visible impact crater known in the Solar System. The basin floor is about -7152 m deep.



The inhabitable zone

Above or below 40 degrees south and north is considered to be too cold and dark for a human settlement. This creates a "band" between the equator and 40 degrees north and south. (NASA, 2015)

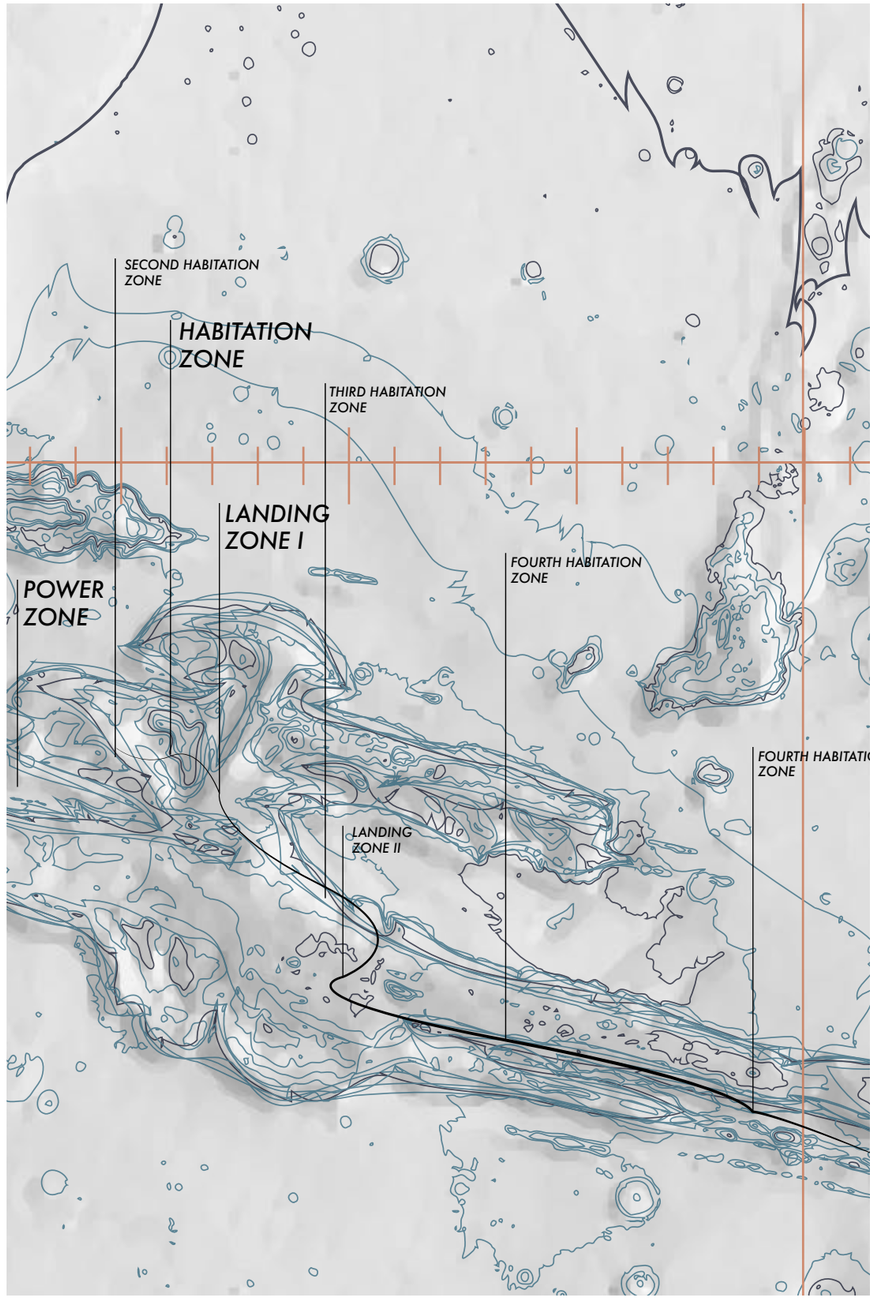


The canyon of Valles Marineris, is a vast canyon system that runs along the Martian equator. Valles Marineris is 4000 km long and reaches depths of up to 7 km.

The spot is an interesting place for exploration but it also has the advantages of:

Lower ground = Less radiation
Underground water and water sources nearby
Elevated enough to be above water if terraforming
Close to big plateaus - landing spaceships
Variety/interesting landscapes
Building materials on site

Digital terrain study model of the canyon



PROGRAM

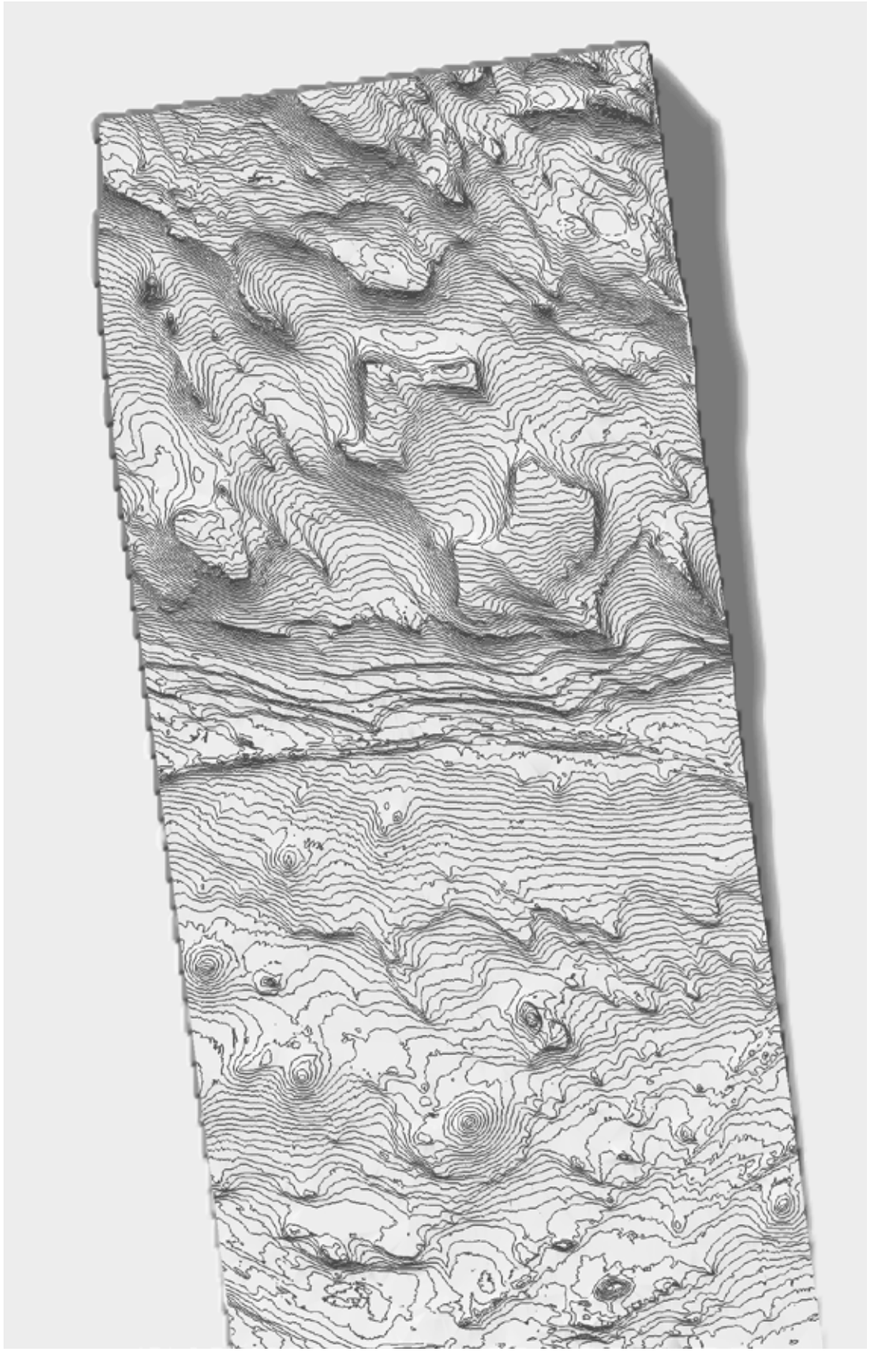
In this future scenario of 2100, the settlement have spatialities of multiple functions. Private areas are connected with community areas, research and production. The focus is to sustain social and mental health. It is a smaller indoor community in one structure that keeps on growing. The idea is that this structure can be extended and added to when more people arrive. But also grow out into several of the interesting sites surrounding the landscape of Valles Marineris.

I. Site strategy: 1:1000
II. Spatial design: 1:200, 1:100, 1:50

Size:32 000 m2
Inhabitants: 150

Master plan perspective:
Habitat zone
Landing zone
Power zone

Habitat zone:
Main entrance
Sleeping quarters with sleeping pods
Hygiene/shower/bathroom unit
Workout area
First aid/hospital
Storage and store
Auditorium/meeting area
Community hall/dining
Kitchen/prepp
Workshops
Laboratories
Studios
Knowledge storage/server hall/study area
Leisure
Hydroponics/vertical gardens
Life supporting systems
Vehicle access/rover dock?
EVA suits access
Airlocks, entry, egress airlock



Digital terrain study model of Candror Chasma

SITE

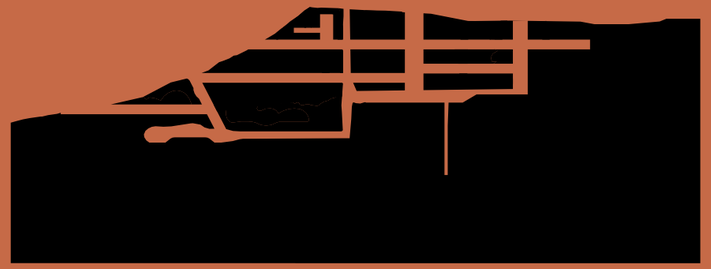
Looking at the area surrounding Melas Chasma, Candor Chasma stands out, a place nearby the flat Canyon Floor, but with it's own topography. Something that gives a settlement a better overview for exploration and infrastructure.

The area is full of rock deposits and layered deposits. The layers of dust and sand sized particles at the site were transported by either wind or water. This part of the canyon may have been filled to its rim by sedimentary layers, afterwards eroded away, most likely by the wind. The drawn out hills might represent areas of rock that are stronger due to differences in the size of the sedimentary particles, chemical alteration, or both (Okubo 2008).

The area has interesting connections to the history of water on Mars. The energy from the chemical reaction with water that created these layers could have sustained habitable oases in the area (Okubo, 2008).

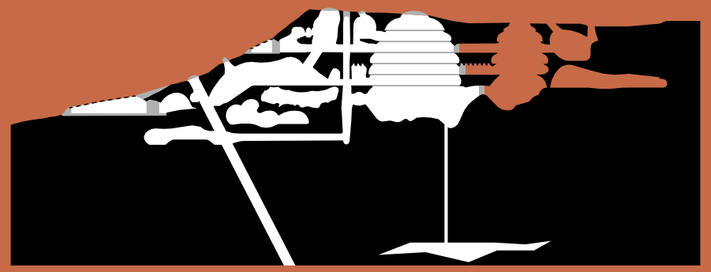
It's still low enough to have better atmospheric pressure. The topography at the site has a range between approximately 5 kilometers below the canyon-rim (Trek, 2019). The site is tectonically very interesting with its own mountains and canyons. Formations created by time which today works as weather protection.

The height data shows that the site is elevated from the canyon floor but still one level down from the plateau above the canyon. Looking at the height levels but also at the maps predicting where mars had water - this means that the site would be saved from flooding if the planet where to be terraformed.

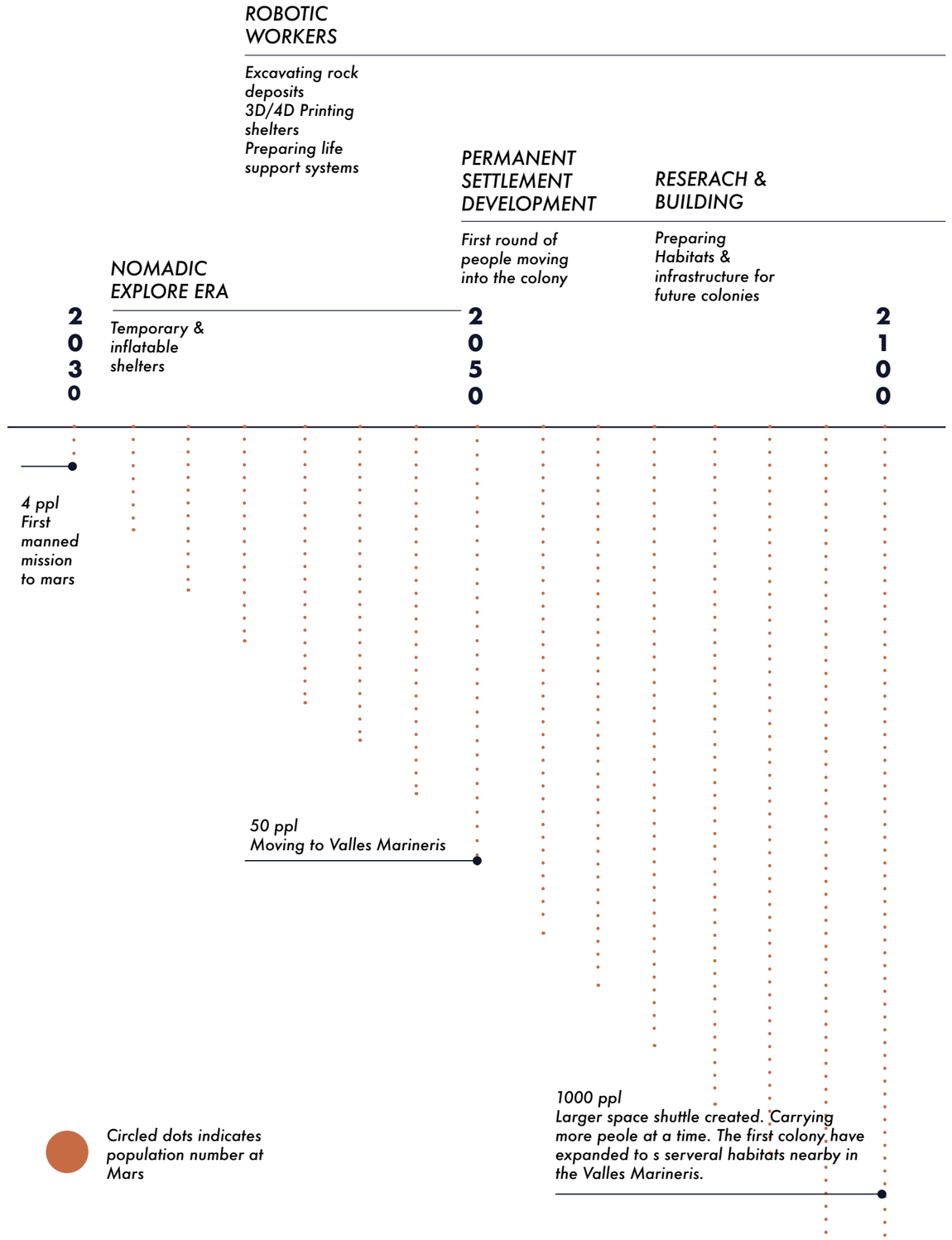


I. First step: excavating tunnels

II. Second step: creating spaces



III. Sealing and installing life supporting systems



THE COLONY

The whole settlement is constructed around the large volumes of the community center and the hydroponic gardens.

