MISSIONRED2030

REBECCA HAYWARD & ELEANOR IVEY

HOCKERILL ANGLO-EUROPEAN COLLEGE
ENGLAND

VENTURE PACK

YOUR INFLIGHT GUIDE TO MOVING TO MARS

CLOTHING

Your life will depend on what you wear!

ADVERTISEMENT

LOOK AFTER YOUR SUIT

IT'S KEEPING YOU ALIVE!

Nothing lasts for ever and in the hard climate on Mars, things are no different. It is vital you maintain your space suits so that they are in perfect condition every time you venture out.

OFFICIAL SAFETY NOTICE

ALWAYS TAKE YOUR LASER POINTER WITH YOU WHEN YOU GO OUT TO ENSURE YOU DETECT MICROBES BEFORE RE-ENTERING

INTRODUCTION

Welcome to Mission Red. From the first observations of Mars through telescopes on the ground of Earth, we have come a long way. Here on Mars we are on average, about 225 million km away from Earth, however this can change from 54.6 million km at our closest point to 401 million km at our furthest.

Mars is filled with interesting areas – we have the highest known mountain throughout our solar system here, the Shield volcano, Olympus Mons. This is one of the key areas to visit, set in the upland region, Tharsis, which is home to several other volcanoes, and the largest canyon system of any planet within our solar system.

Mariner Valley, or Valles Marineris as it is otherwise known is 4000km long and 7km deep making it a breath taking view for anyone to see, unlike anything on Earth. There are two polar ice caps on Mars: Planum Boreum (North), which is prone to avalanches so be careful, and Planum Australe (South), which has stunning geyser-like eruptions, are both permanent. These are only a few of the interesting elements you can visit here on Mars.

Galle crater was popular with humans on earth, resembling the smiley face icons that were frequently used in their communications.

WELCOME

Congratulations on embarking on a new life on Mars and facing the challenges of reaching the red planet, landing with all your supplies, equipment and vehicles on its surface.

EARTH V MARS

Earth and Mars are both terrestrial planets - both being differentiated between a dense metallic core and a less dense mantle and crust. Also they both possess a silicate mantle around their core and additionally there is a solid material for the surface crust on both planets. Mars and Earth bear varying terrains that can change from place to place - including mountain ranges, canyons and sand dunes. The pair have endured collisions with asteroids and meteors, Mars' craters being far better preserved due to the low air pressure and scarce precipitation.

EARTH	MARS
Earth has a radius of 3,959 miles.	Mars has a radius 53% the size of Earth.
Earth only has one moon - the moon, which takes 27 days, 7 hours and 11.6 seconds to orbit the Earth, meaning its orbit is growing larger as it takes longer than the Earth takes to rotate.	Mars has two moons - Phobos, which orbits Mars faster than it takes to rotate, completing an orbit in 7 hours and 39 minutes, and scientists have predicted that within 30 to 50 million years this moon will either collide with the planet or form a planetary ring, and Deimos, which takes 1.2 Martian days, which equals to about 30 hours. Due to it taking longer than a Martian day, its orbit is growing very slowly, like the moon of the Earth.
The Earth's atmosphere is made up of • Nitrogen - 77% • Oxygen - 21% • Argon - 1% • Carbon dioxide - 0.038%	The atmosphere of Mars consists of • Carbon dioxide - 95.32% • Nitrogen - 2.7% • Argon - 1.6% • Oxygen - 0.13% • Water vapour - 0.03% • Nitric oxide - 0.01%
Earth is closer to the Sun, being 149,597,891 km away.	On average, Mars is 227,936,637 km away from the Sun.
The length of a day (time needed to complete a full rotation) on Earth is slightly under 24 hours, but generally accepted as 24 hours.	The length of a day (time needed to complete a full rotation) on Mars is 24 hours and 37 minutes.
The time taken to complete a full orbit of the Sun on Earth is 265 days (Earth days).	The time taken to orbit completely around the Sun on Mars is 687 days (Earth days, not Martian days)
The force of gravity on Earth is 9.807 N (9.807 m/s2)	Gravity on Mars is 3.711 N (3.711 m/s2)
The average temperature on Earth is 14°C.	The average temperature on Mars is much lower, at -40 - -60°C
Water is plentiful on earth.	There is a permanent water ice on Mars but it is difficult to access.

