June 18, 2023

# Idea for Cryonics preservation on Mars

What if you spent your life furthering the prospect of humans going to Mars, just to die on Earth, not knowing how it all turned out? What if you could wake up on Mars in the future for your second life? What about the idea of cryonic preservation on Mars?

Mars Cryonics would be in the highest price range for any cryogenic preservation, but the opportunity could also be available through a scholarship for visionaries working toward a future of humans-on-Mars. Elon Musk may not have a strong interest in cryonics, but might he be interested in the chance of being revived on Mars someday?

Another reason for a cryonics storage facility on Mars would be to house organs and blood for medical purposes for people living on Mars.

My personal interest as a cryonics member is that I am *insanely curious* what the future of humanity holds. I want to be revived someday to see how we've done, and to eventually understand the fabric and origins of the Universe. Some people sign up for cryonics for more personal and emotional reasons. Others I know, who currently aren't interested in cryonics, *would* be if it meant the chance to wake up on Mars someday.

I've done some research into various details of a Martian cryonics facility involving temperatures, location, insulation, maintenance, and so forth. In the most basic terms, here is my proposal:

My best guess at the the most efficient and safe cryonics facility on Mars would be to house it inside of a twelve foot diameter tunnel of some length, drilled into a mountainside on Mars.

Some reasonable tradeoff between proximity of the South Pole and nearest outpost might be best. Several meters of soil all around the tunnel would protect from space radiation, meteorites, and offer thermal stability. Being exposed to the low atmospheric temperatures and pressure inside of the tunnel would offer additional thermal stability.

The extra space within the tunnel diameter would offer room for supplemental equipment and accessibility for humans or robots to perform maintenance. I'm estimating that a twelve-foot diameter tunnel one mile long would provide sufficient space to accommodate dewars similar in size that other cryonics companies use, while allowing for additional infrastructure and access requirements. Perhaps the Boring Company will be drilling on Mars by this time.

The cryogenically preserved bodies could be stored at a facility such as Alcor in Scottsdale, AZ, until a Mars community is ready to take on the project and when StarShip is equipped to fly dewars to Mars.

To bring the concept of Mars Cryonics to fruition, a contractual agreement between SpaceX and a company such as Alcor might be necessary in the beginning, primarily focusing on SpaceX's contributions to the project's early stages, and to outline the cost per person needed above and beyond Alcor's normal fees. This approach would ensure a streamlined collaboration while allowing SpaceX to incorporate and integrate the Mars Cryonics initiative within their overall Mars exploration endeavors.

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Here is some research I've done.

Temperatures on Mars:

The average temperature on Mars generally doesn't reach as cold as liquid nitrogen (-196 degrees Celsius / -320 degrees Fahrenheit). The South Pole several meters underground may be the coldest on average with fairly steady temperatures. The mesosphere in orbit around Mars would the coldest, but not very convenient. Above ground on the poles can be extremely cold, but with wide temperature fluctuations.

The average surface temperature on Mars is about -63 degrees Celsius (-81 degrees Fahrenheit). Temperatures several meters below ground generally reach around -50 degrees Celsius (-58 degrees Fahrenheit).

<u>The poles of Mars</u>
In the colder regions near the poles during the winter season, temperatures can drop as low as -143 degrees Celsius (-225 degrees Fahrenheit).

Based on data from the Mars Odyssey orbiter's Gamma Ray Spectrometer (GRS), which measures the composition and distribution of elements on Mars, it has been estimated that the subsurface temperatures at the Martian south pole range from approximately -68 degrees Celsius (-90 degrees Fahrenheit) near the surface to -110 degrees Celsius (-166 degrees Fahrenheit) at depths of several meters.

Similarly, at the Martian north pole, subsurface temperatures have been estimated to range from around -38 degrees Celsius (-36 degrees Fahrenheit) near the surface to -80 degrees Celsius (-112 degrees Fahrenheit) at depths of several meters.

In summary, at the poles of Mars, temperatures are often lower above ground as compared to below ground, however over the course of a Martian year (687 Earth days), the average temperatures below ground can be colder. The thick layers of ice beneath the surface act as insulation, resulting in more stable and colder temperatures several meters below the surface.

<u>Atmospheric Temperatures</u>
In the mesosphere, which is the region about 50 to 85 kilometers (31 to 53 miles) above the surface, temperatures can reach as low as -125 degrees Celsius (-193 degrees Fahrenheit).

Dewar insulation:

Burial of the tank deep underground *could* provide additional benefits for cryogenic preservation. The subsurface environment of Mars experiences more stable temperatures compared to the surface. The soil acts as a natural insulator, providing thermal protection against temperature fluctuations and external heat sources.

However, burying the dewars would not allow for easy access for maintenance. In addition, exposure to the Martian low atmospheric pressures and temperature would have its advantages.

Therefore the best storage facility, I estimate, would be a tunnel drilled into a mountain.

A 12' diameter tunnel might be large enough to store typical dewars that are 10' tall x 3.3' diameter.

Sufficient soil coverage between the tunnel and outdoors would protect from radiation, meteorites, and drastic temperature changes, while still allowing the dewars to take advantage of the low pressures and temperatures of the Martian atmosphere inside of the tunnel.

Adding surface area to the outside of the metal dewar tank may help with heat dissipation, thus slowing the heat transfer into the tank and reducing the boil off rate of the liquid nitrogen.

Phase-change heat pipes incorporated into the dewar design may offer benefits in terms of heat transfer, temperature regulation, and thermal equilibrium.

Atmospheric pressure:

The low atmospheric pressure on Mars can provide advantages for maintaining the liquid nitrogen inside of a dewar compared to air pressure on Earth. The rate of heat transfer through conduction and convection is generally lower at lower pressures.

Repairing the vacuum of the dewar might be done with getters and absorbers (they absorb gas molecules chemically), which is a no-moving-parts solution. An insulation layer full of little sorbs is a potentially interesting concept to be considered.

Maintenance and power source:

If solar power isn't sufficient, storing a radioisotope thermal generator (RTG) near the dewars could provide electricity for robotic maintenance and periodic tasks, such as robotic liquid nitrogen top-offs or other automated processes.

A power source would enable the operation of robotic or otherwise autonomous systems for maintaining and servicing the dewars. An automatic computer-controlled refill system involving pipes and valves for topping off the cryogenic dewars, including a remote monitoring and control system, could help maintain the desired levels of liquid nitrogen inside the dewars while minimizing human intervention. A large storage tank providing the refills would need to be topped off periodically.

Controlling and maintaining the cryogenic dewar refill system from Earth or relying on a Mars outpost both have obvious advantages and disadvantages. Operating and controlling the system from Earth would involve significant communication delays. On Mars a number of factors might mean that no one is available to monitor the dewars at crucial moments.

Either way, the system would need a high degree of autonomy and automation. Advanced control algorithms and decision-making capabilities would be necessary to handle unforeseen situations or system anomalies without immediate human intervention.

The cryonics facility as a tunnel in a mountainside on Mars:

A tunnel drilled into a mountain on Mars with several meters of soil above the tunnel, while still being exposed to the Martian atmosphere inside, would offer a favorable combination of thermal stability, radiation shielding, mechanical protection, and accessibility for the cryogenic storage system. A 12-foot diameter tunnel one mile long, for example, could provide sufficient space to accommodate the dewars while allowing for additional infrastructure and access requirements.