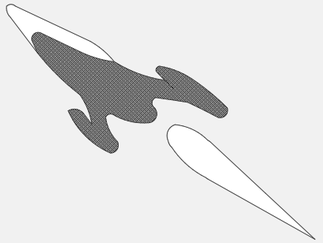
Conceptually, Melas Chasma colony is a vision of a small martian city. It is built into and becomes one with the Martian landscape - in the biggest canyon of our solar system.

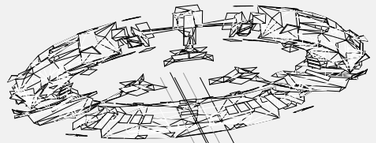
Martian living for the first settlers will be a lot about surviving, research and building up society. Work will be a big part of life, for that reason living and working is closely connected.

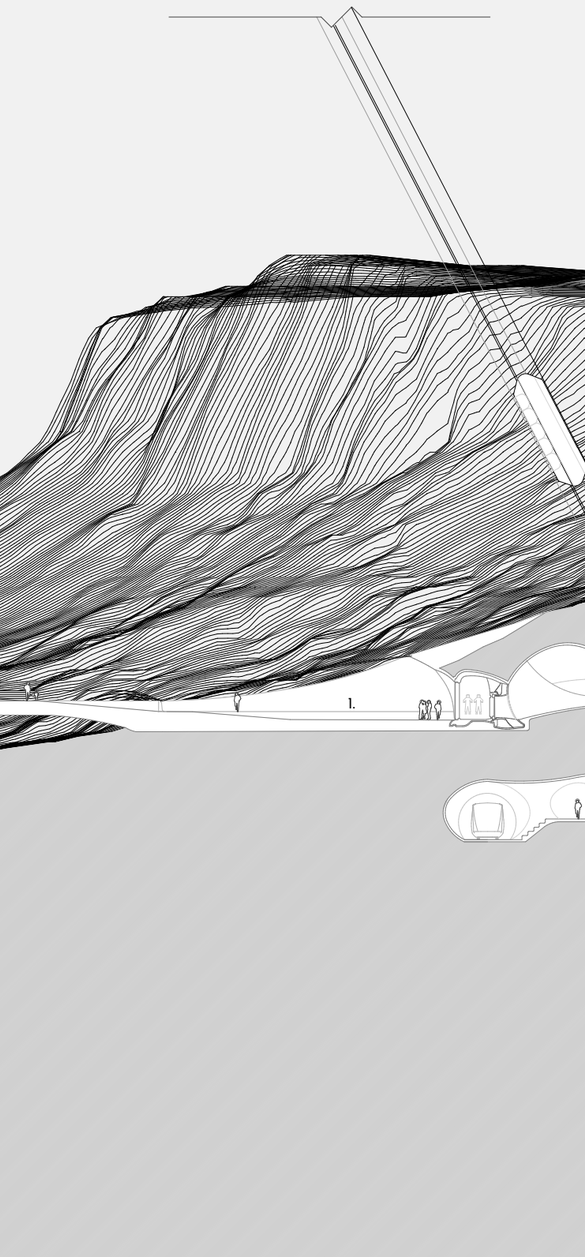
The center of the colony is the community center which creates an inner landscape. The whole settlement is constructed around the large volumes of the community center and the hydroponic gardens. The quality of this human made structures becomes it's own landscape. The residential grounds are built into the regolith, but meets the outside of the planet and are positioning the citizens between the inner landscape and outside world. A landscape barely touched by human hands but being changed.

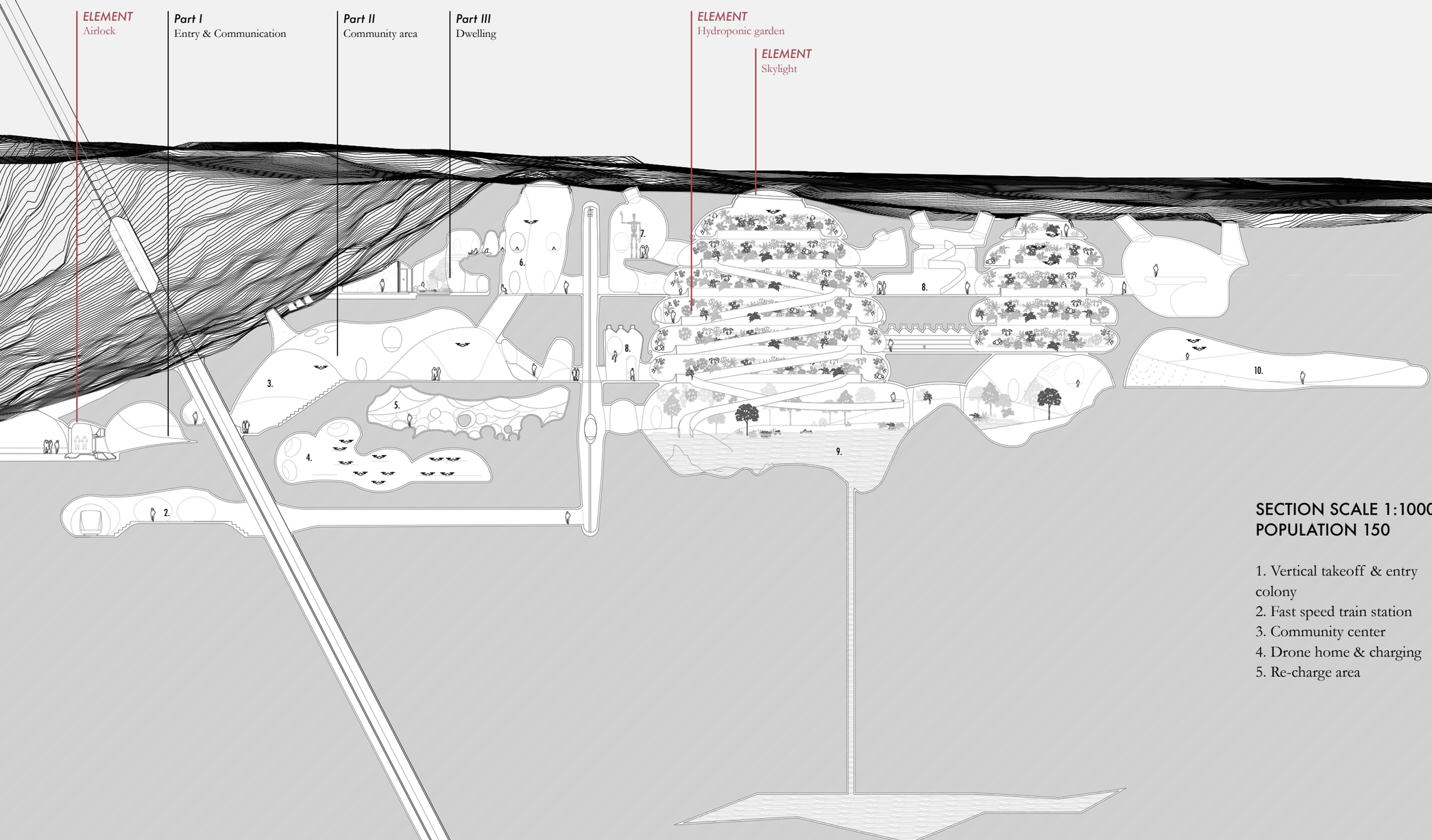
The city terraces down towards the canyon and extends all the time through drones working day and night.

Connected by train and tunnels to other underground structures, each in it's own will soon be a full developed township.



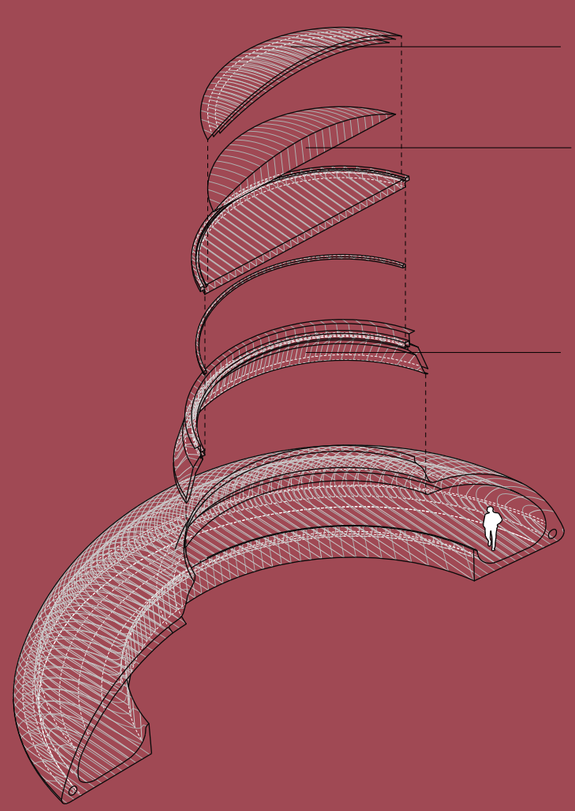






SECTION SCALE 1:1000
POPULATION 150

1. Vertical takeoff & entry colony
2. Fast speed train station
3. Community center
4. Drone home & charging
5. Re-charge area
7. Robot lab
8. Studios
9. Hydroponic gardens - farming, leisure, water+nutrition systems, public baths
10. Research laboratories



Axonometric diagram scale 1:200

ELEMENTS : SKYLIGHT & AIR LOCK

Apertures are important elements of the colony. Windows are especially important for observations and relaxation.

Water filled skylights have been used for maximum radiation protection but there are also some clear viewing windows. It's important for the mental wellbeing to have some clear viewing windows (NASA, 2014).

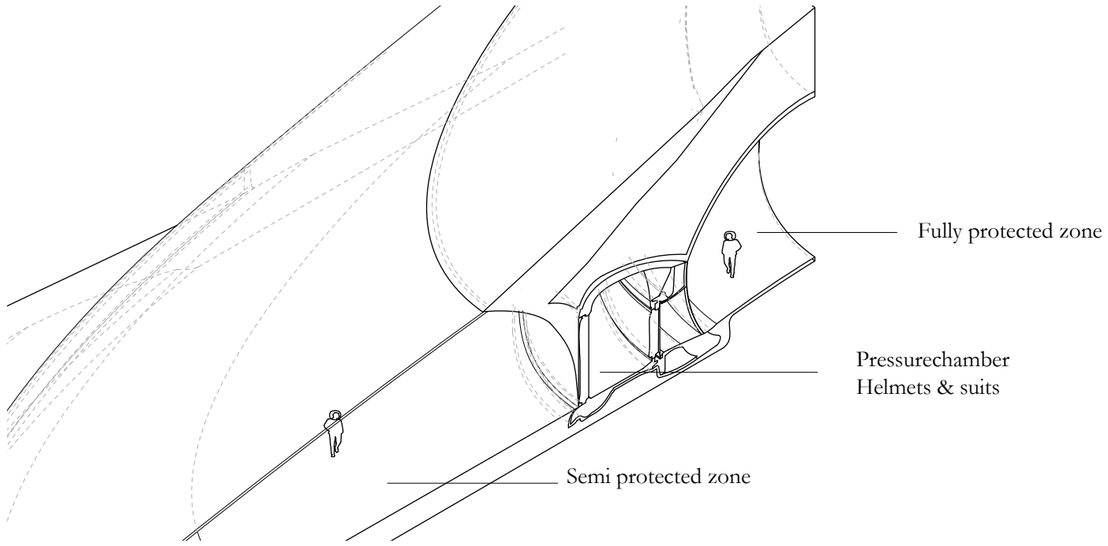
Rounded shapes

The colony apertures have circular or rounded shapes because circular and round windows are generally less expensive to produce and are structurally less prone to stress fractures (NASA, 2014).

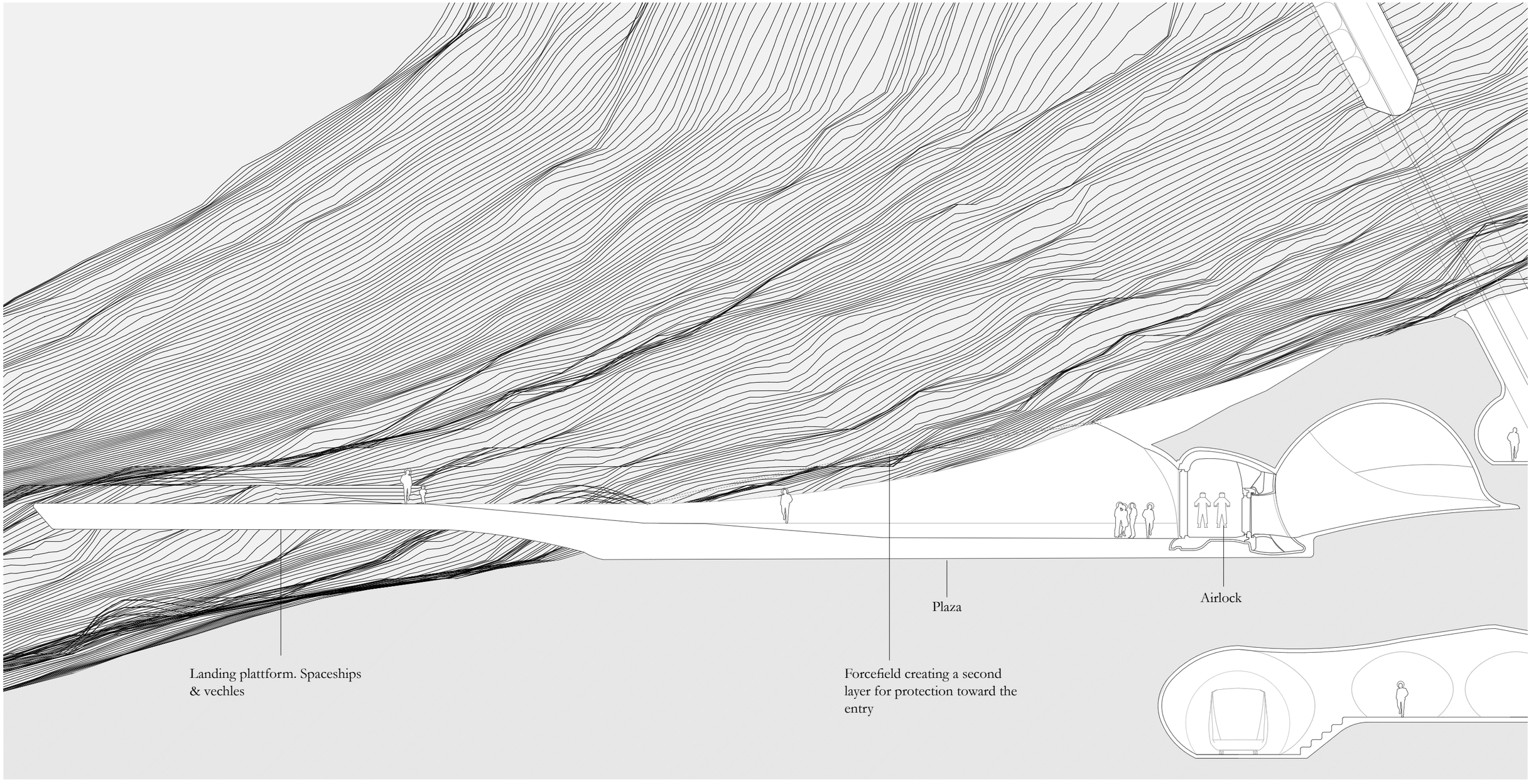
Air lock

The entry to the colony is made through an air lock, a device that permits passage between different environments. It consist of different layers. An outer extra protection through a electromagnetic force field creates a layer where you can be outdoors, protected from some of the extremes the weather at Mars. Airtight doors in a series protect the colony from the outside conditions. The opening is not especially massive to make it easy to operate.