COMPARE

The geography of your new home compared to Earth

CLIMATE

It’s cold out there!

WEATHER

Average monthly high °C
Average monthly low °C
Increased risk of dust storms in the south

SPRING (203 DAYS)	Andromeda	-30	-82	
	Carina	-32	-86	
	Draco	-25	-83	
	Fornax	-13	-78	
SUMMER (182 DAYS)	Hydrus	-4	-75	
	Indus	-4	-71	
	Lupus	-6	-68	
AUTUMN (147 DAYS)	Musca	-12	-70	
	Octans	-7	-71	
WINTER (155 DAYS)	Pavo	-8	-72	
	Tucana	-18	-75	
	Vela	-24	-77	

Based on NASA’s Seasonal Cycle readings at Gale Crater since 2012

An artist’s impression of a Martian dust storm.

NASA

Due to its distance from the sun and its thin atmosphere, it is usually cold on Mars. The tilt of the planet gives Mars its seasons but due to the longer year, the seasons are longer.

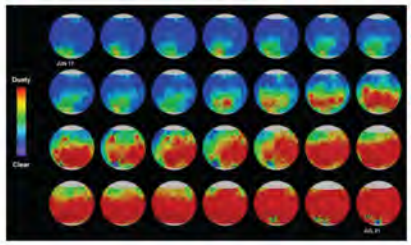
Dust storms play a major role in the Martian weather with dust storms more frequent in the Spring and summer in the south with increased wind speeds leading to local dust storms. The opposite is the case in the Northern Hemisphere where storms are more frequent in the Autumn and Winter during the perihelion (the time we are closest to the Sun).

A majority of the annual dust storms last for several weeks and are usually large enough to cover an Earth continent in size. However, approximately every 3 Martian years, the planet suffers Global Dust Storms which are intense and encircle the entire planet.

A late spring dust devil in Amazonis Planitia. The devil is roughly 644 meters across, 800m high and 30m in diameter.

NASA/JPL-Caltech/University of Arizona, Earth

TYPICAL MARTIAN DUST STORM ACTIVITY



Our thermal Emission Spectrometer clearly shows the build up of dust.

Washington Post

POWER

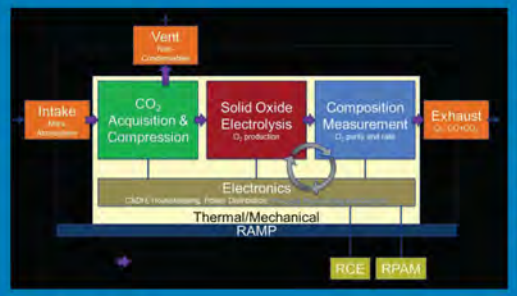
IN ORDER TO SURVIVE ON MARS, YOU WILL NEED TO CONSIDER THESE METHODS OF GENERATION.

Solar Photovoltaic

Currently being used in spacecraft and satellites, and previously used for Pathfinder, the Mars Rover, solar energy could be very beneficial for your trip to Mars, given that it is free and unlimited. We have seen it used on Earth countless times, but obviously there could be some issues with using it on Mars, such as the sandstorms, which could block the direct sunlight that solar photovoltaic panels would need to generate energy. In order to combat this we have ensured the panels can fold during a storm and therefore saving time sweeping dust. As this is currently a small colony, the transportation of solar panels is not an issue, but as it grows, transporting panels to Mars could be hard as more are required due to how fragile they are. A possible solution could be to make them ourselves, but a bigger infrastructure would be needed first.

