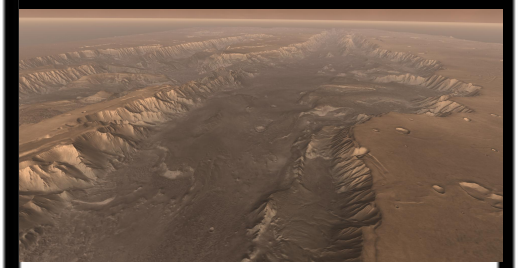
Canyon of Valles Marineris



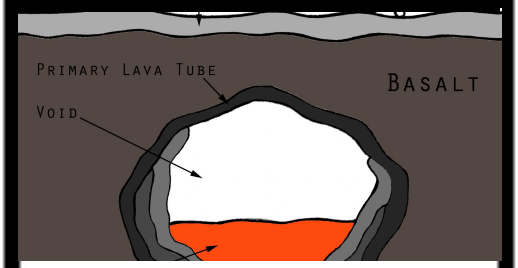
Build inside a deep canyon.

- Along the equator (warmer)
- Possible liquid aquifers
- Possible microbial life
- Canyon walls provide protection
- Difficult terrain
- Must drill to access water
- High winds in canyon

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E1

Equatorial Lava Caves



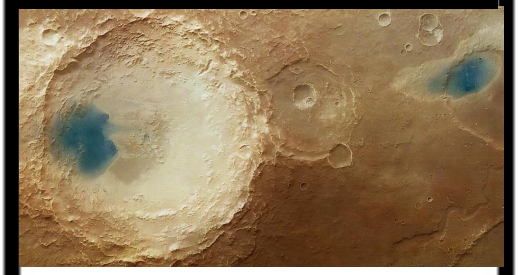
Build underground inside a hollow cave formed by an ancient lava flow.

- Protection inside caves
- Along equator (warmer)
- Study Mars' volcanic history
- No evidence of water nearby
- Must climb high elevation to enter caves

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E2

Arabia Terra



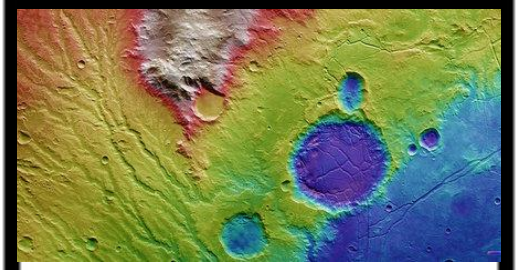
Northern highland made of dense impact craters.

- Evidence of water
- Study history of Mars surface
- Crater walls provide protection
- Safe landing sites
- More difficult to extract water that is deep within rocks

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E3

Glaciers at Hellas Basin



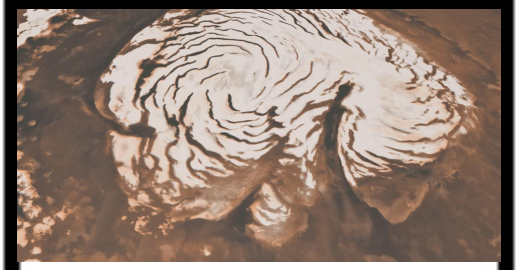
Build in a huge basin near glaciers in mid-latitudes.

- Reliable access to shallow water
- Study Mars climate history
- Protection inside basin
- Dangers of crossing glaciers to collect water

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E4

North Polar Ice Cap



Live near the northern ice caps.

- Reliable ice-water
- Direct-to-Earth communication
- Study Mars' volcanic history
- Possible evidence of life
- 6 months of darkness and cold
- Dust storms in the summer

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E5

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Solar Panels



Convert the sun into electricity. **Battery storage required.**

- Environmentally friendly
- Easy to fix
- Dust storms cause damage
- Only works with sunlight
- Loses efficiency over time
- Works best near the equator

E6

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Wind Energy



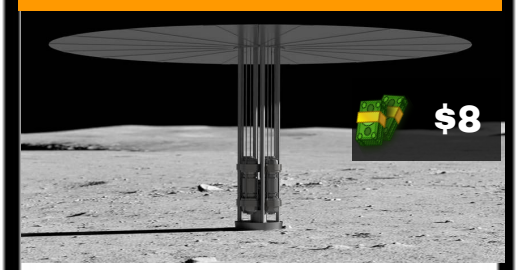
Use Martian winds to create electricity with windmills. **Battery storage required.**

- Renewable energy source
- Environmentally friendly
- Very low density atmosphere
- Need dust storms or high winds in canyons for usable power

E7

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Nuclear Reactor



Harness the energy from splitting atoms to generate electricity.