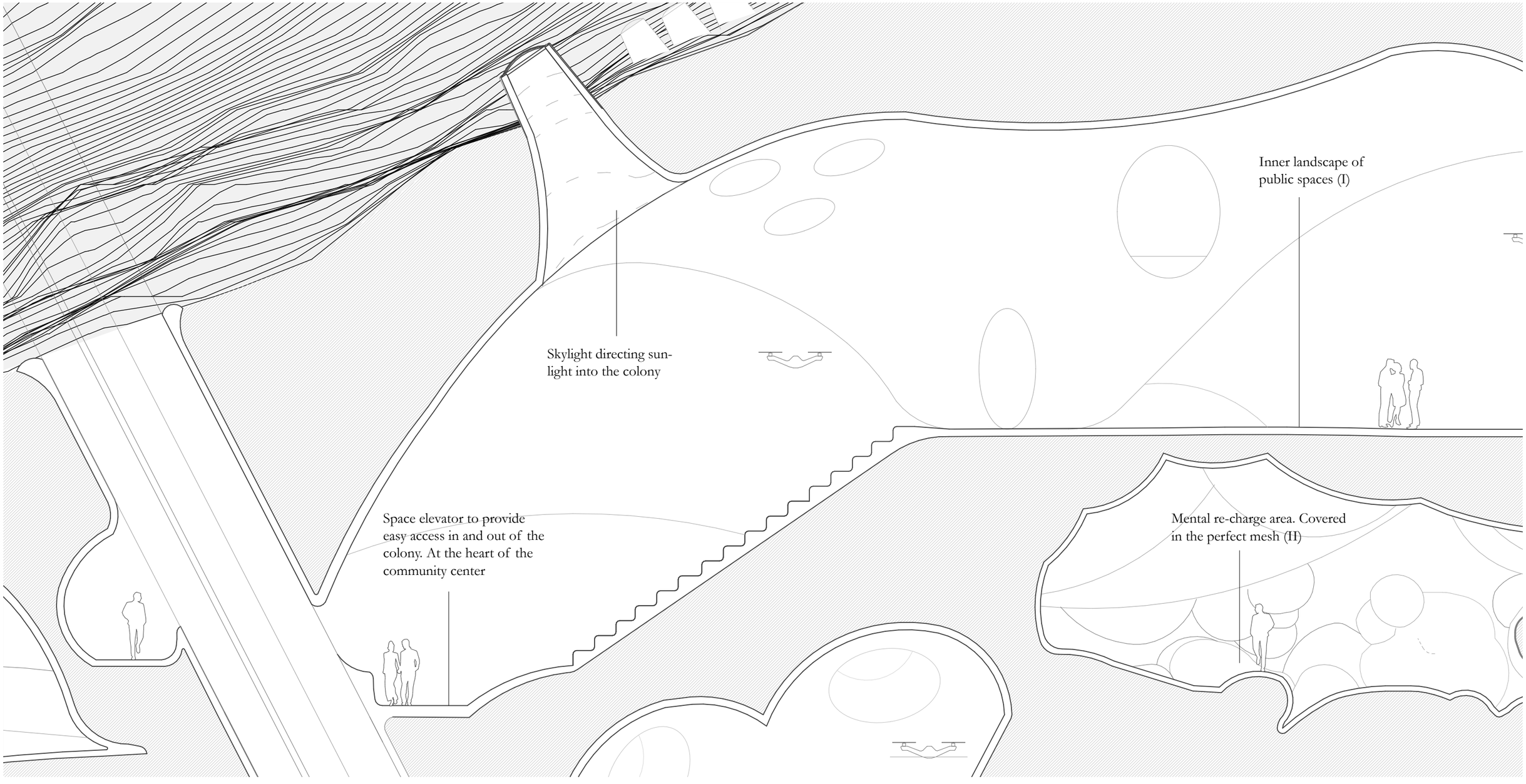
Circular & round windows are generally less expensive to produce and are structurally less prone to stress.



Axonometric diagram scale 1:200

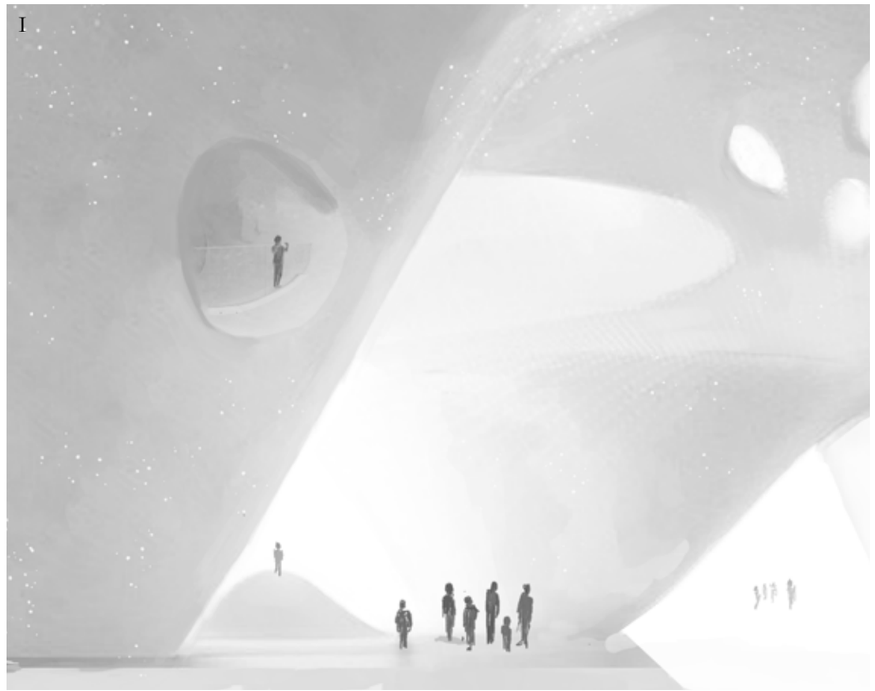


Section of entry and air lock scale 1:200



The community center in scale 1:100

I



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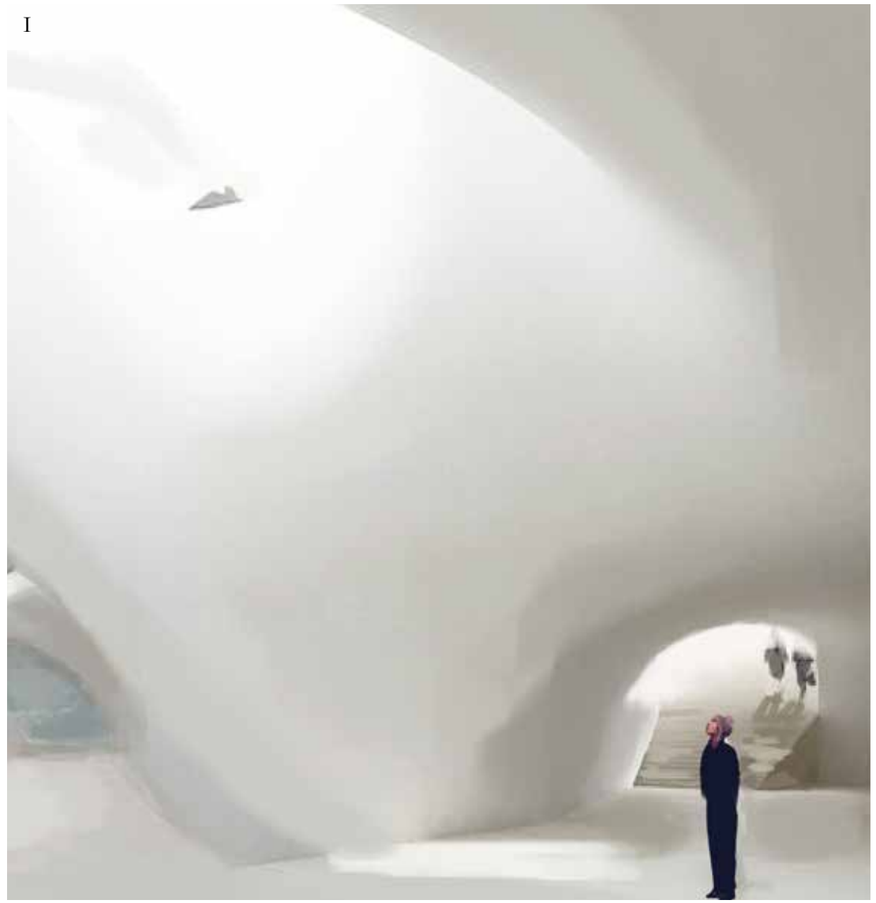
I



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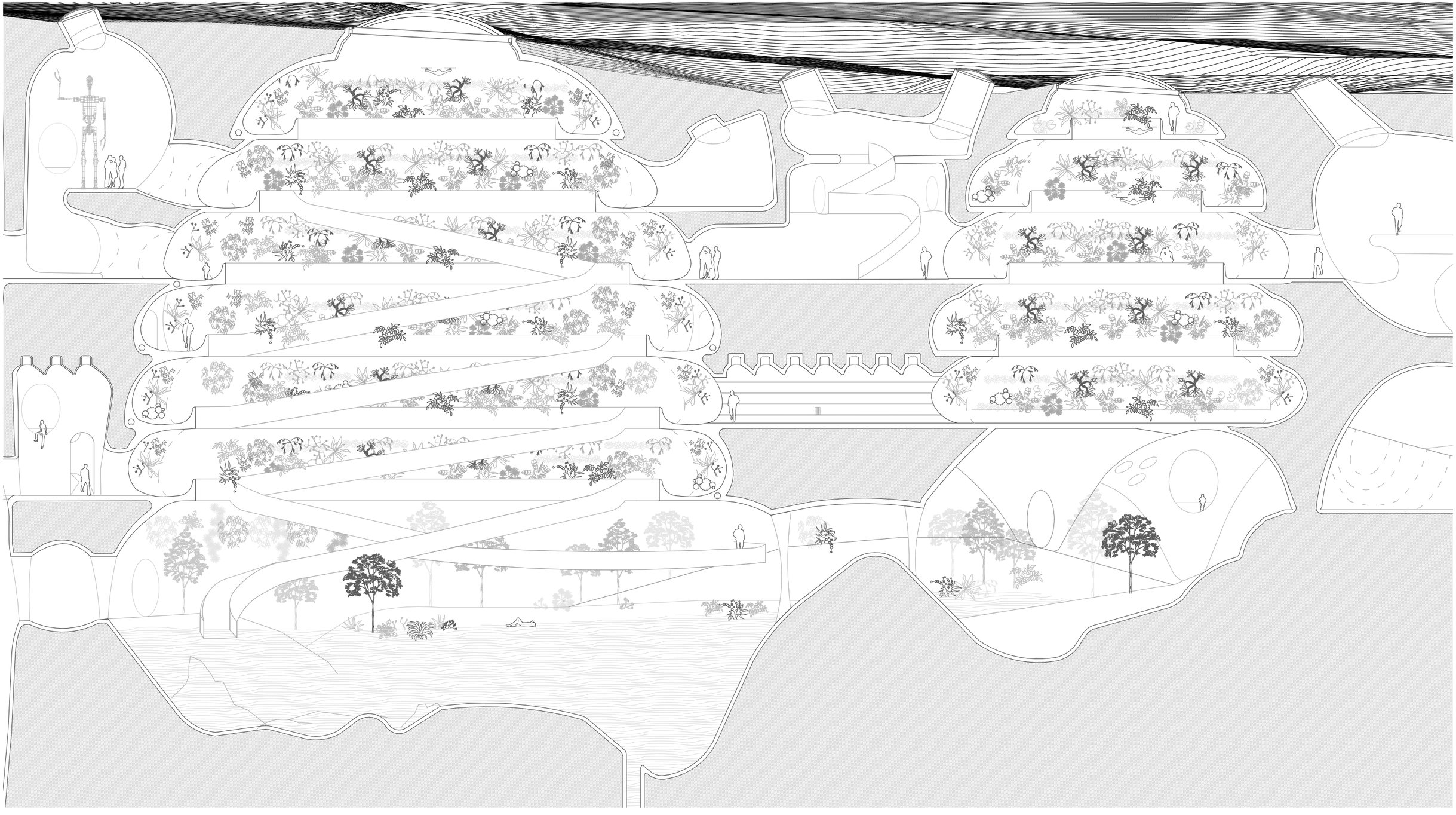
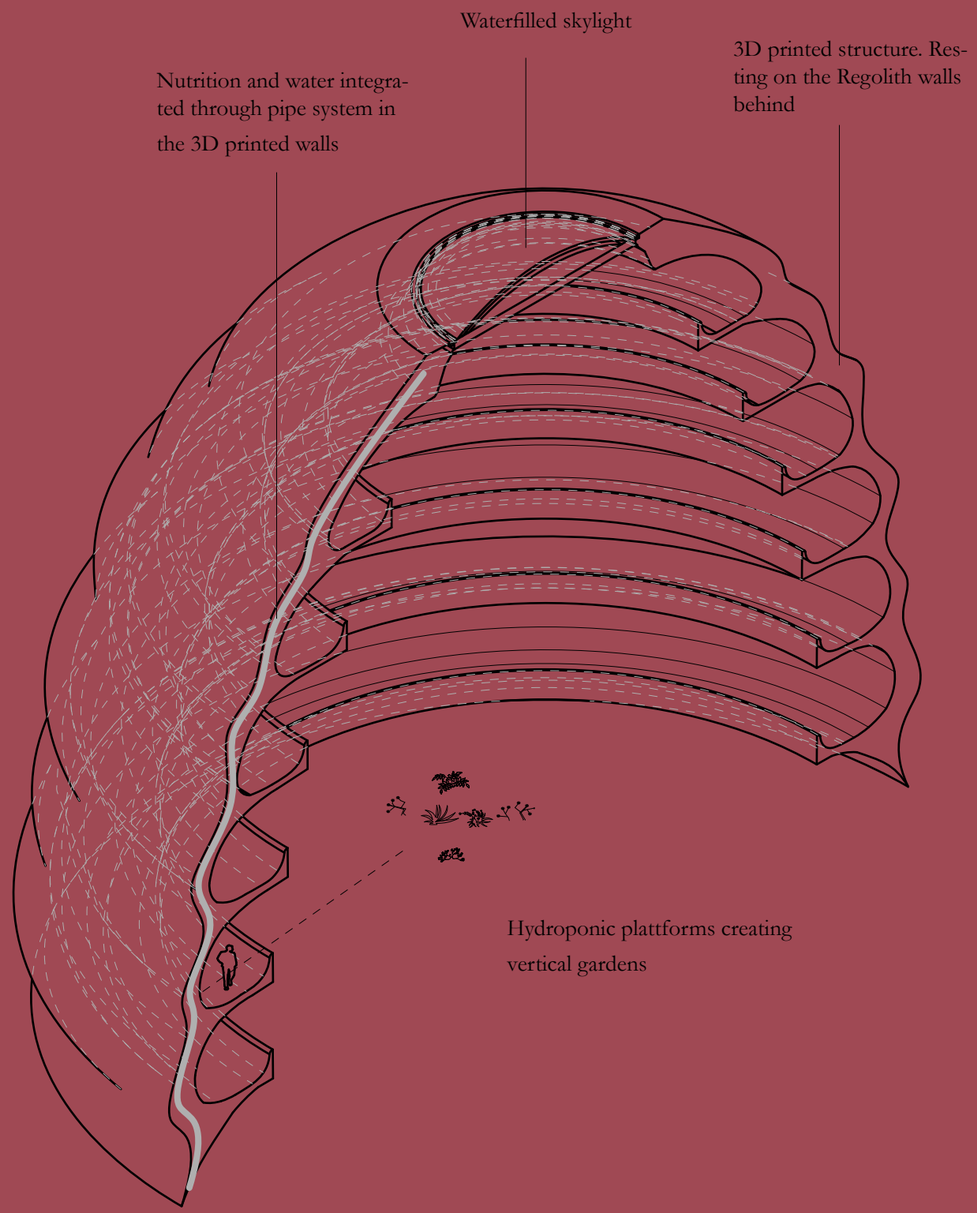