Radioisotope Thermoelectric Generator

RTGs use thermocouples to convert the heat released by the natural decay of a radioactive element to produce electricity. The waste heat produced by RTGs is useful to keep the electronics at a temperature that they can function at, as Mars' temperature is 218K. RTGs should last for a long time too; Mars rover, Curiosity, had this type of set up and was expected to last for 14 years. They also will not turn off overnight, as they do not depend on sunlight, and therefore will be able to provide the constant stream of energy needed for larger settlements. When on Mars, the RTGs can be stacked vertically in order to not use up much ground space for when bigger settlements arrive.



NASA/JPL-Caltech/MIT

Mars Oxygen ISRU Experiment

MOXIE can produce oxygen from the Martian atmosphere through collecting CO_2 from the atmosphere, then compressing it and storing it. This CO_2 is then electrochemically split into O_2, which is then released back into the atmosphere, and it is also split into CO. This system requires a lot of energy but NASA's use of it on the 2020 Mars rover proves that it is possible to use MOXIEs to supply oxygen.

POWER WILL BE VITAL

Survival will be impossible without the careful planning and use of power on Mars.

DAILY LIFE

Routines will be essential to maintain the flow of daily life.

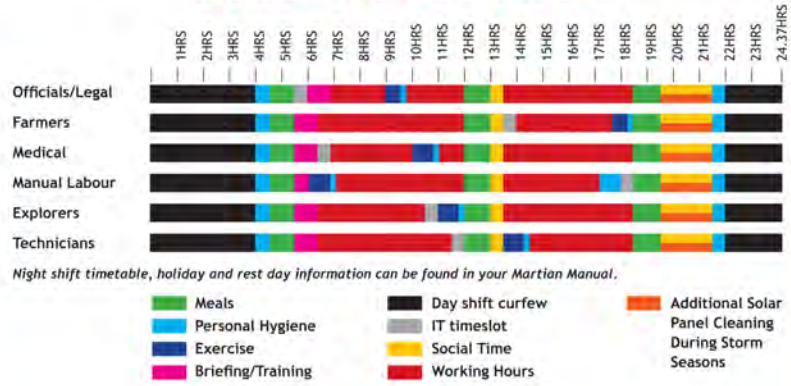
BASIC HOUSING RULES

To maintain stability within the colony, it is important that all Martians must follow the guidelines as in their contract.

- Unless under medical supervision, each person has a maximum of 2.5 litres of water per day
- All social lighting will be turned off for a 6 hour curfew every night.
- Everyone is allowed to wash a maximum of 2kg of personal clothing every two weeks.
- A Martian is permitted to take 1 shower per week which must last no longer than 2 minutes.
- To avoid noise pollution to others, quiet time will begin when lighting is turned off.
- Heating levels are reduced during the night when you are expected to within your thermal bed pods.
- During prolonged dust storms, everyone is required to complete an additional hour of solar panel cleaning.
- All Martians are permitted 50GB of wifi data per week for social interaction.

Detailed information regarding regulations can be found in your Martian contract

DAILY ROUTINE



Night shift timetable, holiday and rest day information can be found in your Martian Manual.

- Meals
- Personal Hygiene
- Exercise
- Briefing/Training
- Day shift curfew
- IT timeslot
- Social Time
- Working Hours
- Additional Solar Panel Cleaning During Storm Seasons

PHASE 1

YOUR HOME AWAITS YOU...

Following the success of attaching the Bigelow Expandable Activity Module (BEAM) to the Tranquility module on the International Space Station in 2016, MissionRed2030 has embraced this technology to provide inflatable pods for use while the permanent infrastructure of Mars is developed.

Each pod provides 330 cubic meters of space, enough for 6 people to live in and others provide good working areas. They were introduced by the first astronauts to reach Mars last year.

Thanks to the ISS research we know that the structures can withstand the harsh conditions, widely fluctuating temperatures, cosmic radiation and impact from any debris from the Martian dust storms.

