

Terraforming Mars: Is It Actually Possible?



Terraforming means changing the environment of a planet to make it more Earth-like and capable of **supporting life**. In the case of Mars, it would involve warming the planet, thickening its atmosphere, producing oxygen, and possibly creating oceans, plants, and ecosystems over time. It sounds like something from a futuristic movie, yet scientists have seriously studied whether it could one day become reality. However, turning an entire planet into a habitable world would be one of the greatest engineering challenges in human history. The question is no longer simply, “Can humans reach Mars?” but rather: Could humans actually transform Mars into a second Earth?

WHY IS MARS THE BEST CANDIDATE ?

Among all the planets in our solar system, Mars is considered the best candidate for future human colonization. Although it is cold and hostile today, it shares several similarities with Earth. A day on Mars is surprisingly close to an Earth day, lasting about 24 hours and 39 minutes. Mars also has seasons because its axis is tilted similarly to Earth's. **Water ice exists** beneath its surface and at its polar caps. Scientists have even discovered evidence that liquid water once flowed across the planet billions of years ago. These features make Mars more suitable for colonization than planets.

Mars is also relatively nearby in cosmic terms. Depending on the positions of Earth and Mars in their orbits, a journey to the Red Planet could take around six to nine months using current technology. However, despite these advantages, Mars remains extremely dangerous for human life. The atmosphere on Mars is very thin and consists mostly of carbon dioxide. Humans cannot breathe there without support systems. Temperatures can



*Conception of the process of terraforming Mars.
(Adobe images)*

drop **below -100°C** in many regions, and the planet lacks a strong magnetic field, exposing its surface to harmful radiation from space. Gravity on Mars is also much weaker than Earth's, only about 38% as strong. Scientists still do not fully understand how living long-term in **reduced gravity** would affect the human body. In its current state, Mars is completely uninhabitable without advanced technology.

HOW COULD MARS BE TERRAFORMED?

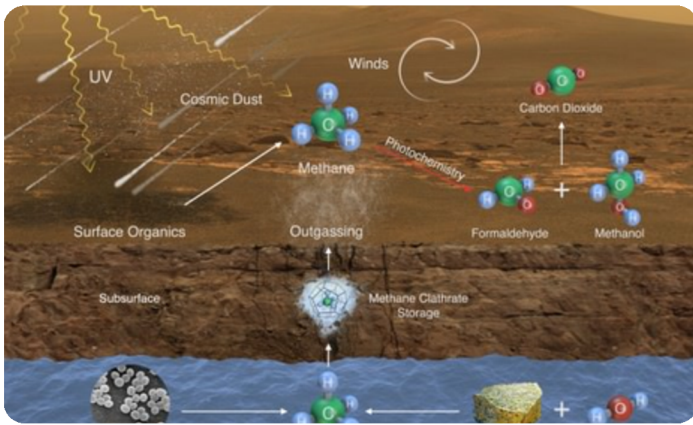


Illustration of production of methane on a Mars base. (wikipedia)

1. Restoring Water

Mars already contains large amounts of frozen water beneath its surface and at its poles. If temperatures increased:

- underground water reserves might become accessible
- and enclosed farming systems could support plant life

Water would be essential for drinking, agriculture, and sustaining ecosystems.

2. Thickening the Atmosphere

Mars has a very thin atmosphere, making it impossible for humans to breathe or for liquid water to remain stable. To thicken the atmosphere, scientists propose:

- releasing gases trapped underground,
- or producing gases artificially through industrial processes.

3. Producing Oxygen

Even with a warmer atmosphere, humans would still need oxygen. Some possible solutions are using:

- algae
- bacteria
- insects
- or specially engineered plants

to convert carbon dioxide into oxygen through photosynthesis. However, that would take centuries.

4. Warming the Planet

Mars is extremely cold because it receives less sunlight than Earth and has a thin atmosphere that cannot trap heat effectively. Scientists suggest increasing the planet's temperature by:

- releasing greenhouse gases
- building giant mirrors in space to reflect sunlight.

As Mars warms, frozen carbon dioxide trapped in its polar ice caps and soil could enter the atmosphere, creating an even stronger greenhouse effect.

5. Building Ecosystems

The final stage of terraforming would involve creating stable ecosystems. Scientists imagine gradually introducing:

- microorganisms
- plants

This would help balance oxygen, soil, and environmental conditions over time.