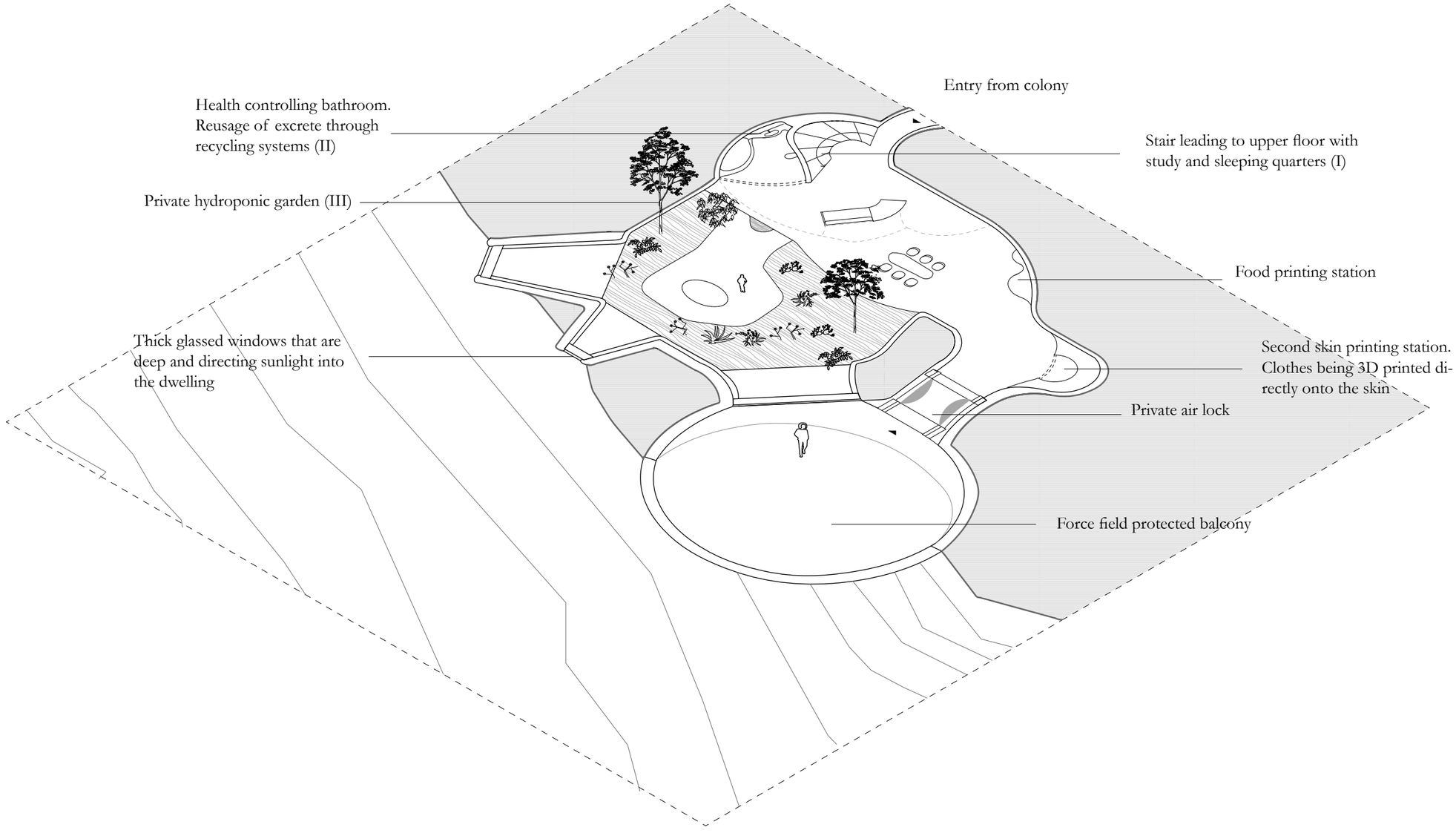
The hydroponic gardens in scale 1:200



Axonometric diagram scale 1:200

ELEMENT: HYDROPONIC GARDEN

Part of section scale 1:100. Soilless farming through hydroponics. A garden and swim area for leisure, plants providing oxygen. The heart of the colony.



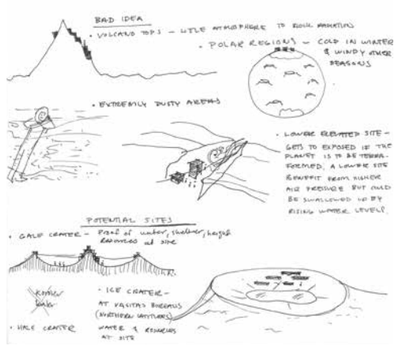
Axonometric diagram scale 1:200

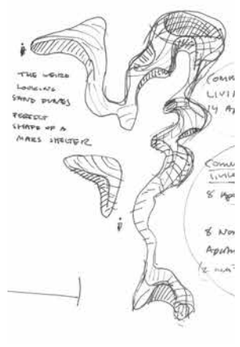
I

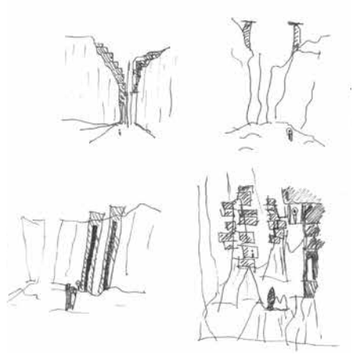
II

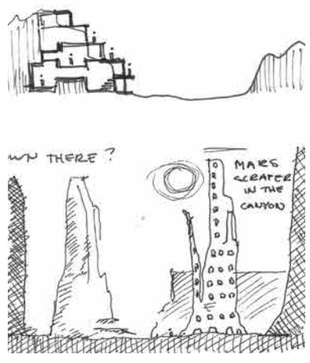
III

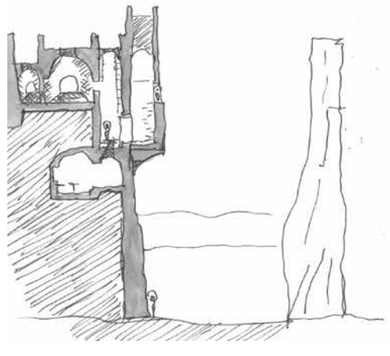
04: DESIGN INVESTIGATIONS

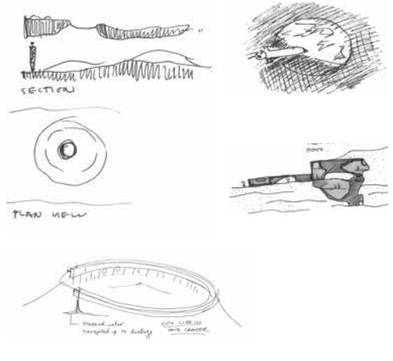




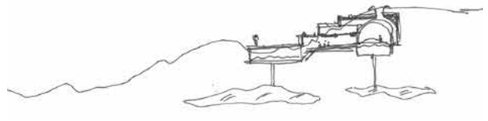


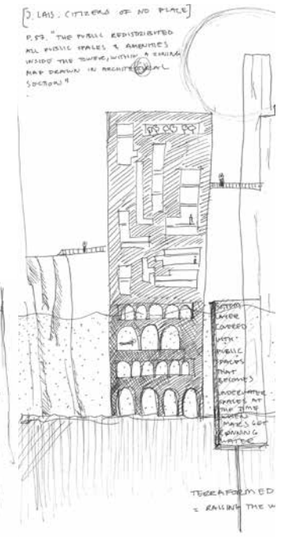


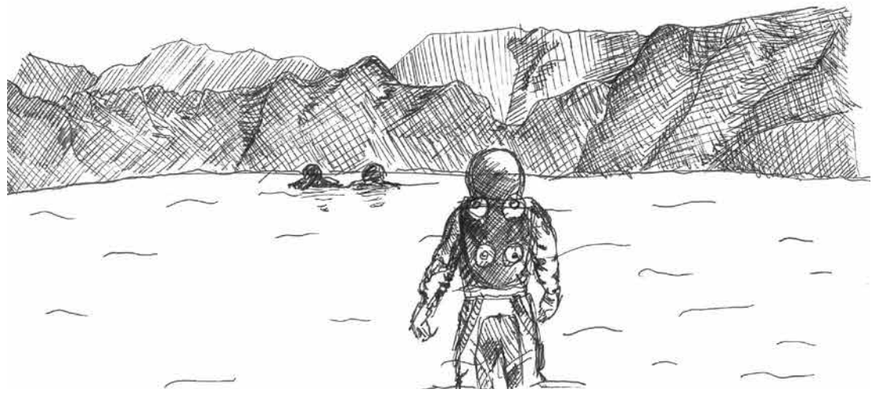


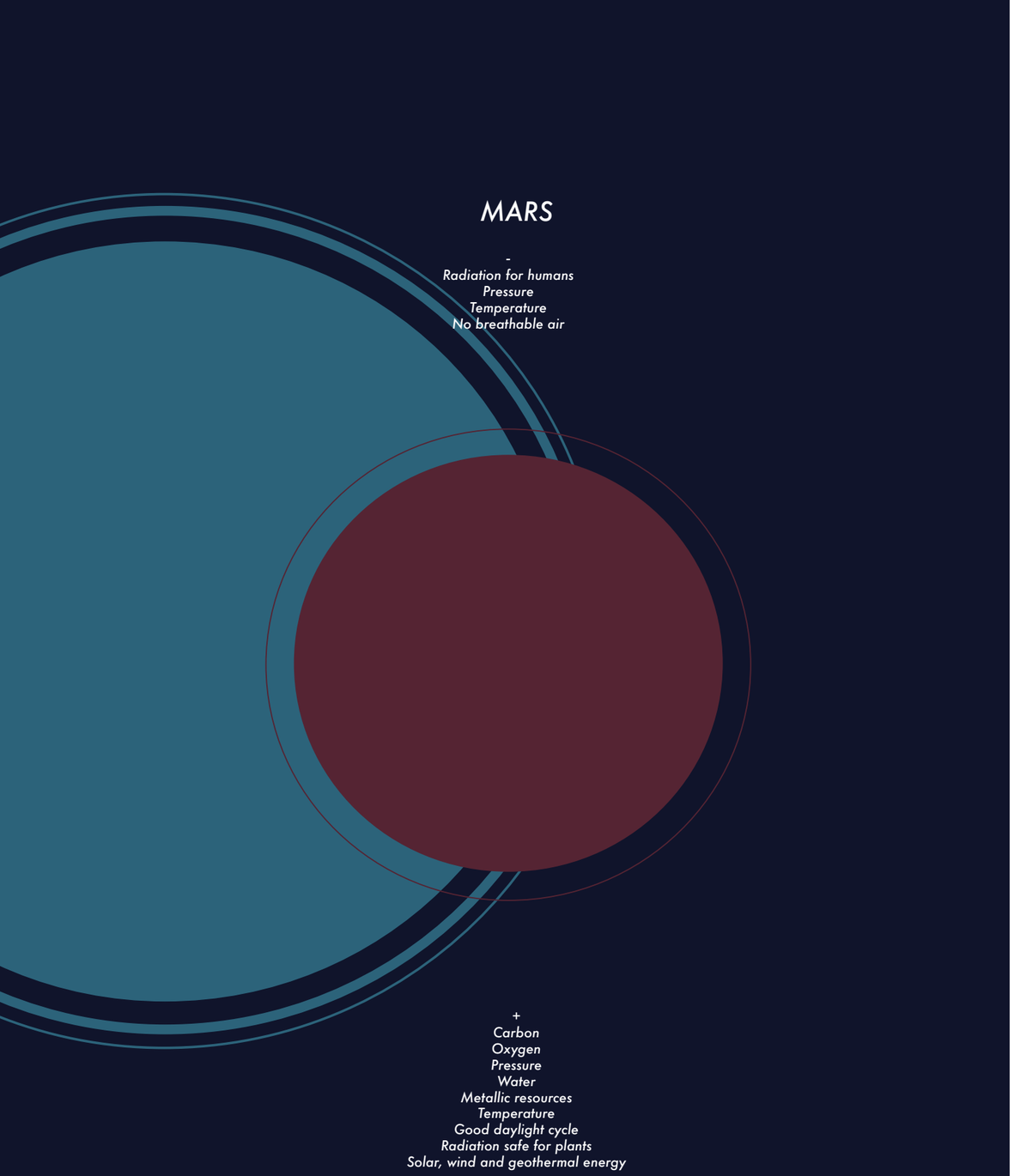


Initial concept sketches









BASIC CONDITIONS

Water

At Mars we will have to create opportunities for good living conditions. Fortunately a lot of resources can be found on the planet. Water can be extracted from the soil : the Martian Regolith. Water can also be extracted from the humidity in the atmosphere, from ice lakes and glaciers at the poles. (Levin, 2015).

Oxygen

Oxygen is possible to extract from the carbon dioxide rich atmosphere with help of a oxygenerator, MOXIE invented by Michel Hecht. Since a Martian day is almost as long as an earth day our plants can be grown at Mars. Food can therefore be brought dry from earth as a start and can be farmed at Mars through hydroponics systems as a long term solution. Special clothing developed by Dava Neuman at MIT can be used to create an atmospheric pressure on the human body and lock out radiation (Levin, 2015).