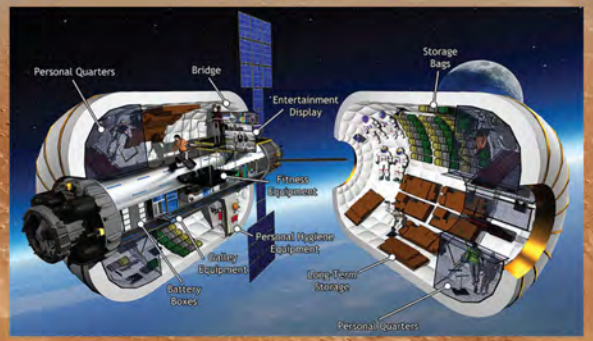


IMAGE: Bigelow Aerospace

HOUSING

PHASE 1
Immediate accomodation

HOUSING

PHASE 2
Long term accomodation.

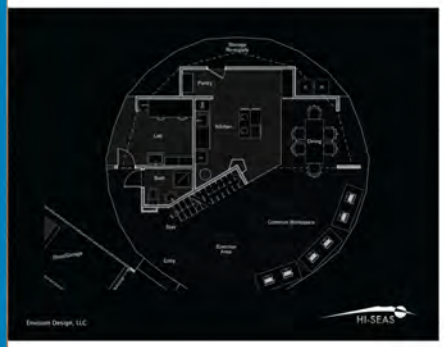
PHASE 2

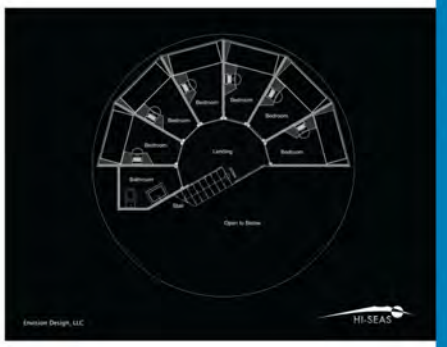
YOUR SAFETY & COMFORT ARE OUR MISSION!

The BEAM pods are expected to last about 20 years giving Martians plenty of time to create a larger colony.

The Phase 2 planned development of the Martian Colony will be based on the successful HI-SEAS Habitat, funded by NASA, on the northern slope of Mauna Loa. This will see the introduction of better living and working facilities.

Each dome is 36 feet in diameter. The ground floor has an area is 878 square feet and the upper level is 424 square feet. Your future accommodation will include a kitchen, dining area, bathroom with shower, personal laboratory as well as a small exercise area. The upper level will contain 6 bedrooms and a small bathroom. In addition, a 160 square foot workshop converted from a 20-foot high steel shipping container is attached to the habitat.





EXERCISE

Essential time spent on the treadmill

The Advanced Resistive Exercise Device (ARED)

You will benefit from cycling, no matter what angle you are at!

Photo credit: NASA

Exercise is vital on Mars if you want to survive!

Your journey to reach Mars will result in a decrease in your muscle mass of up to 15%, a reduction in your aerobic capacity, and will have a huge impact on your bone density.

Physiologically you will be under immense stress and this brochure will help guide you through this and help you to maintain your health and fitness levels.

Your journey will last a year, it is essential you exercise constantly throughout the flight. Although Earth's gravity is 38% stronger than Mars, you will still feel the impact of your journey when you finally touch down.

When Mars One astronauts arrive on Mars (62.5% less gravity than Earth), they would theoretically be stronger compared to an astronaut returning to Earth's gravity after a mission of similar duration.

Medical help is available for those with severe osteoporosis but our aim is to prevent you facing this problem.

OFFICIAL SAFETY NOTICE

You will have received your in-flight training schedule and you must stick to the 2.5 hours/day allocated to you. This must continue when you finally arrive on Mars, however, you will have the benefit of slightly more space to train.

Equipment available includes the standard stationary bike, treadmill and ARED that you will be familiar with from pre-flight training.

Maintaining your routine of bench presses and squats will also help you to achieve optimum fitness for your new life.

EXERCISE

Physical and psychological stimulation will be vital

TASTE OF THE FUTURE

Establishing successful farming and agriculture processes is vital before supplies run out.