- Lightweight and high-capacity
- NASA-tested technology (Kilopower project)
- Doesn't need sun or wind
- Need specialized skills to fix
- Nuclear accident is possible

E8

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Fuel Cell



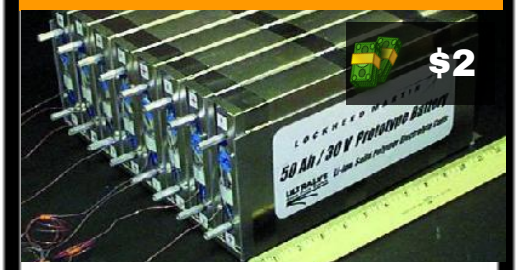
Use hydrogen and oxygen in the atmosphere to produce electricity. **Battery storage required.**

- Doesn't need sun or wind
- Lightweight & long lasting
- Need initial energy to start
- Lower power system
- Technology under development

E9

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Battery Storage



Stores power to use as needed. **Backup power source only.**

- Reliable
- Not affected by weather
- Heavy
- Must be recharged
- Must be periodically replaced

E10

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High-Gain Antenna



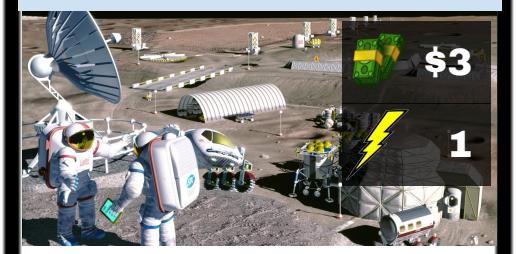
Connect with Earth.

- Communicate with *audio and video* to family and NASA
- Send scientific data
- At least 3 minute delay between messages
- Place in high elevation

E11

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Low-Gain Antenna



Connect with Earth.

- Communicate with *audio* only
- At least 3 minute delay between messages
- Place in high elevation

E12

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Photosynthesis



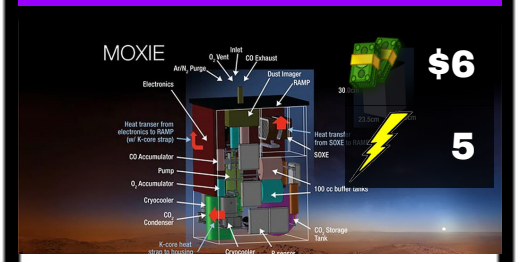
Use the oxygen produced by plants in the greenhouse. *Only choose if you are farming.*

- Environmentally friendly
- Damage to crops can decrease oxygen supply

E13

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Extract from Atmosphere



MOXIE: a new NASA technology that converts CO2 from atmosphere into oxygen.

- Atmosphere is mostly CO2
- New technology - to be tested on NASA's new Mars 2020 rover
- Heavy equipment needed

E14

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Nuclear



ALPH: NASA's micro-nuclear device that can melt its way into ice caps and collect water.

- Lightweight
- Access underground water
- Untested technology
- Possible nuclear accident

E15

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Vaporize: Solar Tents



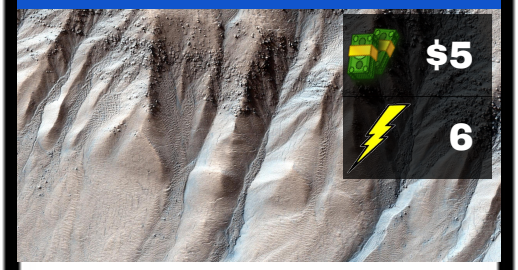
Use sunlight to heat regolith and vaporize the water for collection.

- No need to move regolith
- No heavy equipment
- Rover transports device to collect water.
- Dust storms may block sunlight
- Unable to access underground water

E16

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Vaporize: Microwave



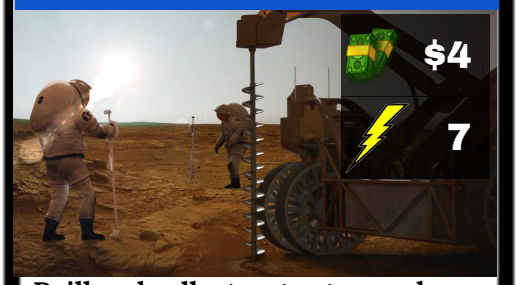
A microwave device heats and vaporizes water for collection.

