

Problems and Potential Solutions for Mars Colonization

1. Dust Devils: Mars Month-Long Massive Dust Storms

Mars dust storms can immerse the entire planet with some twice the size of the United States. The dust may damage equipment by completely covering rovers' mechanical gears in dust causing damage. It can make landing and takeoff more challenging and make solar panels less efficient.

Storms can also make landing and takeoff more challenging.

Luckily, landers like Insight are able to put themselves into "safe mode" to save battery juice when the dust prevents sunlight from reaching its solar panels. Also, the Mars Reconnaissance Orbiter, Odyssey, and MAVEN are able to monitor and relay dust storm info back to Earth.

Dust Devils can make solar panels on equipment less efficient without proper protection but researchers and engineers are prepared. Curiosity rover is unaffected by dust storms because it isn't solar powered and landers like NASA's InSight can go into 'pause mode'.

<https://nasa.gov/solar-system/the-fact-and-fiction-of-martian-dust-storms/>
[https://mars.nasa.gov/resources/26555/mars-report-dust-storms-on-mars/...](https://mars.nasa.gov/resources/26555/mars-report-dust-storms-on-mars/)

2. The Red Planet has Limited Natural Resources

Water is essential for humans to live on Mars and Mars is limited. One solution is to extract water using tools and technology from Martian soil. The Mars Regolith Water Extractor is one system designed to do this. And it turns out Mars soil is rich in many essential mineral resources.

<https://sbir.nasa.gov/SBIR/abstracts/10/sbir/phase1/SBIR-10-1-X1.01-8174.html#:~:text=The%20Mars%20Regolith%20Water%20Extractor,freshly%20removed%20from%20the%20ground....>

3. Mars Distance and Communication Lag

To communicate with someone on Mars is to wait longer than you'd probably like. Depending on the planet's position, you'd have to wait anywhere from 4 to 24 minutes for your message to get to someone and for their message to return to you. Even if you're patient, this time delay can be problematic or at least challenging for real-time remote control of equipment.

One solution is communication via lasers, or optical communications.

Rather than sending and receiving signals using longer wavelength radio waves, lasers would allow a greater volume of information to be sent in less time.

[https://nasa.gov/technology/laser-communications-empowering-more-data-than-ever-before/...](https://nasa.gov/technology/laser-communications-empowering-more-data-than-ever-before/)

“If a viable Martian civilization can be established, its population and powers to change the planet will continue to grow.” - The Case for Mars, Robert Zubrin

4. Mars Radiation and Ultraviolet radiation plus the Harshness of Mars Natural Environment

Mars weather also gets Extremely cold. NASA's Curiosity rover is currently tracking weather and providing reports on Mars temperatures. Just one week ago, (December 21, 2023) the temperature was at a high of 28 degrees F and a low of -98 degrees F.

[https://mars.nasa.gov/msl/mission/weather/...](https://mars.nasa.gov/msl/mission/weather/)

Mars weather is partly due to its low atmospheric pressure and because Mars is about 50 million miles further away from the Sun than Earth it receives less of the Sun's rays.

Mars also has a Thin atmosphere, Lacks a global magnetic field, and Lacks a protective ozone layer. The challenge is in providing astronauts with proper shielding and protective gear against the radiation.

Astronauts and future colonizers, again, need protective gear, special equipment, and more research to combat the harsh Mars seasons and to make a trip to Mars successful!