DIET

The Martian Diet

Our farmers are the most valuable work force on the planet. Supplies are expensive and not always consistent. We are beginning to grow our own food but this is in the very early stages and the results are yielding little in the way of edible supplies so far.

New supplies of freeze-dried beef and chicken chunks, cheeses, dehydrated fruits and vegetables come in with each new crew but these supplies are limited.

The first thing you will notice is the lack of colour in food and it will become hard to be enthusiastic about meals, it is crucial, however, that you maintain a balanced diet.

Water is vital, we recycle as much as we can. The extraction of water from the ground is a slow and complicated process. We ask that you all adhere strictly to your daily allowance and notify the necessary people immediately should you face a problem with your supply.

There is zero tolerance of food and water wastage on Mars!

We still rely heavily on space agencies for food supplies but hopefully we will soon become self reliant.

Recycle when you can

Lettuce grown by NASA

3D PRINTING

Australia's Monash University created the world's first 3D-printed jet engine.

3D printing is an important part of your journey to Mars and Martian life due to the lack of resources currently on the planet and distance from Earth. It is a fast, cost-effective solution to all your daily needs.

A 3D printer uses heated plastic, metal or other materials to build up layers to create a 3D object. Since 2014, 3D printers were tested and improved aboard the ISS. Tests continue to this day as we develop more sophisticated 3D printing methods both on the ground and beyond. It provides an on-demand manufacturing service for everyone with access to the printer, crucial for space flight, and helpful in daily life here on Mars.

At the moment we rely on supplies from Earth however, 3D printing is sill fast and relatively inexpensive, which is perfect for space travel, as it reduces the need for expensive spare parts, greatly benefiting long-term missions, such as MissionRed2030. It allows those involved in the mission more freedom, as many tools and essentials can be created, without having to carry the weight of the item on the rocket out from Earth.

Some good examples of uses for 3D printing in space are machine parts, medical equipment and replacement body parts with the potential to create replacement organs in the future.

Designed by Sergey Grishchenko from Russia, Earth.

3D printing can improve your home

We are able to create replacement body parts, including teeth!

PRINTING THE FUTURE

A quick, cost effective way of creating products

RECREATION

space pro®

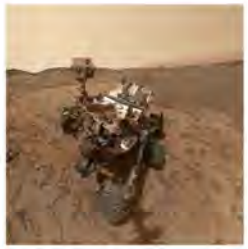
an app that allows you to experience playing different sports on different planets.

CURIOSITY

After just over ten years of dedication and hard work, the oldest operating Mars Rover spends her time in retirement at the Mars Museum.

Since landing on August 6, 2012, Curiosity was one of the solar system's leading Rovers, in both technology and successful missions. We are proud of Curiosity and the talented engineers and designers back on Earth. Curiosity now has pride of place in our museum.

While on Mars, Curiosity had to perform certain tasks to complete the ultimate mission of finding life on Mars. She discovered clay minerals that could only have formed under water conditions in the past. Other missions included:



The Biology of Mars	Nature of carbon compounds, natural chemicals like oxygen and nitrogen and search for life
Geochemical	Composition of the surface materials and rock formation - looking for signs of water
History of Mars	Mars evolution and search for water and chemicals in the atmosphere
Radiation	Monitoring radiation levels for safety and effects of the suns rays.

Sadly the malfunction of her back right wheel in 2018 resulted in a drastic reduction of movement by Curiosity and by 2019 she ground to a halt but continued to take readings while stationery for a further three years until her Radioisotope Thermoelectric Generator died.

Currently, radiation levels are kept to a minimum and oxygen levels are stable. Curiosity and her colleges helped achieve this and so much more during the years she operated. The museum intends to update Curiosity's power source next year so visitors will soon be able to see her in action once again!

COMING SOON...

With ten years' extraordinary scientific achievements enabling geological samples from Mars to be taken to Earth, Mars2020 will be joining our museum soon, taking her place beside Curiosity.