ETHICS & PHILOSOPHY: A DEEPER ANGLE

Some scientists and philosophers believe humans have a responsibility to spread life beyond Earth. They argue that becoming a multi-planetary species could protect civilization from global disasters such as climate change, asteroid impacts, pandemics, or nuclear war. In this view, terraforming Mars would represent the next step in human evolution and exploration. Others see Mars as a world that should remain untouched. If microbial life exists beneath the Martian surface, altering the planet could destroy an entirely **unique ecosystem** before it is even discovered. Humans may accidentally contaminate another world simply by bringing Earth-based organisms there. Terraforming also raises concerns about humanity's relationship with Earth itself. Critics argue that instead of searching for a **“backup planet”**, humans should focus on solving environmental problems on Earth. There is also a

philosophical aspect to the idea of changing an entire planet. For the first time in history, humans may eventually possess the ability to reshape worlds on a planetary scale. This creates difficult questions about power, responsibility, and the limits of human ambition. The debate continues, and perhaps the most important part of terraforming Mars is not the technology itself, but what the idea reveals about human nature, curiosity, and our desire to survive beyond Earth. They question whether escaping to another planet reflects progress or failure.

“The Earth is the cradle of humanity, but mankind cannot stay in the cradle forever.”

~ Konstantin Tsiolkovsky (scientist)

COULD HUMANS REALLY LIVE ON MARS?

Living on Mars is scientifically possible in theory, but it would be extremely difficult and dangerous with current technology. Unlike Earth, Mars is a harsh and hostile world where humans cannot survive without advanced life-support systems. One of the biggest problems is the atmosphere. Astronauts would need sealed habitats and oxygen producing systems to stay alive. Radiation also poses a serious threat. Because Mars lacks a strong magnetic field and thick atmosphere, harmful cosmic radiation constantly reaches the surface. Long-term exposure could damage human health and increase cancer risks. Scientists believe future Martian colonies may need to be built underground or protected by thick shielding.

Despite these difficulties, many organizations including **NASA** and **SpaceX** are actively researching human missions to Mars. Some experts believe temporary settlements could become possible within this century. However, early Martian colonies would likely resemble isolated



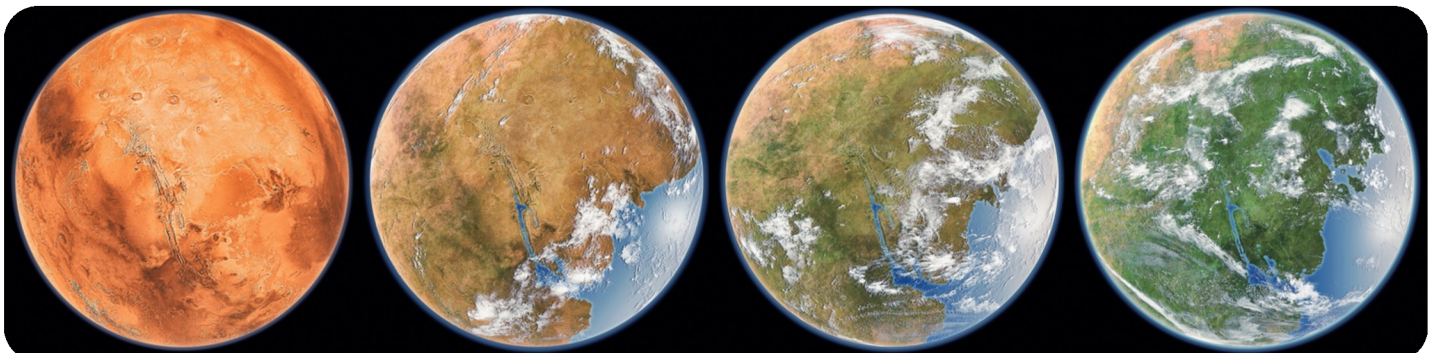
Life inside a future human settlement on Mars.

research stations rather than comfortable cities. Humans would depend on technology just to survive. Even so, the dream of living on Mars continues to inspire humanity. It represents not only scientific progress, but also the possibility of becoming capable of surviving beyond Earth.

SCIENCE VS SCIENCE FICTION

The idea of humans living on Mars has fascinated writers and filmmakers for decades. One of the most scientifically accurate portrayals of Mars appears in **The Martian**. The film shows an astronaut using science, engineering, and botany to survive alone on Mars. While some details are dramatized, many aspects such as growing food in controlled habitats and depending heavily on technology are grounded in real scientific ideas. Other stories, like **Interstellar** or **The Expanse**, explore larger themes of space colonization, survival, and humanity's future among the stars. These stories imagine advanced spacecrafts, artificial gravity, and large interplanetary societies that are still far beyond current human capabilities. Ideas once considered impossible such as space travel, video communication, or robotic exploration later became reality through scientific

advancement. Engineers and scientists today are sometimes inspired by fictional stories they watched or read as children. However, real science moves much more slowly than fiction. Building sustainable colonies on Mars would require solving enormous challenges involving food production, oxygen generation, radiation protection, mental health, and long-term survival in low gravity. In many ways, science fiction shows humanity's dreams, while science reveals the difficult path required to achieve them. The line between science and fiction may still be wide, but with every new space mission, humans move one step closer to turning imagination into reality. The relationship between science and science fiction is therefore deeply connected. Science fiction imagines the future, while science attempts to make parts of that future possible.



Hypothetical step-by-step terraforming of Mars from a barren desert into an Earth-like world. (Mind matters)