- No need to move regolith
- No heavy equipment
- Rover transports device to collect water.
- Unable to access underground water

E17

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Drill for Water



Drill and collect water trapped under the surface

- Access underground water deep under the surface
- InSight and ExoMars are testing drilling capability on Mars
- Need new technology for deeper drilling
- Heavy machinery

E18

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Recycling & Storage



Conserve water by recycling and reusing from showers and toilets.

Required

E19

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Hydroponics Farming



Grow plants without soil. Fuse nutrients directly into water system.

- Underground: use LED lights
- Above ground: sunlight from a greenhouse
- Plants make humans happy

E20

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Aquaponics Farming



Grow plants without soil. Plant roots grow in water with fish that provide nutrients.

- Underground: use LED lights
- Above ground: sunlight from a greenhouse
- Plants make human happy
- Fish can survive travel to Mars

E21

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Insect Farming



Get protein from insects.

- Inexpensive.
- Reliable technology.
- Great for backup food source.
- You are eating insects.
- Only one food type.

E22

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Livestock



Bring small livestock such as pigs and chickens for fresh meat and eggs.

- Delicious food variety.
- Happier humans.
- Very expensive.
- Unreliable. Animals might die on the journey or on Mars.

E23

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Seed Vault



Store backup seeds in a frozen vault in case of crop damage.

- Backup for farming.

E24

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Dehydrated Food



From meats to vegetables, a supply of dehydrated foods.

- Back-up food source.
- Lasts up to 10 years
- Limited supply.

E25

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Animal Lab



Study the effects of Mars on small animals like fish, ants, or rabbits.

Research Ideas:

- Do fish swim the same?
- Can bees still make honey?
- Do ants change their ant farms?

E26

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Food Lab



Test out new ways to grow better crops.

Research Ideas:

- How does lowered gravity affect plant growth?
- Can Martian nutrients be used to grow plants?

E27

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Atmospheric Science Lab



Study the weather of Mars.

Research Ideas:

- How strong are the winds in dust storms?
- What are the range of temperatures throughout the year?

E28

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Geosciences Lab



Study the rocks and landforms of Mars.

Research Ideas:

- What minerals are in regolith?
- How were craters formed?
- Where is water located?

E29

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Space Science Lab



Study celestial objects and their effects on Mars.

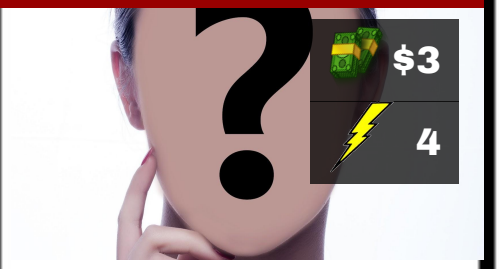
Research Ideas:

- How frequent do meteors impact the surface of Mars?
- How much radiation is coming from the Sun and other stars?

E30

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Mental Health Lab



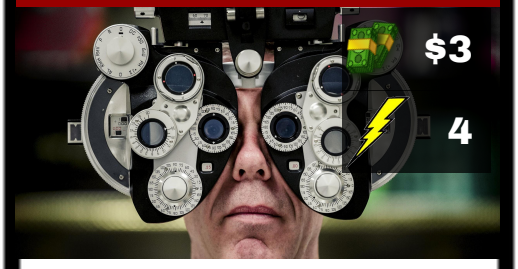
Study the mental health of your colonists.

Research Ideas:
- How does living on Mars affect happiness?
- How do colonists resolve conflict?

E31

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Human Body Lab



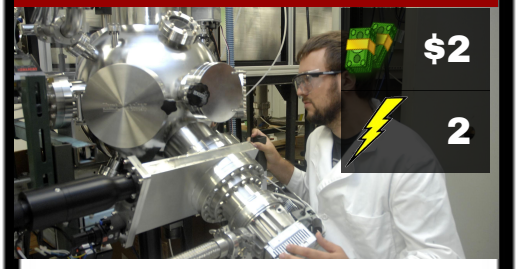
Study the changes in the human body while living on Mars.

Research Ideas:
- Does blood pressure increase?
- Does muscle strength change from lowered gravity?
- Does eyesight decrease?

