

# The Colonization of Mars: Ethical Concerns Regarding the Future of Human Life

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On my honor as a University Student, I have neither given nor received  
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## **Abstract**

The space age during the 1960's was once simply a monument to human accomplishment, but since the last humans visited the Moon in 1972, focus has shifted to using space travel as a means to ensuring human survival. This research paper argues for the continued innovation in the field of space travel in order to allow humans to eventually colonize Mars. Initial perceptions around space travel were political in nature due to the context of most early development being formed during the Cold War. However, experts in the fields of science in the early 21<sup>st</sup> century, such as Stephen Hawking and Elon Musk, have grown wary of the human race's ability to survive on the Earth. Although there are several key obstacles that are impeding the success of colonization efforts, including political uncertainty, biological limitations, and social issues, which are difficult to overcome with current technology and institutions, finding these solutions is necessary for the survival of the human race. Climate change, among other societal and political issues, plagues the Earth today and threatens human life if it is not addressed soon, although scientists such as Hawking have claimed that humans are "past the point of no return" and unable to fully fix these underlying problems. As such, investment in space travel and colonization technology and policies are the most effective way to ensure the survival of the human race.

# **The Colonization of Mars: Ethical Concerns Regarding the Future of Human Life**

## **Introduction**

In 1969, the United States became the first country to land a man on the moon, marking the culmination of a politically charged space race and the start of a new age in innovation and technological inquiry. In the decades since, space travel has again become a greater topic of discussion, with some like Harrison and Thomas claiming that the second space age has begun. Companies and countries alike have turned their attentions back to reaching deeper into space and understanding more of its potential for humans (Harrison and Thomas, 2016). It has been popularized by movies, science fiction writing, and mainstream media. Interestingly, the context of space travel has changed as well. Technological development in this field is no longer dominated solely by political motivators. Instead, the question has become: has space exploration, specifically the colonization of Mars, become necessary for human survival? Reputable scientists such as Stephen Hawking appear to believe so, claiming that the mission to move humans to a new home world has become the greatest priority for mankind. He, like many others, believes that the Earth has “reached the point of no return,” where the damages done to the planet’s environment have become irreversible (Gohd, 2017). This mindset has driven the movement to explore the planet further. However, complications still exist that limit the human race’s ability to reach and settle the planet. A mix of technological, political, and societal factors that impact how humans could survive on Mars stand in the way of effective colonization, and now the governments of the world must decide whether to go forward with the effort to reach Mars, or whether to attempt to mend the damage done to the Earth. Forcing humans into an unknown world that lacks the same social constructs, political stability, and infrastructure as the Earth poses significant drawbacks. For these reasons, colonization is often seen in a negative

light. However, efforts to colonize must be supported in light of failures on the Earth, because moving to a new planet offers a fresh start with knowledge of how to preserve the ecosystem. As the motivation behind the colonization of Mars changed from being political in nature to necessary for survival, continuing innovation in the field of space travel has become vital for human survival, even in the face of political, social, and technological challenges.

An important tool in the analysis of this debate is the History of Technology. This methodology studies not only how technology and society are interconnected, but how context of the past impacts how technologies are developed in the present. It looks holistically at how historical context could be flawed and how those flaws influenced decision-making and technological innovation in the past (Long, Siddiqi, & Post, 2021). Throughout this paper, the driving efforts to innovate new technology to explore space will be analyzed in the context of the historical motivation in which it occurred. The History of Technology provides a means to understand this context more in depth, as it does not simply study the technology that has been and will need to be invented to colonize Mars, but it studies the rationale for invention to begin with and the historical flaws with that reasoning. When obstacles to space exploration are discussed later in the paper, they will be done so by comparing current and past events. Through the study of history, the ethicality of future programs and endeavors can be studied more effectively. Technology that drives the colonization of Mars will be studied not only through the purposes it must fulfill and the obstacles that must be overcome, but also through the historical context in which it occurred.

