MARS TERRAFORMING: 
CREATING SUITABLE CONDITIONS ON MARS FOR THE 
LIFE TO EXIST

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ABSTRACT
Terraforming refers to a term of converting a planet to a 
habitable and sustainable house for life to exist. Terra 
means Earth so any planet whose conditions are to be 
converted to the conditions identical to the Earth is 
known to be terraformed. Mars closest planet to the earth 
contains properties similar to the earth. Mars is mainly 
comprised of carbon-dioxide gas which is trapped inside 
the polar ice-caps in the polar region of the planet. 
Therefore we have to find some way to heat the surface 
of the planet Mars in order to evaporate the carbon-
dioxide gas in the form of vapors which is the life giving 
gas for plants. Next we have to find a way to find some 
more important gases in the atmosphere of mars such as 
oxygen, nitrogen etc. Living on mars is a science fiction 
concept today but after all today’s fiction can be 
tomorrow’s reality.

I. INTRODUCTION
Around 4.54 billion years ago, when the earth is born, 
until now it is the only planet in our solar system where 
life exists. It is just because it possesses the ideal 
conditions for life to exist such as water, oxygen, 
atmosphere, and fertility. But now things are changing 
rapidly. The increasing green house effect with the 
depletion of ozone leading to rapid change in 
temperature made me doubt if it can resist to another 
millions of years. So the biggest question of the century 
is Can there be any alternative? Certainly, there are 
seven more planets on our solar system that can 
accommodate the whole mankind if the modern 
engineering can avail the conditions identical to the earth 
on those planets. The process of converting the 
conditions of any planet to that similar to earth so that it 
could become habitable for the mankind to survive is 
known as terraforming(terra=earth).

II. EARTH 2
The Earth is the most habitable and sustainable planet in 
the solar system for the life to exist. This is due to 
availability of atmosphere, water, oxygen and plants on 
Earth. So if we want the terraforming of any another 
planet we have to make these things available on it for 
the life to sustain. But before that our basic need for the 
hour is that the planet is as close as possible to earth 
since we have to transport the whole earth’s population 
to the planet. Using this condition, the two planets that 
can volunteer themselves would be Mars and Venus. 
Venus the second closest planet to the surface of the sun, 
its size, mass and gravity are all closest to the earth 
which is why it is called the earth’s twin. But I think this 
is point where all similarities end. Its surface 
temperature is around 870°F which doesn’t allow the 
human to land on its surface.[2] To add up the problem 
its atmosphere contains 100 times denser carbon dioxide 
which would definitely choke our lungs and when it 
rains it’s of sulphuric acid. However the science fiction 
writers have even found a way to get aside to this 
problem which is something called floating city but in 
our case the first condition is that the city should be 
reliable and comfortable which is not fulfilled.

Now the remaining candidate alive is Mars. It is a dead 
planet but there is one property of mars that can keep it 
on top of the table i.e. water which is trapped inside the 
polarized ice caps of Mars. The surface of Mars is 
entirely consisting of a gas named carbon dioxide (about 
95.32%). So, in order to do terraforming of Mars and to 
make it sustainable for life to exist we have to warm up 
the surface of mars by about 81 to 100°F. Now the 
question that arises from the minds of everybody is how?

III. MARS TERRAFORMING
The answer lies simply within the problem. It is ironic that the gas which is responsible for warming up our planet earth and building up the threat would be helpful in setting up the life on Mars. Carbon dioxide is the green house gas which would trap the sunlight making the temperature more warm which in turn sublimates more carbon dioxide from the surface leading to more greenhouse effect. Once the cycle has been started it will go on. So now the amount of temperature that is to be boosted up on the planet goes on a steep decrease from 100°F to about 10°F.[3] But wait a minute, still there is a problem, how in this world can we able to increase the temperature of the whole planet by 10°F? We will look again at our modern engineering and still they have a solution.

BoPET (Bi-axially oriented polyethylene terephthalate) is a polyester film made from stretched polyethylene terephthalate (PET) and is used for its high tensile strength, chemical and dimensional stability, transparency, reflectivity, gas and aroma barrier properties, and electrical insulation.[6] It has various trade name the most common of which is Mylar.