E32

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Your Choice Lab



What do you want to study on Mars? Must be approved by NASA!

Research Ideas:
- Your choice!

E33

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Curiosity Rover



Use NASA rover that landed in 2012 and is still operational.

Specialty: Finding water and organic materials for life.

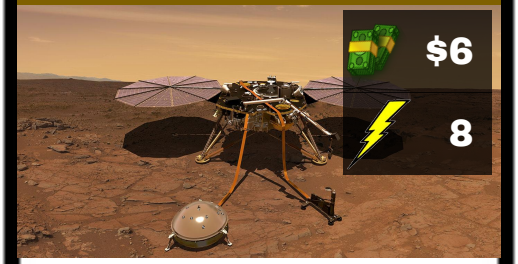
Weight: 1982 lbs

Top Speed: 0.09 mph

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E34

Insight Lander



NASA lander that landed in 2018.

Specialty: Observe Mar's core and seismic activity.

Weight: 1530 lbs

Top Speed: 0 mph

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E35

Opportunity Rover



Fix the NASA rover that landed in 2004 and went silent during a dust storm in 2018.

Specialty: Finding evidence of water on Mars.

Weight: 374 lbs

Top Speed: 0.1 mph

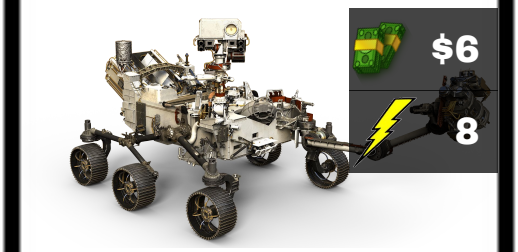
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E36

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Perseverance Rover



NASA rover that landed in 2021 and is still operational.

Specialty: Understand the geology of Mars and seek signs of ancient life.

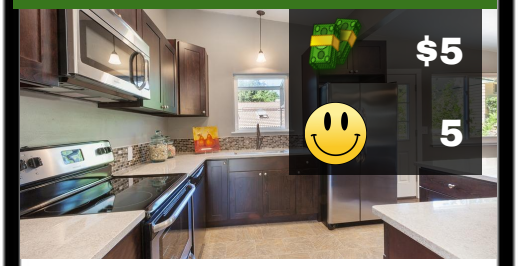
Weight: 2,260 lbs

Top Speed: 0.1 mph

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E37

Personal Kitchen



Enjoy a private kitchen with all your personal favorite items!

Personal kitchens are shared between 3 colonists. Total of 4 kitchens to serve your colonists.

M1

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Shared Kitchen

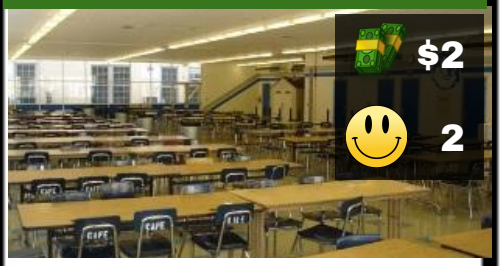


A shared space for all colonists to prepare meals.

M2

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Cafeteria



A large hall for socializing and eating. Everything is self-serve, and colonists clean-up after themselves.

M3

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Luxury Dining



Pamper your colonists with a luxury dining experience. Waiters serve chef-prepared 3-course meals.

M4

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Shared Bathroom

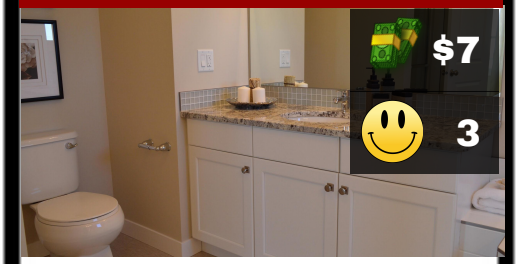


All colonists share a restroom with toilets and sinks.

M5

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Private Bathroom



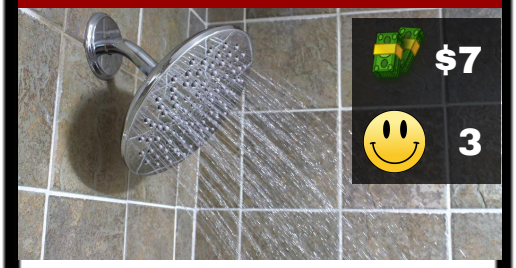
A private bathroom with toilet and sink.