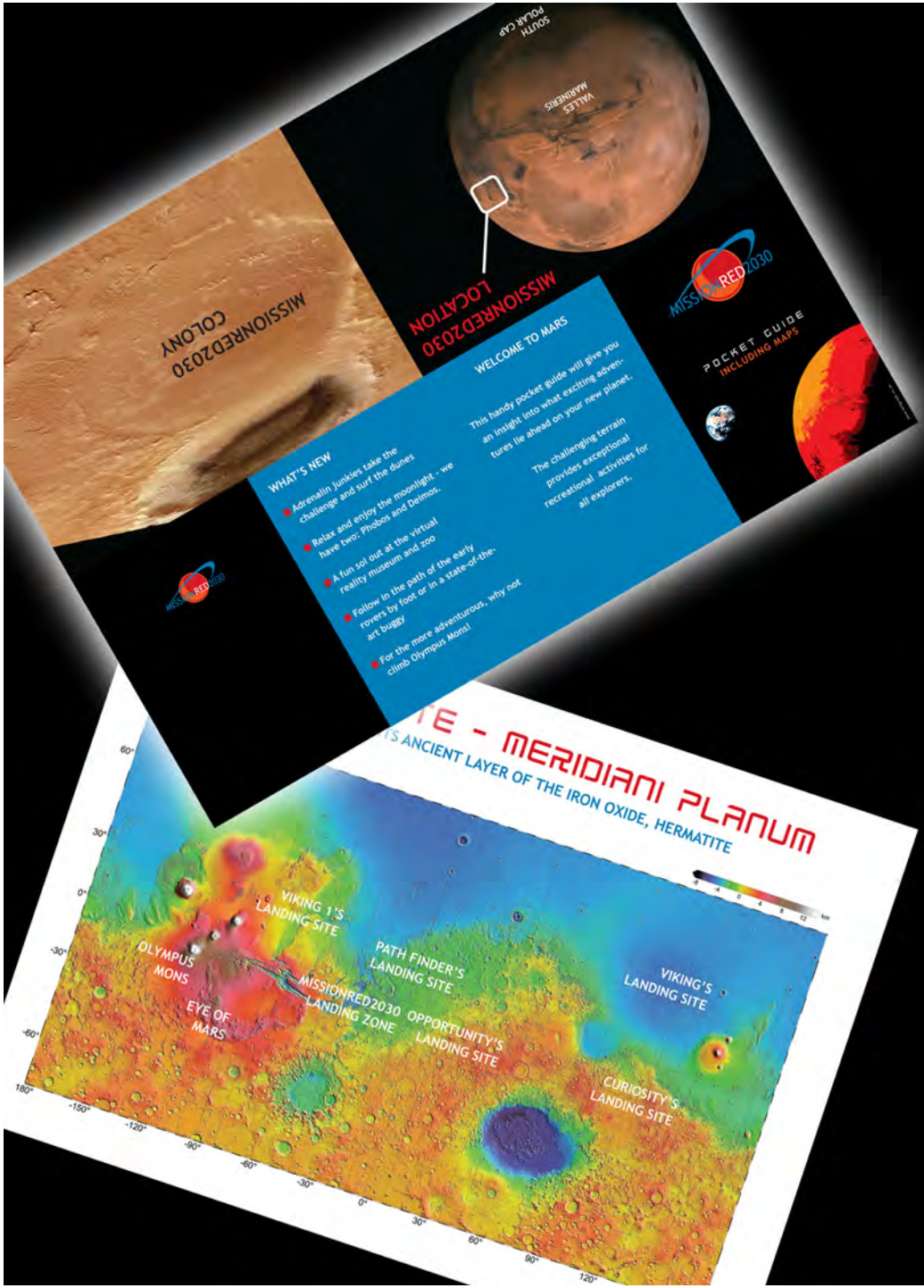
Images: NASA

MARS ROVERS

It all began with Curiosity

RECREATION

Enjoy your time off



POCKET GUIDE

Where to visit. What to see.

VIDEO LINK

MISSIONRED2030

ENJOY THE FUTURE

THANK YOU FOR LISTENING