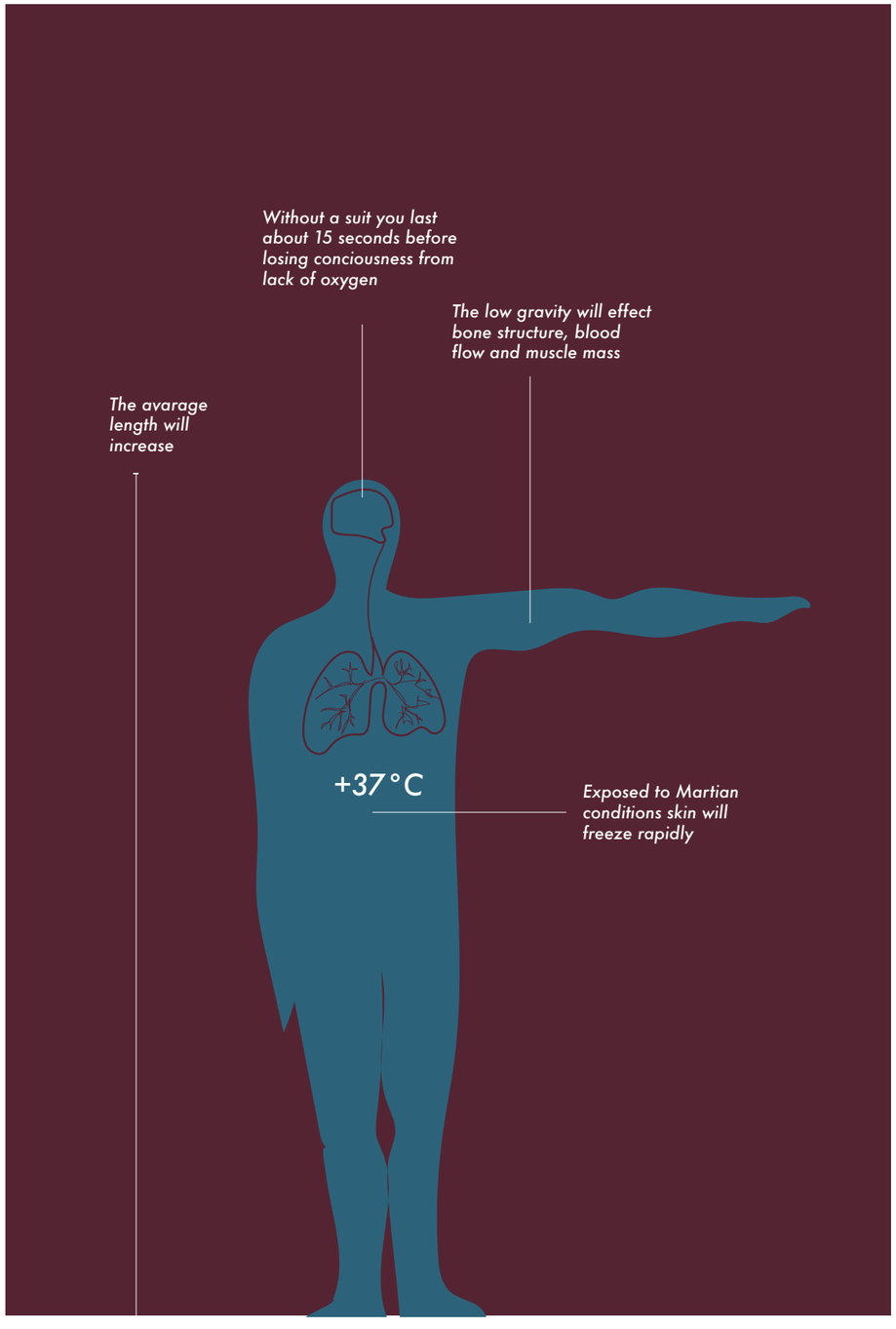
Minerals

The planet has a lot of carbon, minerals and metallic resources that can be mined. Regolith is a good material to cerate shelters as protection against radiation for the inhabitants of the colony.

Energy

Energy is important to collect in order to sustain a good temperature in dwellings, greenhouses and to be able to run the life supporting systems. Mars is further away from the sun than earth but solar energy is possible to use in large scale, geothermal energy or nuclear power.

Terraforming: "Planetary engineering"
1. Build a large solar ref lector in space
2. Seed the surface with photosynthesis plants
3. Form a ozone layer when we have an atmosphere
4. Stabilize liquid water (Robinson, 1995)



THE HUMAN BODY AT MARS

Atmosphere & Radiation

The atmosphere is not breathable and the temperature has extreme colds. The air pressure at Mars is very low 0,6, almost the same as being in deep space. Big health issues deal with air pressure and radiation (NASA, 2019). In comparison to earth Mars has no magnetic field. This means that the solar radiation hits the surface of the planet, possible causing health issues such as cancer (ESA, 2019).

Gravity

Being in an environment with low gravity (g) make your body become taller. Studies of astronauts living in 0 g have showed that general standing height increase by 3%, seating height increase by approximately 6%. This is the result of spinal elongation and straightening of the spinal curvature. In 0 g muscles are called on to supply stabilizing forces that the gravity normal supplies. Body Circumference Changes because fluid shifts toward the head. Furthermore the total mass of the body may decrease up to 8%. (NASA, 2014).

Time Zone

The time zone at Mars is very similar to what we have on earth. A Martian days lasts for 24:39:40 hours. The 39:40 minute difference with an earth day is mentioned as the timeslip in SF, during which the Martian clock stops at 12:00 am to be in line with time at Earth (Robinson, 2009).

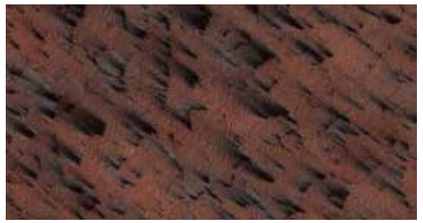
Reflections

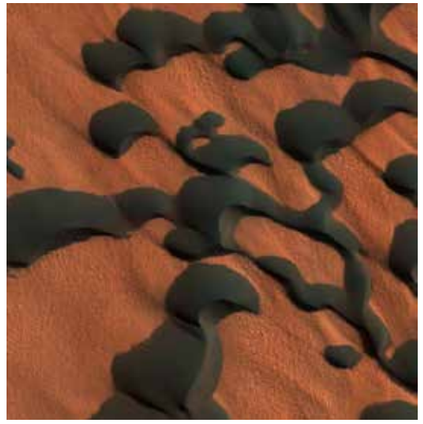
Since body measures changes in 0 g it seems highly possible that they will change in 0.38 g. For that reason a new standard of hypothetical measures should be applied in the sectional plane of the colony. Looking into using taller room heights, stairs and seatings. A new body standard creates new spatial needs and being aware of gravity effects while designing is an essential factor creating built structures at Mars.

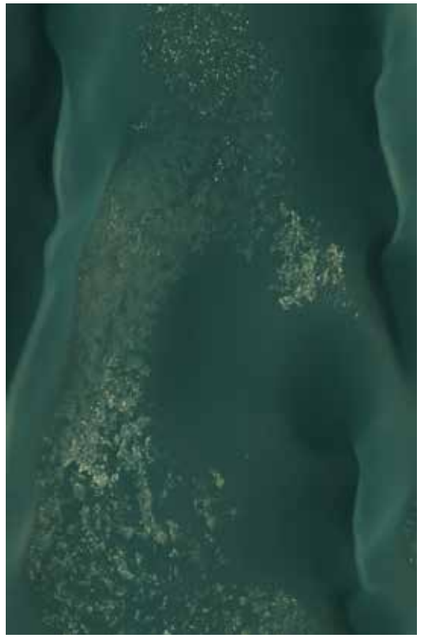
Because gravity is connected to a planets mass. And even though terraforming is a possible way of getting a thicker atmosphere to protect against radiation. The mass of Mars will be constant and therefore gravity will always be a factor to deal with, in the future as well. Possibly astronauts going to Mars will have elongated spines. But something to consider is also the first born martians. Since they wont grow up on earth and have a 1 g pressure on their body, there is a possibility that they will become even taller than their parents moving to Mars (Robinson, 1995).

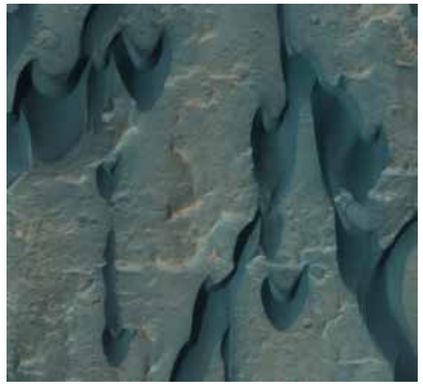
THE MARTIAN LANDSCAPE

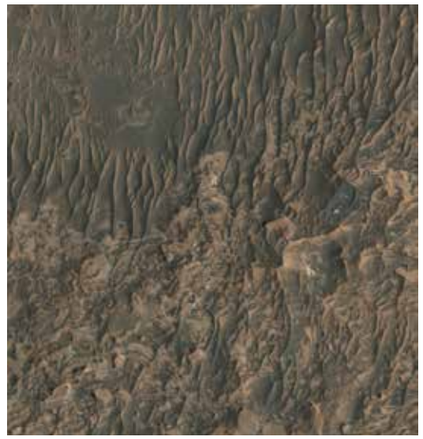
A study of satellite pictures. Getting to know the planet.











HYDROPONICS

In the extreme environment of Mars greenery has an important role. Plants and cultivation provides oxygen but are also needed for food production. Moreover it's a very important aspect for our wellbeing. Studies carried out in the field of healthcare architecture have shown that plants and greenery help improve human wellbeing and recovery (Ulrich, 2012).

Hydroponics is an efficient low tech system that needs a small amount of water and care and is able to produce a lot of vegetables. You get a fresh produce in a closed loop system of water and nutrition. It can be done indoors and since vegetables only need 10% of the normal light spectra they can grow without daylight, using only red and blue wavelength light (Urban Oasis, 2019).

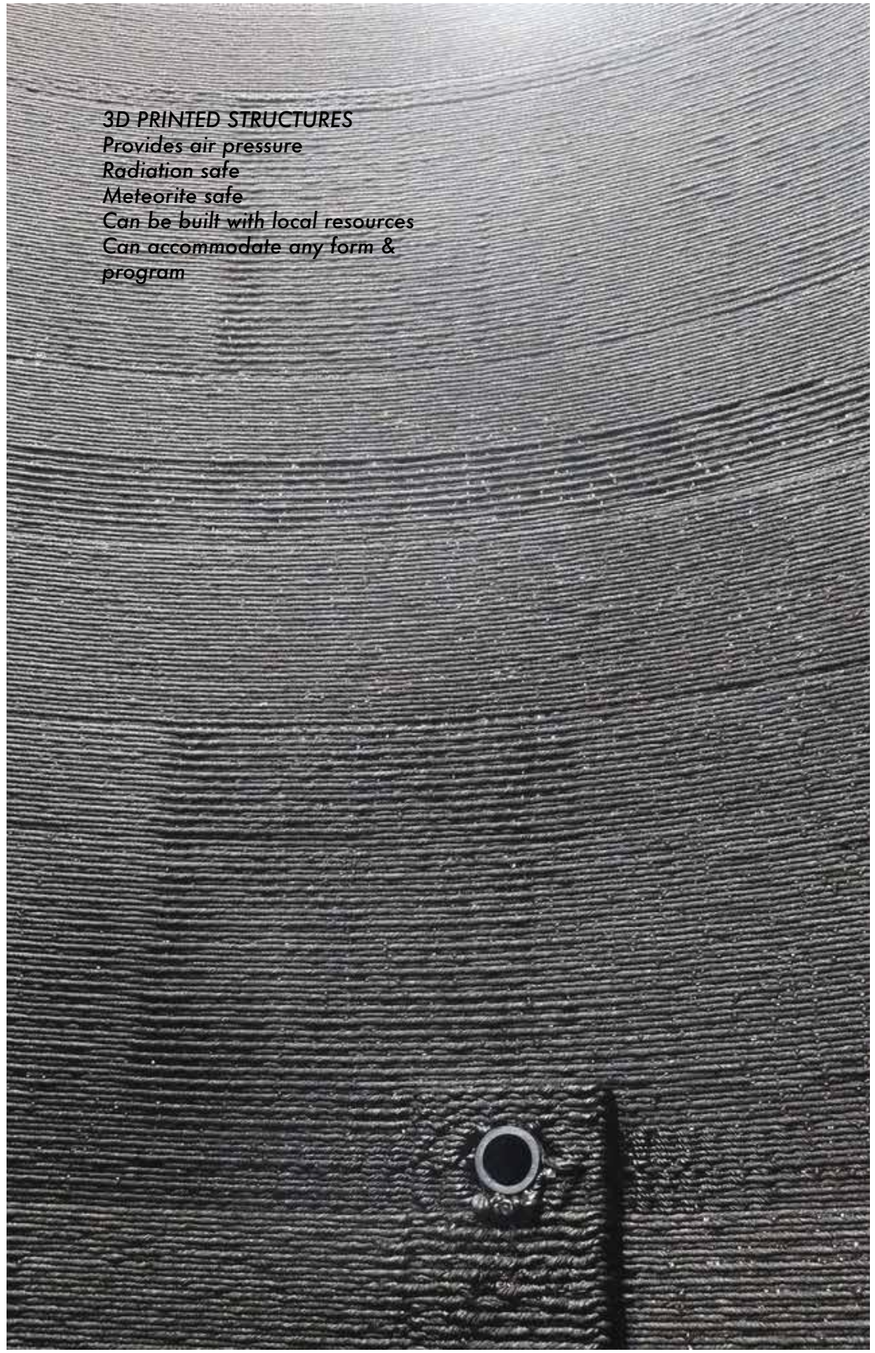
Another aspect than efficiency is a social aspect, hydroponics have also been used to promote social interaction. One example is Pasona Headquarters in Tokyo, made by KONO DESIGN (2010). It's a 9 floor office building with green space of over 4000 m2 with 200 species. The office workers share common spaces filled with crops. One example is that passion fruit and lemon trees are used in meeting spaces, tomato vines are hanging above conference tables, salad is grown inside seminar rooms and bean sprouts are being grown under benches. This to promote mental health, social interaction and to engage the community (Kono Design, 2019).

Reflections

The importance of closeness to water and greenery are important aspects that are connected to the image of a great city (Kostov, 2009). Furthermore a green space is a good place and a good activity that connects people and promote interaction between them.

The purpose of creating a society at Mars is to create extra terrestrial human habitation. To do that we will need greenery for wellbeing as a deep rooted part of being human but also because we need to create a system capable of sustaining human life.

As a conclusion, gardens will be an important aspect of the colony. They should exist in plural and be a part of all inhabitants life, not just as a automated production space. But a space to spend time in, a sanctuary. A combination of leisure, farming and research. The gardens should be in close contact with both living spaces and dwellings. This would maximize the opportunity for each individual to use the green spaces.



Picture form MARSHA, 3D printing experiments

MATERIAL

It will be important to use materials on site since bringing materials to Mars is extremely expensive (Nyström, Reuterswärd, 2013). A good alternative is using regolith.

Researchers at Northwestern University proposes the use of sulfur concrete. Most Earth concrete, requires water mixed with cement and gravel. Sulfur, is widely available on Mars and can take the place of water and bind the concrete together

Experiments

In the experiments the regolith was heated up with sulfur in different ratios, then the concrete was stress-tested, both physically and through computational analysis. Sulfur concrete made with Martian regolith came out twice as strong.

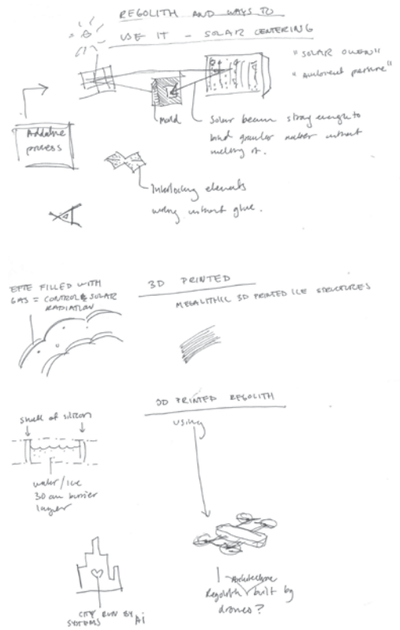
Recast?