Private bathrooms are shared between 3 colonists. Total of 4 private bathrooms.

M6

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Private Shower



Enjoy the luxury of private showers with hot water.

Private showers are shared between 3 colonists. Total of 4 showers.

M7

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Wipes

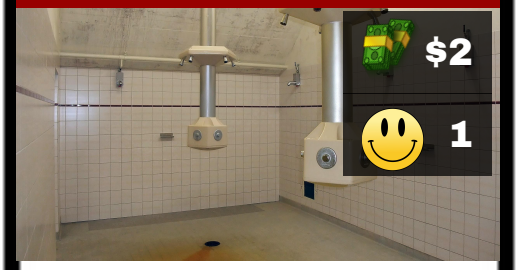


Save on water and power by using reusable water wipes in place of showers.

M8

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Community Shower



Save on water and power by having a large community shower for everyone to share!

M9

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Gym

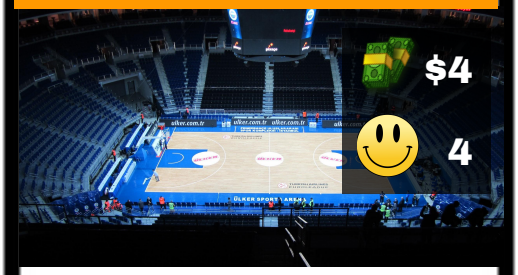


Treadmills and resistance bands work muscles and heart to keep crew healthy.

M10

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Sports Arena



Play sports to keep crew in shape and entertained.

M11

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Outdoor Workout

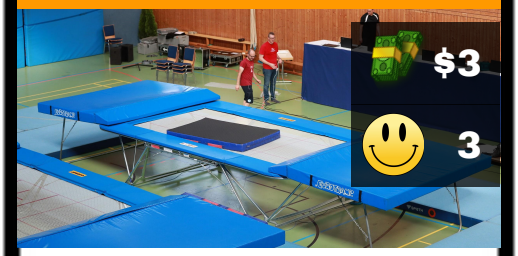


Climb a cliff or lift Martian rocks for the ultimate outdoor workout While exciting at first, continual exposure to radiation will cause cancer.

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M12

Gymnastics



With 1/3 the gravity, jumping on a trampoline has never been so fun!

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M13

Virtual Reality

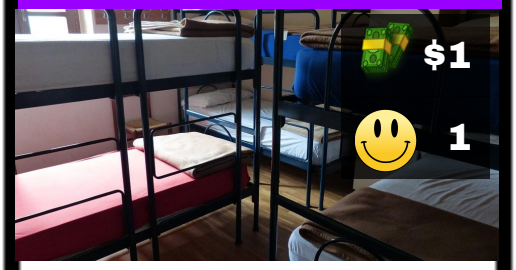


Play any sport in a virtual simulation.

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M14

Sleeping Room

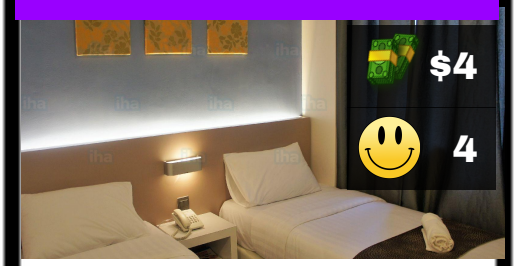


Rows for bunk beds for 12 colonists to sleep in one room.

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M15

Shared Bedrooms



2 colonists per room for a total of 6 bedroom units

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M16

Private Bedrooms



The ultimate luxury with a private, individualized space for each colonist. Total of 12 rooms.

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M17

Music



Play instruments of your choice.

M18

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TV Room



Movies and video games.

M19

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Library



Read and expand your knowledge.

M20

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Art



Let your creativity flow with arts and crafts.

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M21

Your Choice

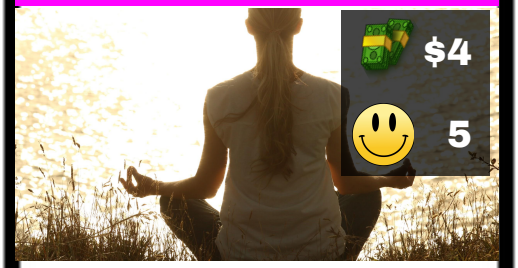


Create your own unique entertainment space! Must be approved by NASA.