![Chemical formula of BoPET or mylar](image)

**Fig 1. Chemical formula of BoPET or mylar**

It is a thin sheet material 10 times thinner than the human hair and what is more better than a material that uses the natural and most efficient source of energy in the solar system i.e. sunlight. So our project until now goes like that:

![Manufacturing of Mylar](image)

**Fig 2. Manufacturing of Mylar**

We have giant enormous sheet of mylar surrounding the mars and controlled by rockets to move in the orbit of mars. This material would reflect the maximum of the sunlight towards the surface of mars. This would increase the surface temperature of the mars to about 4Kelvin. This will surely sublimate the carbon dioxide which is trapped inside to make a dense cloud of atmosphere. The gas as a green house gas will trap the sunlight more and this cycle continues till the surface becomes warm enough to have life on it. But don’t you think we are missing something? It is definitely a great effective and practical concept but surely an engineering nightmare. Manufacturing the huge amount of mylar material that would cover up the whole surface of mars whose radius is about 3,400km is not at all going to be easy. So what I think is of a whole new idea of heating up the surface of Mars but first we would like to study the difference in the conditions of mars with respect to the earth. [10]

<table>
<thead>
<tr>
<th></th>
<th>Mars</th>
<th>Earth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td>0.6kpa</td>
<td>101.3kpa</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>95.32%</td>
<td>0.04%</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>2.70%</td>
<td>78.08%</td>
</tr>
<tr>
<td>Oxygen</td>
<td>0.13%</td>
<td>20.94%</td>
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**Table 1. Comparison of properties of Mars and Earth**

![Three way process of terraforming Mars](image)

**Fig 3. The three way process of terraforming Mars**

In addition to this, the gravity of mars is about 38% of that on earth. This will create many problems related to weightlessness. Mars lacks a magnetosphere, which poses challenges for mitigating solar radiation and retaining atmosphere but on the other hand Mars exists on the outer edge of the habitable zone; therefore Mars has the potential to support a hydrosphere and biosphere.
Another way of heating the surface of Mars is the most complicated task to do in the history of space research. The scientists are trying to create an artificial meteor shower on the surface of Mars that would do the job. According to a study, four 10-billion-tonne ammonia rich asteroids are to be impacted scientifically to generate a rise of eight degrees increase in temperature. Ammonia rich asteroids have an upper hand as they will provide the buffer gas to the atmosphere of the Mars which is nitrogen and is helpful as we know the earth atmosphere consist of majority of nitrogen (around 78%). Moreover the asteroids contain frozen gases that will help thickening the atmosphere around the new planet. The biggest meteorite that has fallen on the American soil is 16 ton which is a fragment of what we require. So here is the question. How can we move an asteroid which is miles apart further miles in the space to collide with our terraformed planet in the right areas. So here is the solution.

![Diagram of collision of an asteroid with the surface of Mars](image)

So finally we have found a way for terraforming Mars and there is a sign that life would exist one or another day on Mars. It has certain advantages over other planets to sustain life. Large amounts of water ice exist below the Martian surface, as well as on the surface at the poles, where it is mixed with dry ice, frozen CO$_2$. Significant amounts of water are stored in the south pole of Mars, which, if melted, would correspond to a planet wide ocean 11 meters deep. Frozen carbon dioxide (CO$_2$) at the poles sublimates into the atmosphere during the Martian summers, and small amounts of water residue are left behind, which fast winds sweep off the poles at speeds approaching 250 mph (400 km/h). This seasonal occurrence transports large amounts of dust and water vapor into the atmosphere, giving potential for Earth-like cirrus clouds.

**IV. CONCLUSION**

The basic need for Mars terraforming is because of the threats that rises from the increase in the earth’s atmosphere and need for an alternate home for the mankind. So here is the plan. First of all four really gigantic asteroids are to be spotted which are about 10-billion-tonne each. These asteroids or meteors are to be pulled towards the back side of the Jupiter’s gravitational field through large rockets which lead them to whip around the orbit of the Jupiter and collides with the surface of the Mars at their polar regions. Due to this collision, the temperature at the polar region of the Mars tends to increase by eight degree which sublimates the carbon-dioxide gas trapped in the polar ice-caps. This gas will act as a green house gas which in turn traps the sunlight making it warmer. This cycle will result in the formation of a dense cloud of atmosphere where phytoplankton are to be planted which converts the remaining carbon dioxide gas into oxygen. The ammonia in the asteroid will act as a buffer gas resulting in more dense atmosphere as well as the foundation for the plants to be planted. Thus the life cycle will automatically be initialized and people will be transported to their new home.

**REFERENCES**

1. Robert M. Zubrin (Pioneer Astronautics), Christopher P. McKay. NASA Ames Research Center (1993?). "Technological Requirements for Terraforming Mars".


4. Gravity Hurts (so Good) - NASA 2001