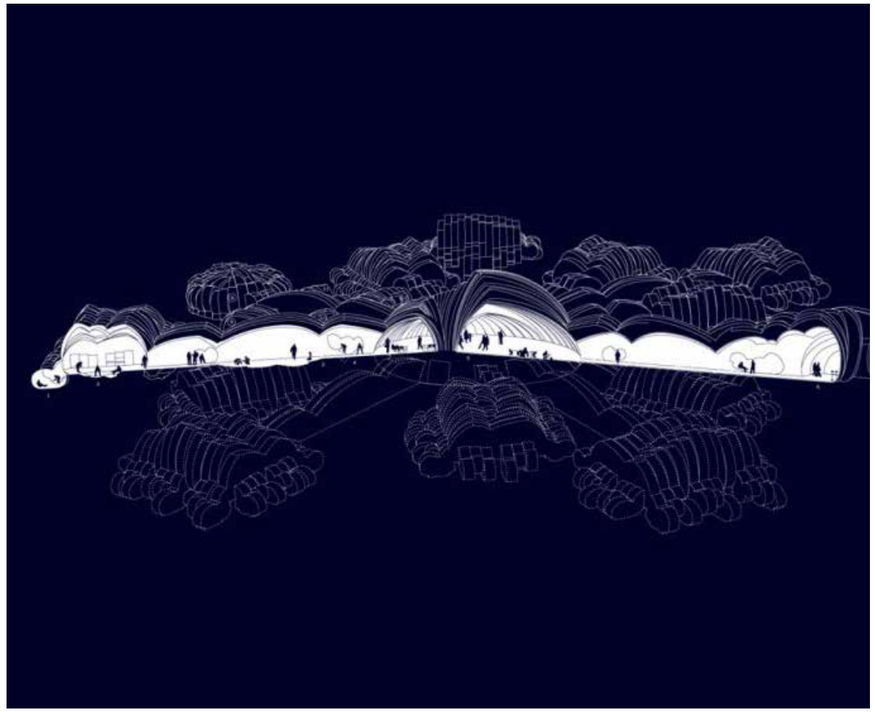
The material has the strength needed to construct a shelter. But it also solidifies in an hour or less. All you need is Martian regolith, and maybe a solar panel as an energy source to melt the sulfur with.

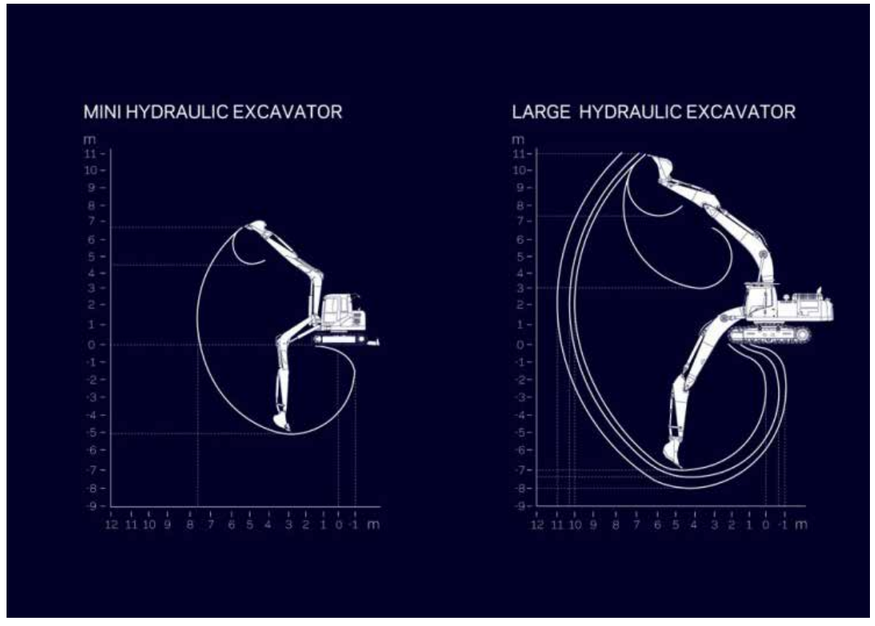
The material can also be melted down and recast. But it also means that it is not very resistant to high Temperatures. If a sulfur concrete building would catch fire, it could melt the material (SEGIM, 2015).

Reflections

We will need to bring materials with us, which will be expensive and generally unreliable (what if you need a spare part?), A 3D printed house would be promising to use instead of using up the Martian water deposits (ice habitats) to make a safe, radiation proof habitats.







ICEBERG LIVING STATION: EXTRACTION

Creators: MAP Architects
Year: 2015

The Iceberg Living Station is a structure created to host 100 people visiting the arctic climate.

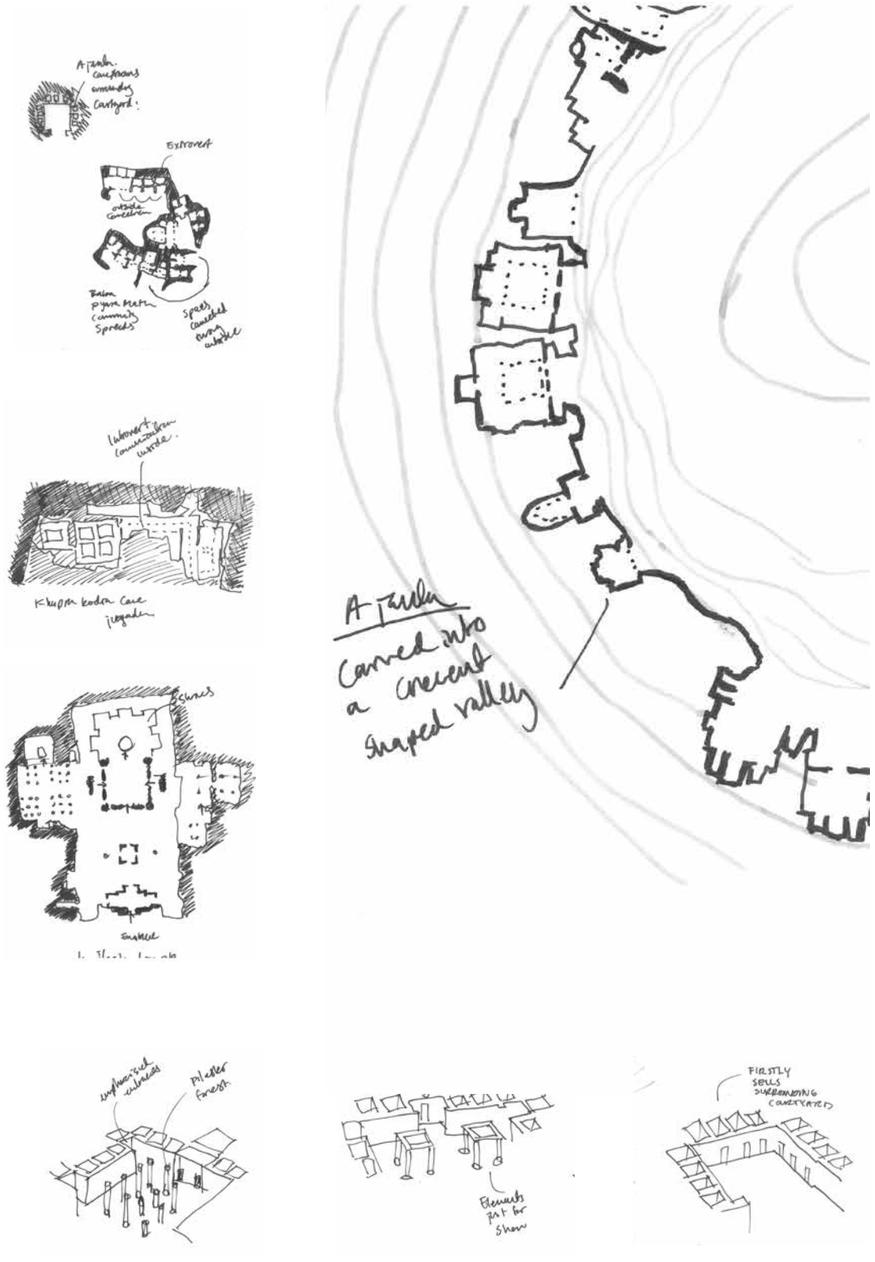
The station hosts 100 visitors and is meant to make a minimum environmental impact. The architects concept was to not use a traditional approach with transported materials from other countries. Instead they looked to the materials on site and the architecture is carved out of a large iceberg (about 2.5 km2 area). This iceberg would eventually melt in about 10 years time.

Icebergs are made of compacted snow. The snow becomes ice at a depth of 25 m. As igloos have demonstrated trough out the centuries, snow is a efficient insulation material.

The fabrications of the project is done by caterpillar excavators. Something that is traditionally used in Antarctica to move and clear snow. The logic of the movement of the machines have been studied by MAP and is used to design the spaces of the Living Station and to create the curves of the interiors (MAP, 2019).

Reflections

It's interesting how Map use an extraction process instead of the normal adding process. Something similar could be done at Mars. Excavating the Ice/regolith ground. But at Mars it would be good to have the process started before humans arrive. To already have a shelter on site ready. Developing this approach, one idea would be to use a bigger group of drones excavating the habitat. This would be more flexible and also increase the possibility of how to excavate the ground.



Sketches investigating references

CAVE ARCHITECTURE

The cave is the earliest form of a dwelling space in most parts of the world (Jain, 2002). It has a strong place in the human habitation history.

The simplicity of the early caves developed more for associational and aesthetic reasons. A lot of elements where used just to reassemble the known structures that were not caves, event though not needed such as pilasters not carrying any weight. Neither structural nor functional. Just for the look of it.

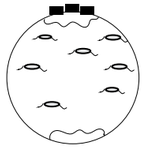
The highest craftsmanship and design was used to make the raw space into architectural elements. The relationship between space and people were represented in the cave dwellings and temples.

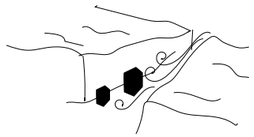
Cave architecture is interesting since it is one of the earliest forms of space making.

The space associated with cave architecture often brings forward an image of a basic one room space with the bare minimum. But that is not fully true, looking at examples. Even from the 8th century.

Sketch research of:
Cave 19, Ajanta, 2th century BC
Baba Pyara Math, Junagadh 2th century BC
Cappadocia, 4th century BC
Kaliash Temple, Ellora, 8th century
Elephanta 8th centruy

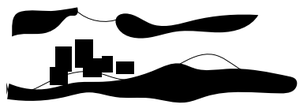
"The notion of selecting the cave as a shelter is linked to the idea of isolation, inward exploration, meditation and renunciation of the wordly possessions. "
-Jain (2002)
Thematic space

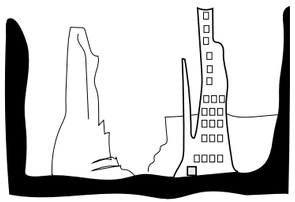




- To be exposed is not a good idea at Mars

+ Craters create shelter and usually have a lot of resources on site.





+ Other formations that create natural shelter at Mars are the lava tubes and sandstone formations that could be dug out.

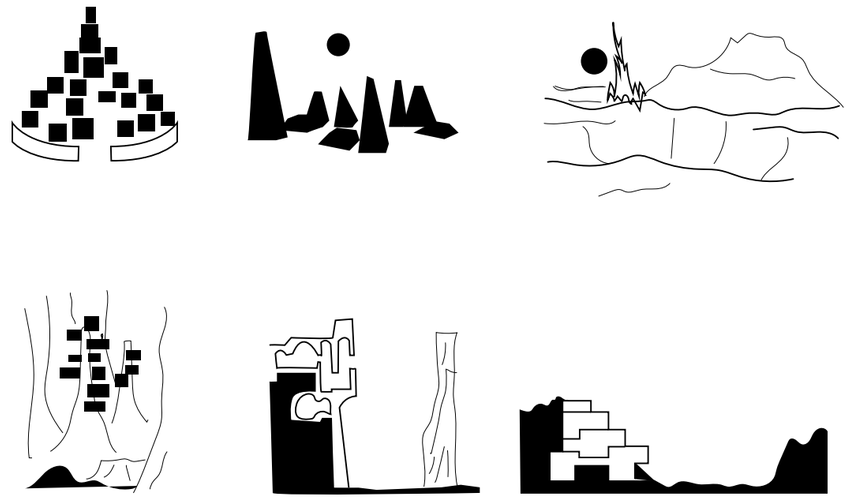
FINDING A MARTIAN SITE

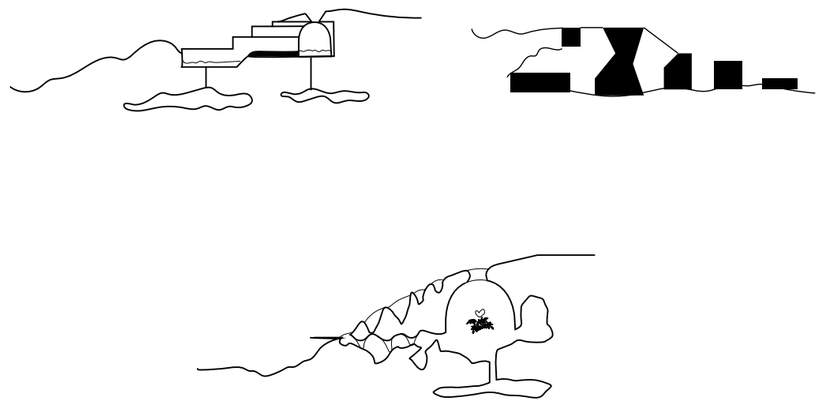
Negative

- Volcano tops (little atmosphere to block radiation)
- Polar regions (cold in winter and windy other seasons, little/low light. The intensity of sunlight at Mars is less tense, so lighting will be extremely important.)
- Martian Lava tubes. Natural protection from conditions on the surface. But getting into one and ensuring it's safe can be difficult. Not all are giant caves we can drive down into, and having tons of rock overhead could be challenging (Matthew, 2019).

Positive

+ A lower elevated site benefits from higher air pressure (NASA Gravity map, 2016)
+ Lower elevations are more accessible by landing craft, since you can use more of the atmosphere to slow down.
+ Craters. Particularly those that provide some radiation shielding with their rims, are appealing. The trickiest part is getting in and out of there if they are small or steep. We're often loath to send rovers or astronauts down into craters due to the risk that we couldn't get out. For the larger craters, not as much of a concern (Matthew, 2019).
+ Ice would be a great shelter from a radiation perspective. But ice goes through transitions due to the environment on Mars. It can sublimate away or melt





The lower gravity at Mars creates bigger possibilities construction wise. Buildings could potentially become super tall. Living at the equator could be many different things using the landscape as construction material. The colony would have to be a connected system. Intelligent and ecological.

ARCHITECTURAL TYPOLOGY

Looking at vernacular examples in a warm climate such as Cave dwellings, Troglodyte houses of Tunisia, The Mesa Verde and in cold climates: the igloo typology one can spot some patterns.

It is clear that uniform, accessible and on site materials have been used to keep extreme warms/colds out and also there is a use of round typologies in different shapes.

Traditional construction methods did not rely on industrial processes and fabrication. In the beginning at Mars, we will be in a similar situation. There will be no industries to supply building material, likely early settlers from earth can bring tools and a few valuable materials.

Using the Mars local material Regolith through the methods of using stacking through 3D printing and digging/carving/ tunnel boring is an answer o achiving an architecture of spatial comfort that is radiation safe and thermal insulated. Another aspects is pressurization, something that was not investigated in detail (see delimitations).