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M22

Meditation Room

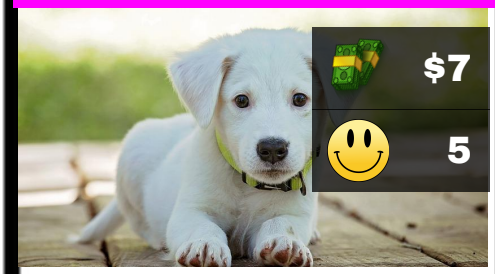


A peaceful space for colonists to escape and relax.

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M23

Pets



Bring a few furry friends as a companion to keep colonists happy and prevent boredom.

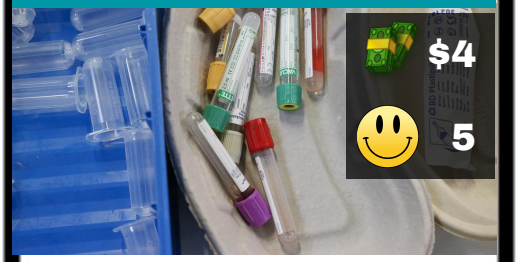
M24

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Medical Center



Heal ailments such as colds, broken bones, or dehydration as well as more serious diseases such as cancer or heart attacks.

M25

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Mobile Medic



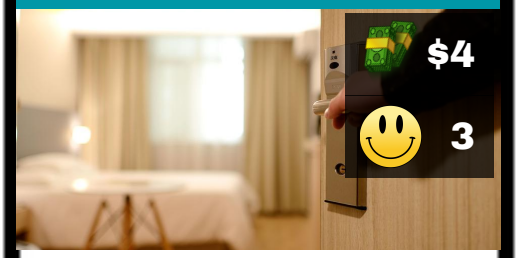
For larger colonies or those spread across large distances, a mobile medical clinic can quickly bring first aid.

M26

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Hotel

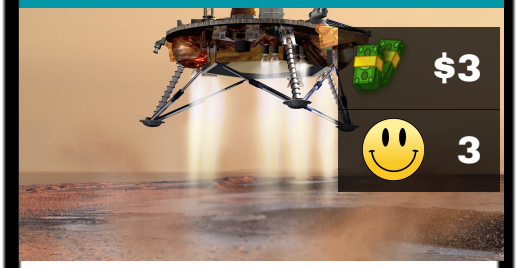


Tourists from Earth come to visit you on Mars!

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M27

Rescue Pod



A back-up space ship ready to ship colonists back to Earth in case of disaster.

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M28

Disaster Shelter

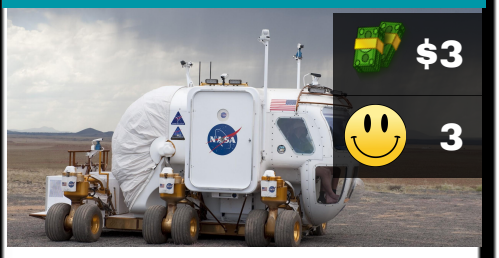


An underground safe space stocked with supplies in case of disaster in your colony.

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M29

Exploration Unit

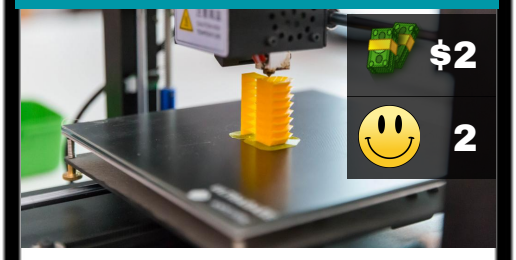


Take a tour of Mars.

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M30

3D Printing

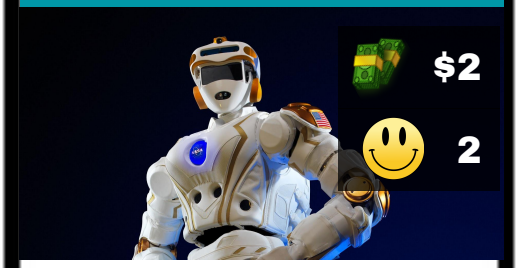


Print needed tools and building materials for colonists.

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M31

Robot



NASA's Valkyrie personal robot will help colonists with farming, repairs, and other tasks.

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M32