The Possibility Of A Space Colony Of Mars

Earth's future has become increasingly unstable over the course of hundreds of years, not only do we face terrorism, climate change and catastrophic events but humans could also be wiped out in an instant by a meteor collision, says Steven Hawkins (Hoare, 2019). In order to ensure the human races survival, we must become a two planet species.

Mars, being one of the closest planets to Earth is our most viable option. Not only does it have an atmosphere, water, oxygen and gravity, but it also has days similar in length to Earth's. Because Mars has an atmosphere, it has the ability to be terraformed, a process that changes the environment of a celestial body to more closely represent Earth's (Cambridge dictionary, n.d.). By thickening the atmosphere we can add protection from solar radiation and heat the surface, an important consideration since it is on average - 60 degrees Celsius on Mars (Sharp, 2017). Water and oxygen, both essential to support human life, would be needed in vast quantities, therefore it would be impossible to bring these resources from Earth. Luckily both are present in the air on Mars. Existing high-tech equipment called Moxie and dehumidifiers will extract these for human use.

So how would we get there? Large space crafts would be needed to transport the astronauts, necessary equipment, and cargo shipments - which would arrive once every two years. The space crafts will use rocket fuel and solar panels. Due to the orbital alignment of both Earth and Mars, it is only every two years that these planets are at their closest point of approximately 55,000,000km (Cain, 2013). The lowest energy transfer to Mars is a Hohmann transfer orbit, which involves approximately 9 months of space travel. The orbit of the space craft will be boosted so that it follows the orbit around the sun instead of Earth. Eventually the orbits of Mars and the spacecraft will intersect (NASA Science, 2019). Transportation would initially focus on basic set up requirements to support construction crews tasked with establishing rudimentary permanent dwellings on Mars. From these modest footholds expansion would begin.

A significant challenge for colonisation on Mars is the establishment of a reliable power source. Unlike Earth, there are no fossil fuels, and therefore energy production must come from either; wind, geothermal, solar or nuclear energy. Wind energy on Mars is negligible, due to the low-density atmosphere which is only 2% of Earths, so high winds will fail to push the heavy turbines (National Geographic, 2016). Geothermal energy, a potentially abundant power source, has not been proven. It is only speculated that there is geothermal activity and if there is, drills would need to drill potentially 10s of kilometres down to reach it (Dorminey, 2016). Hence, solar power will be used in conjunction with nuclear energy, with the addition of a large power storage unit which will act like a battery. This dual energy source will prevent any power outages brought about by the inconsistency of solar panels; a lack of sunlight at night and dust storms both inhibit solar energy production (Grush, 2018). In addition to this, Mars is further away from the sun than Earth and therefore only has 60% of the sunlight intensity of Earth. Despite this, solar energy is relatively simple and easy to set up and maintain. Space crafts sent to Mars will already be fitted with solar panels, which can be used in the early days of colonisation (Martian Wolf, 2018). A nuclear power plant is the ideal long-term option. Plutonium 338 is a safe product to bring into space, and already is powering various space bodies. Nasa is currently working on Kilopower, small nuclear reactors specifically designed for use on Mars (NASA, 2018). Nuclear fission in the reactors will produce heat, this will be delivered by heat pipes to power generators, called sterling convertors. Nuclear energy is favourable as it is both reliable and power dense, producing around 10 kilowatts of energy, and is self-regulating (NASA, 2018).

Human habitation also requires the ongoing provision of sufficient food and water. The average astronaut eats 0.83 kg of food per meal, a population of 2000 would therefore require 1,660 kg of food per meal. Typically, astronaut food is dried and vacuumed sealed (NASA, n.d.). This would provide for the journey to Mars, however, relying on vacuum sealed food for the longer term would become problematic due to the damaging effects radiation has on its nutritional value. In addition to this, the food is likely to lose colour, making it unappetising (Martian Wolf, 2018). To become a self-sufficient planet, these packaged meals should only be used as emergency supplies. The long-term solution will rely on cellular agriculture, edible insects, and plant-based foods (Carlson, 2019). The growing of crops will require a pressurised and underground greenhouse in order to avoid radiation, therefore artificial light would be required. The soil on Mars contains heavy elements such as lead, copper and iron which can all be harmful to vegetables. Hydroponics are the solution to this, I proposed that peas, tomatoes, radish and rye would all be grown. Algae is high in nutrients and also easy to grow without much sunlight, and insects like crickets can be eaten whole or powdered and used as flour. (Thompson, 2018) In conjunction with this, 50 litres of water on average will be needed to provide for each astronaut. The atmosphere of Mars reaches 100% humidity at night, and therefore a low-tech dehumidifier will extract more than enough water for the growing population, which will ultimately require 100 000 litres of water. In addition to this, surface water in the form of ice can be melted if needed (Petranek, 2015). All waste water will be caught, including urine, sweat and moisture from breath. The water will be kept in large storage containers and will be recycled within the facility by filtering out impurities using chemicals.

Venturing into space can have damaging effects on both the body and the local ecosystem. It is unnatural for humans to live in such a closed environment and this can have many phycological effects on the human body. Mars has a similar day length to Earth, however the nine-month journey could cause insomnia, which will be countered by artificial lighting mimicking Earths sleep schedule (Weir, 2018). The 20 minute communication delay between Mars and Earth means that it will be difficult interacting with mission control and astronaut’s families. This alone can evoke feelings of isolation and loneliness which may lead to stress and anxiety (Weir, 2018). Exercise on Mars is going to be pivotal in maintaining a healthy mind and body. Exercise releases endorphins that trigger a sense of happiness in the brain, boosting moral and helping to prevent the possibility of phycological disorders (WebMD, n.d.). The use of treadmills and other machines will help future Mars inhabitants combat muscle dystrophy and deterioration of the skeletal system due to the lack of gravity by adding muscle to the body. MRI scans have proven that a microgravity environment also causes a change to the brain, and its relative position in the skull as well as a change in fluid distribution throughout the body and vision impairment. Some of these issues are inconsequential however as the proposed mission is one way, there will be no need to readapt to Earth’s environment (Fong, 14). One of the most prominent issues is radiation, it can alter the structure and function of the brain, which will be minimalised by living underground (NASA, 2015). This also helps in reducing human impact on the local environment. It is inevitable that humans will change Mars, and it is understood that this could have irreversible and detrimental effects. Additionally, each human is host to around one hundred trillion microorganisms, it is unknown how these will react to the Mars environment. To avoid any future issues the colony must be contained, which will prove to be an achievable but difficult task.

A mission to mars is an extremely costly investment, sixty six percent being associated with the launch and landing of the spacecrafts (Mars One, 2019). Ultimately, this will need to be funded by the global community, and consequently G-GASA and similar organisation’s budgets will be dependent on the interest and opinions of this community. As climate change in particular continues to become a pressing issue, trepidation of Earth’s future could swing funding one of two ways. Concern for the continued survival of humans may urge huge investment into space travel or perhaps do just the opposite, in fear of ruining yet another planet. Space colonisation is already a controversial issue and arguments are made about how money could be better spent on trying to make our own planet more habitable. Without funding, technological advancements in the industry will be limited.