3d printed structures

+

Can provide air pressure
Somewhat radiation safe
Somewhat meteorite safe
Can be built from local resources
Can accommodate any form and program

-

No daylight
No views
Time consuming to build
Needs secondary membrane layer for air tightness

Carved out structures

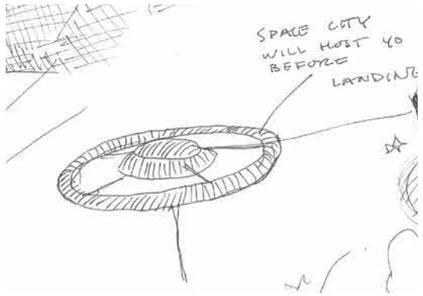
+

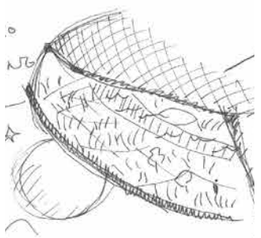
Can provide air pressure total radiation safety
Total meteorite safety flexible in shape and program built of local materials great durability

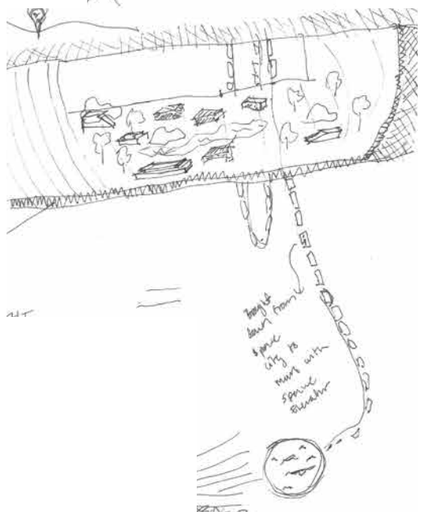
-

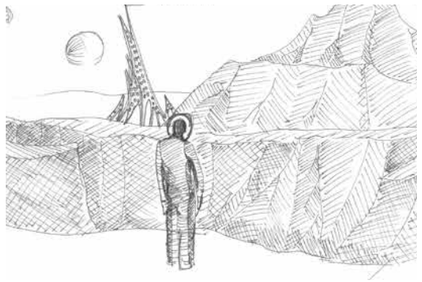
Are only somewhat radiation safe, are only somewhat meteorite safe and complicated to achieve airtightness

Sketch building up the context through a narrative









I.

Arriving to the space city. Spending time there in the transition to take the space elevator down to Mars.

II.

Gravity and the plentiful of materials makes the boundaries of architecture grow, grow tall and sleek.

A FUTURE SCENARIO

The idea was to tell a story of how it will be to live in the future scenario of the space colony.

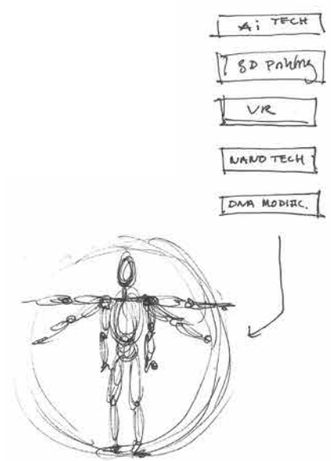
Firstly: building up the feeling of the narrative from the moment you are standing in the space shuttle and later arriving at the planet with the space elevator, taking the public transport of the self driving fast train to entering the colony.

Secondly: showing typical living situations like being in public spaces, private home area, working and exploring the planet.

Next two pages that follow have some sketches from the process that formed the narrative. They worked as a great source of inspiration together with the use of computer sketching in vectors and 3D.

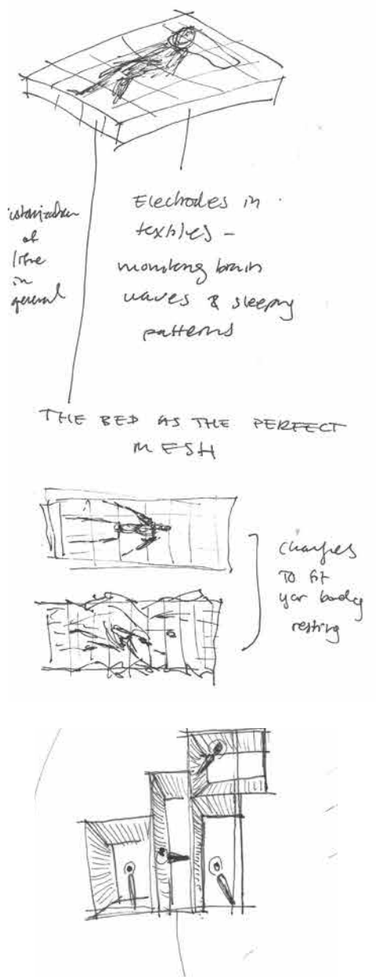
Reflections - important future features:

AI technology
VR technology
3D printing
Nano technology
DNA modifications



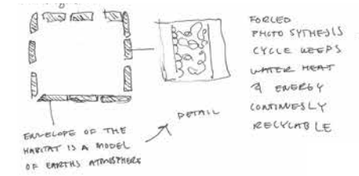
III.

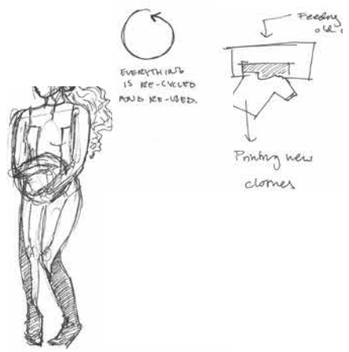
In the future scenario we are using technologies to improve ourselves and our surroundings. Ai is something that we connect to. DNA modification could make it possible for us to adapt better to the planet.

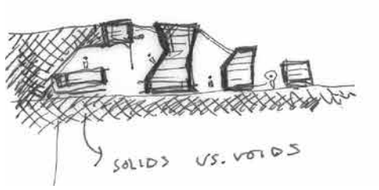


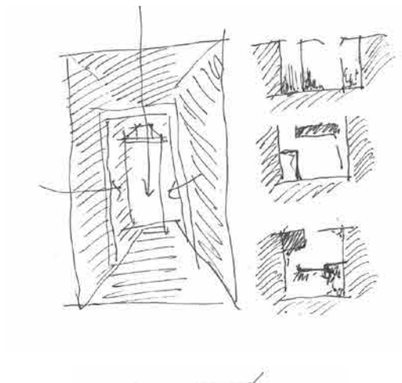
VI.

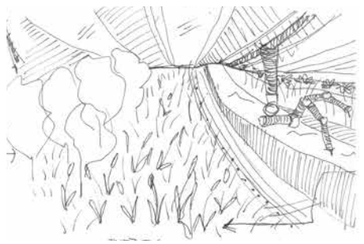
With the low gravity environment the habitat environment could be more changeable according to needs. And the sectional plane more developed. 1/3 stairs would be needed etc.









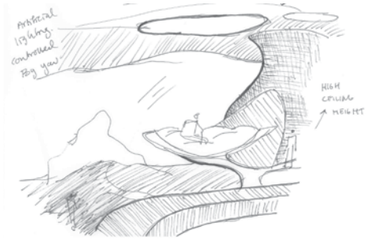


V.

Robotic helpers are a part of work and life. Some food are grown but not a lot since most energy is produces by the smart suits and printing. The space suit becomes a second skin. It controls body temperature, creates pressure, recycle fluids & produce energy through photosynthesis. Electronic membranes attached can track exercise and vital signs/UV exposure.

VI.

Light shapes the spaces of the colony. Even though the colonies of Valles Marineris are partly protected under ground they are not disconnected from the Martian landscape.



VII.

The home is a smart home that helps your everyday through AI technology looking into what you need to eat and how your health is. Integrated in your unit is a smaller aquaponic unit.

VIII.

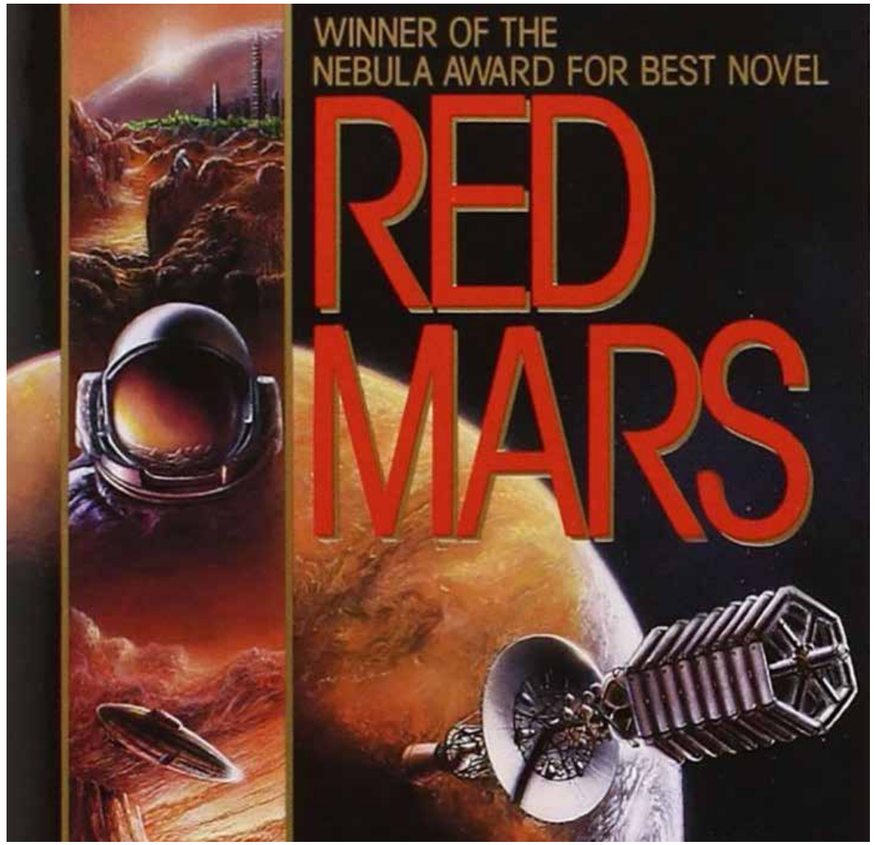
Taking the 2D sketches and experimenting in 3D. Using renderings as a way of getting a feel for textures and light.

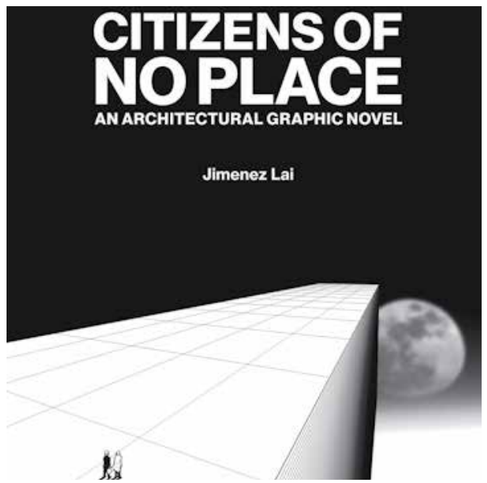
Reflections

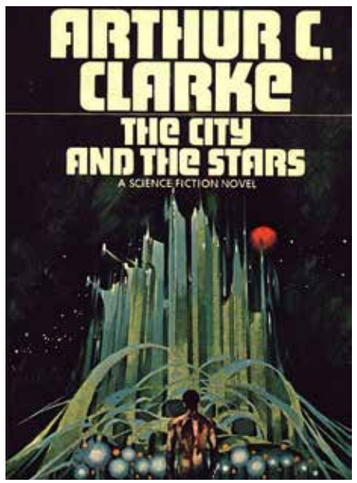
Framing the scenario have been important to create a context to the project and getting into the futuristic conceptual thinking. Sketching in 2D is a quick way of getting down ideas but getting into the 3D modeling gives more dimensions to the design work.

From the 3D models I got a main idea of the atmospheres to develope. Working with bright colors and sand tones from the regolith. But I still appriciated the style of the architecture created in the 2D sketches more than what became the first 3D model drafts. A fusion helped creating the final result of the colony.

05: REFERENCES







SCIENCE FICTION: LITERATURE

Red Mars, Kim Stanley Robinson (1992)
Red Mars is the beginning of a trilogy that follows up with Green Mars and Blue Mars. The books follows the process of terraforming Mars. The development on the planet is seen from the eyes of different characters throughout the books. The story is more utopian than dystopian and focuses on sociological and scientific advances made on Mars, at the same time as Earth suffers from overpopulation and climate change.

Citizens of no place, Jimenez Lai (2012)
A graphical novel dealing with contemporary architectural ideas and society. In New York a mega skyscraper is built on top of central park reaching for space. All public space is integrated vertically. At the space ark the architects are thinking about what the perfect adjusted dwelling is for each person.

The City and the Stars, Arthur C. Clarke (1956)
The City and the Stars takes place one billion years in a futuristic city. By this time, the Earth is so old that the oceans have gone and humanity has all but left. As far as the people know, there is the only one city left on the planet. This city is completely enclosed and is run by the Central Computer. The city is repaired by machines and the people are created by the machines. The computer creates bodies for the people to live in and stores their minds in its memory at the end of their lives.

Hyperion, Dan Simmons
Different life-tales that conceptualizes the future life of humans. Tales from different people on space ship heading to Hyperion. Interesting reflections on humanity and society.

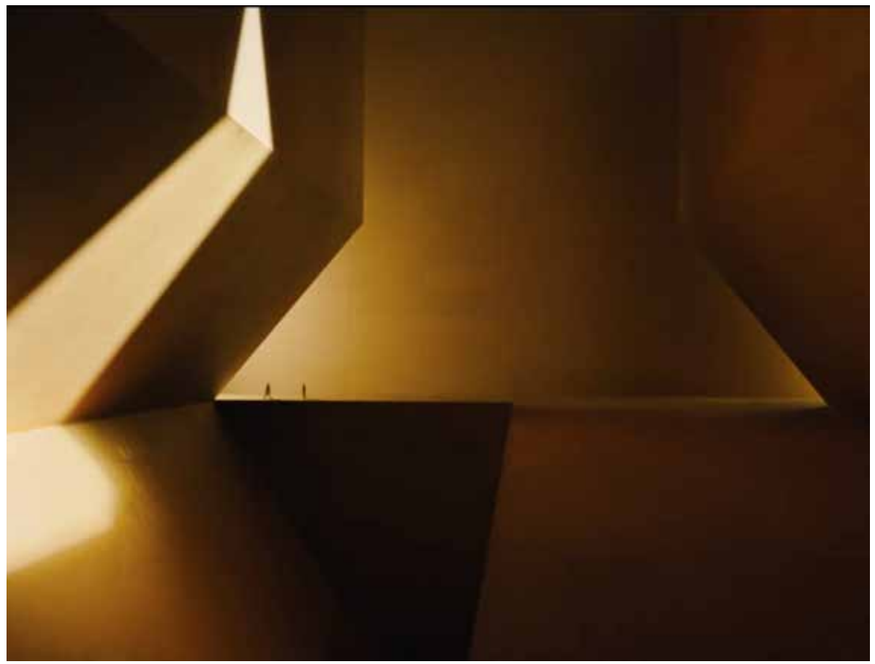
Reflections

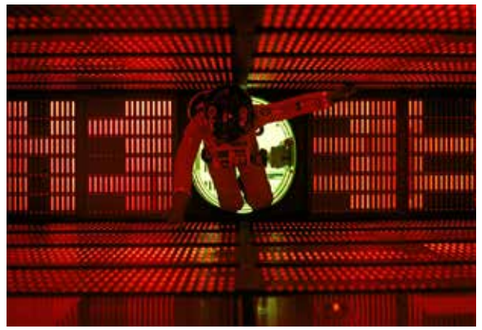
The future visions of the authors are very interesting in the way they go beyond the technical. Focus is instead on social issues such as what does it mean to be a human and how do we manage in an extra terrestrial environment? But also politically with ideas of the future utopia/dystopia with ideas like Clarke (1956) has about the Artificial Intelligence ruled city or like Robinsons trilogy that explores the political development of the Mars colonies and life. What is our identities as humans? In Green Mars the generation born at Mars don't care about the big debate about making Mars like earth, because all they have ever known is Mars in the state it is.

Mars has always had a role in our culture since we started to watch the skies. During time when space exploration have been less in focus, the literature is what have kept the interest for space exploration and Mars alive.

But to conclude I think SF is a big source of inspiration and a very important piece in the process of developing speculative architecture at Mars. It have continued being a part of the process from start to end.

Other books of interest:
Burroughs, John Carter series
Bradbury, The Martian Chronicles
Clarke, The Sands of Mars
Dick, Martinan Time Slip
Bear, Moving Mars
Aldiss + Penrose, White Mars
We Can Remember It for You Wholesale (Total Recall) - the dream of the Mars colony





SCIENCE FICTION: MOVIES

2001: a space odyssey (1968)

The Martian (2015)

Meteroplis (2002)

Blade runner (1982) + blade runner 2049 (2017)

Star wars (1977 -2019)

The Expanse (2015)

Mars (2016)

Total Recall (1990)

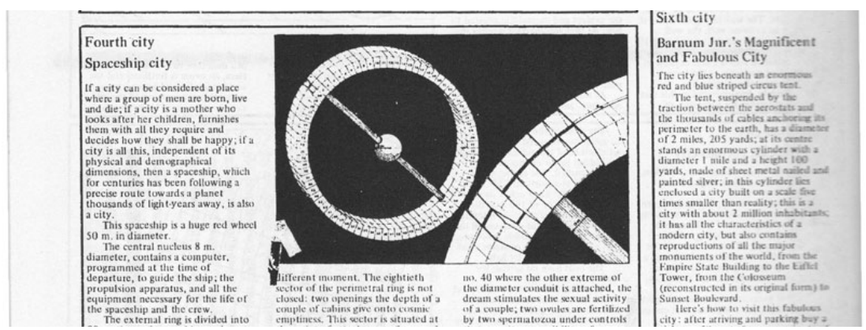
Reflections

Architecturally the movies of Blade Runner and Star Wars appeal to me the most.

Blade runner with it's dramatic light conditions is almost spiritual. The spaces have an evolved dynamics and shows an architecture manipulating sunlight and reflections. But from the outside Architecture is functionalist, showing off infrastructure and the high tech is being exposed. Inside the mega structure of the big corporation that rules the city, the brutalistic architecture instead becomes elegant and minimalistic. A spiritual sanctuary untouched by the chaos outside. The architecture in the movie seem to be inspired by office Barozzi Veiga, but could perhaps also be connected to Tadao Ando, John Pawson and Peter Zumthor.

Star Wars because of the feeling of sincerity. Not everything is polished and perfect in the galaxy far, far away. Most things are a bit dirty and sometimes rusty, depending on the climate and the planet the architecture looks different. The setting is made up differently depending on looking at the "dark side or at the rebels. Environments setting the mode for the feeling of the scene.

"We had an environment fighting the elements and the architecture reflects that; it has to become stronger."
- Production Designer Gassner. D. in MARK (Blade Runner 2049)



Fourth city

Spaceship city

If a city can be considered a place where a group of men are born, live and die; if a city is a mother who looks after her children, furnishes them with all they require and decides how they shall be happy; if a city is all this, independent of its physical and demographical dimensions, then a spaceship, which for centuries has been following a precise route towards a planet thousands of light-years away, is also a city.

This spaceship is a huge red wheel 50 m. in diameter.

The central nucleus 8 m. diameter, contains a computer, programmed at the time of departure, to guide the ship; the propulsion apparatus, and all the equipment necessary for the life of the spaceship and the crew.

The external ring is divided into

different moment. The eightieth sector of the perimetral ring is not closed: two openings the depth of a couple of cabins give onto cosmic emptiness. This sector is situated at

no. 40 where the other extreme of the diameter conduit is attached, the dream stimulates the sexual activity of a couple; two ovules are fertilized by two spermatozoa under controls

Sixth city

Barnum Jnr.'s Magnificent and Fabulous City

The city lies beneath an enormous red and blue striped circus tent.

The tent, suspended by the traction between the aerostats and the thousands of cables anchoring its perimeter to the earth, has a diameter of 2 miles, 205 yards; at its centre stands an enormous cylinder with a diameter 1 mile and a height 100 yards, made of sheet metal nailed and painted silver; in this cylinder lies enclosed a city built on a scale five times smaller than reality; this is a city with about 2 million inhabitants; it has all the characteristics of a modern city, but also contains reproductions of all the major monuments of the world, from the Empire State Building to the Eiffel Tower, from the Colosseum (reconstructed in its original form) to Sunset Boulevard.

Here's how to visit this fabulous city: after arriving and parking buy a

ARCHIGRAM: VISIONARY STATEMENTS

Creating a futuristic reality of hypothetical projects and mega structures, using inspiration of technology to create another reality.

Instant city was a concept of a mobile and technological event that was supposed to produce mass culture by drifting into underdeveloped towns via air balloons. Taking with them temporary structures that worked as performance spaces in the town. The whole structure had the purpose of eventually move on but still leaving behind advanced technology hookups. **Plug in city** was a mega structure of a massive framework. Dwellings could be integrated in the form of cells or standardized components.

Tuned city had rooms and infra structure that attached themselves to an existing town at a percentage that left evidence of the previous development (Wikipedia, 2018).

The walking city was an idea of an intelligent building machine. Big self sustained living pods that roamed the cities. The form came from a combination of insect and machine and was inspired by Le Corbusier's idea of a house as a machine to live in. The pods were independent, but still parasitic as they could "plug into" way stations. Occupants would be exchanged and resources replenished (Wikipedia, 2018).

The works of the Archigram creates a vision of a future with an machine age where technology is a medium of solving problems. Although, social and environmental issues are left undressed. The vision of a consumerist focus feels non modern, but the ideas in general have made a clear impact over time, and is still referred to. Sometimes the extreme is what is needed to start interest and the Archigram awakes new thought and debate.

SUPER STUDIO: SOCIAL PERSPECTIVE

Twelve cautionary tales of Christmas are tales of ideal cities where technology provide mechanisms that optimizes each city for its citizen. The tales proposes discussion about cultural, social systems and behavior as a result of the imaginary cities. One of the cities is a space city that manage everything from reproduction to death.

"The final haven of Man in possession of Truth, free from contradiction, equivocation and indecision; totally and fur ever replete with his OWN PERFECTION" (Super studio, AD #12 in 1967)

MARS ICE HOUSE: CLIMATE ADAPTABILITY

Creators: SEArch & Clouds AO, Year: 2015

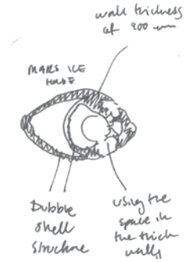
The Ice House is a 3D printed structure made to function as a smaller Habitat on Mars. The habitat is built up by a double shaped ice shell structure, contained within a transparent ETFE film. The outer ice shells have no specific programming but is mentioned as undefined space for contemplation and a buffer zone if the life support systems fail. It's biggest function is being a shelter for the radiation. A 5 cm thick shell of ice is an effective radiation protection, both against ultra-violet solar and galactic gamma rays. Ice translucent properties allows natural daylight to stream into the dwelling and connects the inhabitants to circadian cycles which is necessary for maintaining healthy biorhythm.

Reflections

A lot of Architectural Mars projects have domes covered by a layer of earth/regolith. I believe this creates quite dark and claustrophobic habitats . Which might have bad effect on the health of the Martian dwellers.

What is interesting about the Mars Ice House is that it brings something new to the typology of a Mars dwelling. The translucent shell structure that lets in light creates a much more comfortable living situation. Furthermore, the fabrication process still relies mostly on site specific materials and conditions which is great.

"Through an understanding of the physics /.../ of the Martian environment,/.../we've designed a process to turn subsurface ice into water vapor, vapor used to deposit liquid water, in an environment cold enough to print a form in solid ice."
- SEArch & Clouds AO (2015).



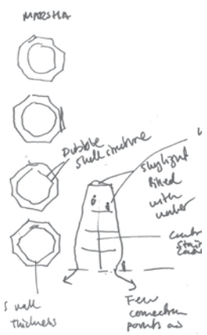
MARSHA: HUMAN CENTERED PROGRAM

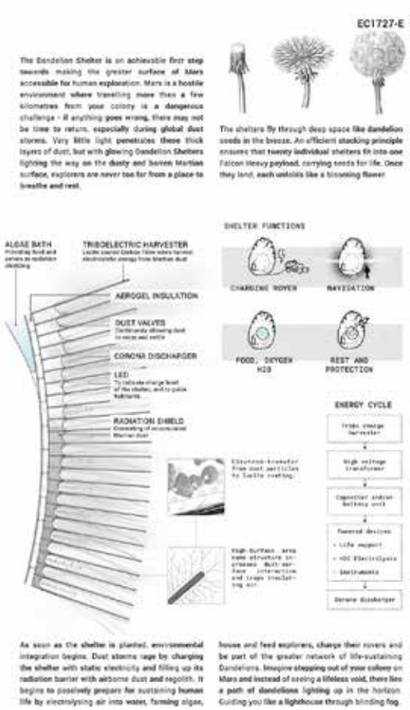
Creators: AI SpaceFactory, Year: 2015

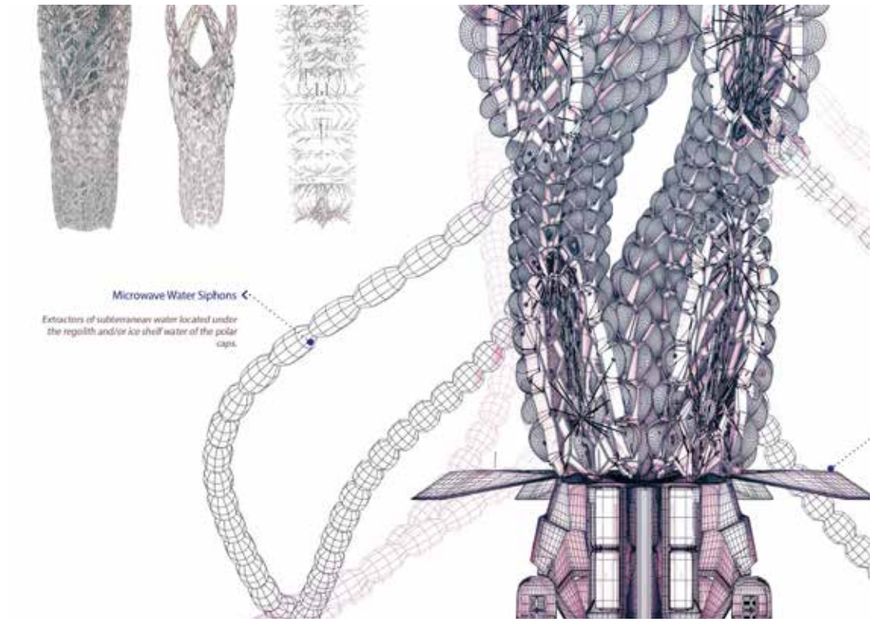
Marsha, a 3D printed structure that has a dual shell system to isolate the habitable spaces from the natural expansion and contraction caused by extreme temperature swings on Mars. Indirect natural light comes from the large water-filled skylight and intermittent windows. It still keeps the crew safe from harmful solar and cosmic radiation. Material: 3D printed Basalt fiber reinforced polylactic acid (BF-PLA).

Reflections

It's interesting how AI Space factory worked with movement in the spaces and gravity, focusing on wellbeing. A nice architectural element is how the large skylight and the offset of the core form the outer shell in the building and creates a light well connecting all levels with diffuse natural light. The departure of the design comes from previous Martian designs: typified by low-lying domes, here same strategies are made to create a new typology.







Competition posters from: *https://www.eleven-magazine.com/?competition=marstopia*

ELEVEN MARSTOPIA: SHELL AS A PRODUCER

Background of the competition

The Eleven Marsotopia competition was launched in 2015. The brief was to answer the question of: "what does Martian vernacular architecture and design look like?"

The competition take it for a known fact that it's unquestionable that we will walk on Mars soon and the important part becomes how we will inhabit the planet.

Creators: Karl-Johan Sørensen & Sebastian Aristotelis Frederiksen

The Dandelion Shelter

A 3D printed structure. It's inspired by Dandelions and it's a self building fluffy shelter. It is clad with a glowing Triboelectric Harvester which transforms electrostatic energy into power and traps Martian dust as a radiation shield. Algae Bath works as secondary radiation shield and food source for the inhabitants..

Creators: Aleksandar Bursac & Ivan Djikanovic

Mars H2.0

Is a space ship that turns into a habitat landing on Mars. Furthermore it harvest Martian water.

Reflections

It's interesting to use competitions as references since they give nice inspiration on how to pitch your ideas. Looking through the competition entries of Marstopia I find there is a wide range of ideas when it comes to the future and Mars. The competition entries range from small scale to big scale, exploratory and conceptual, utopias and dystopias.

But two entries that cough my interest was these projects where the architecture becomes its own living being. Both competitions entries have been creative in making the facade something more than an exterior protector. It becomes a producer. One facade creates electricity and the other one produces water! Architecture pushing the boundaries of what is possible.

It opens up the idea of how to protect the colony. The envelope becomes something more than a protective barrier. Using the research of artificial photosynthesis as a base (Wendell 2010, Nocera 2011), the idea of making the Colony envelope produce energy came alive.

"Private industries, public efforts, and prestigious space agencies around the world are set on the Red Planet "
- Eleven, 2015

JIMENEZ LAI: DESIGN APPROACH

Office: Bureau-spectacular
Date: 2016, Coachella,

The Bureau Spectacular *believe that economic focus in Architecture today is driving forward a character-less architecture. That it creates a mono-cultural society. Instead they want to reconsider urban architecture inside, outside, between, and beyond the monotonous rectangular buildings seen in most city skylines.*

In the installation ***Tower of Twelve Stories*** the form of the architecture is prioritized over efficiency, trying to cerate a diverse urban typology. The project is something between art, architecture and a comic book, The Tower of Twelve Stories is a 1:1 section model . The structure exposes the interior of stacked cartoonish bubbles. The different shapes are supported on each other on tangent points of curves, behaving in compression.

Reflections
I find the working method interesting, creating form strong architecture with a spatial focus, wanting the building to be more than just a building. Providing different experiences, functions and expression. It's an approach reconsidering architecture and what architecture is in the eyes of the users and people passing by. I also find it important as an architect to see to the characteristics of the building first. Not economic effectiveness. That creates a freedom to what the architecture can become.

J. Lais methods worked as an inspiration in my own process; being a storyteller, blurring the boundaries between design, art, architecture, sociology, technology and imagining other worlds.

"With specificity, there is the possibility for eccentricity – a person with exact disobedience to normalcies. A tower without typical plans, but rather specific rooms with specific geometries, will demand atypical actions."
- Bureau-spectacular

SIMON STÅLENHAG: GRAPHICAL

Simon Stålenhag is an artist and a designer specializing in futuristic digital paintings. The theme in his work is often combines memories of childhood imagination and sci-fi movies, all taking place in a stereotypical Swedish landscape. All in a neofuturistic touch.

Reflections
The artworks of Simon Stålenhag often gives an interesting contrast between the futuristic and the rural.

Beautiful landscapes in contradiction with rough technology. The style of the digital brush he uses also adds a layer of a dreamy feeling to the Picture.

The graphical method sets a specific feeling and mode to the pictures that I tried to develop as well during the thesis. But instead a contrast between the harshness of the Martian landscape and the dreamy notion of the shelter - the architecture.

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