## A Shift in Context

The 1960s was a decade plagued by a feud between the two largest world superpowers at the time: the United States and the Soviet Union. In a quest for global power and ideological superiority, both nations turned their attention to space travel as a means to prove themselves the better of their adversary. The first major milestone came when the Soviet Union launched Sputnik in 1957, the first satellite to enter low-Earth orbit. Innovation only escalated from there, driven by the political ideologies of the two nations. The Soviets were also the first to put a man, Yuri Gagarin, in space in 1961, and the United States were quick to gloss over the accomplishment to diminish its impact. Eight years later the Americans landed the first spacecraft on the surface of the moon. The event was recounted worldwide as a great day for “humankind,” though allies of the Soviet Union refused to acknowledge the landmark achievement at all, similarly to how the United States reacted to the Soviet accomplishments. The USSR applauded the achievement, but noted that they had taken more considerable steps in the field before the Americans had (Jouhki, 2019). It is through the reactions of these nations that the context of space travel was most visible. Neil Armstrong walked on the moon to prove that American ideology was superior than the Soviets’, and though the event was largely acclaimed in the technological fields, it was a more powerful political message than any other (Jouhki, 2019). Even before the first man landed on the moon, treaties were drafted in the United Nations, specifically designed to restrict political acquisitions of land not on the Earth (*Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, 2021). It is clear to see that the development of this technology was driven by social and political needs of the United States.

In the decades following the moon landing, the nature of innovation pertaining to space exploration shifted significantly. The last humans to walk on the moon were Gene Cernan and Harrison Schmitt of the Apollo 17 mission in 1972 (Benson, 2019). Since that time, discovery of the solar system has been done in low Earth orbit, such as aboard the International Space Station (ISS), or through rovers and satellites sent across the galaxy to study other celestial bodies. These actions are still being performed today, as shown by the Perseverance Rover that landed on the surface of Mars in February of 2021 (Wall, 2021). However, the lack of human passengers voyaging into deep space is significant. It shows the understanding humans have of their ability to study space through more remote technological means. However, it also highlights the fact that there is much less motivation driving them to send humans to another planet for political gain. Instead of focusing on the political motivators behind space exploration, rovers and space stations allow humans to study the solar system in order to assess their ability to survive on a place other than Earth.

The possibility of finding a new home for humans on another planet was conceived almost at the same time as the first humans set foot on the moon. Benson describes the “overview effect” where astronauts who left the Earth develop an “instant global consciousness, a people orientation, an intense dissatisfaction with the state of the world, and a compulsion to do something about it” (Benson, 2019). NASA likewise has found new purpose, not only in exploring and developing human understanding of outer space, but also in studying the Earth itself. Data from its various satellites indicate the deteriorating conditions of the planet’s surface and atmosphere and the need for humankind to actively attempt to fix it. Astronauts that once landed on the moon have become heroes and spokespeople toward advocating methods to save

the Earth (Benson, 2019). No longer is technological innovation in the field of space travel created to serve a political purpose; it is done to help the human race survive.

This shift in ideology presents itself frequently in every day media, serving as further representation of the change in motivation behind the creation of new space technology. Stephen Hawking is among the most prominent physicists who has added his voice to the debate, claiming that it is time for humans to accelerate the innovation process to ensure that they have a future home (Gohd, 2017). Buzz Aldrin has also suggested that human exploration should begin to “start thinking seriously about what life on Mars might look like in the future” (Gohd, 2017). Along with the input of influential figures is the growing efforts by private companies to invent technology that could benefit colonization efforts. Among these companies is SpaceX, whose CEO Elon Musk claims that within the next two decades, he will be able to establish a one-million-person colony on Mars that could set the foundation for greater numbers in the future (Platt et al., 2020). Evidence of the media’s focus on continuous discovery on Mars and the emergence of new competitors in the industry of space travel symbolize that the efforts to settle other planets has become embedded in society today, engrained to the point where the common perception of innovation in that realm is seen as necessary to survival.

### **Obstacles Blocking the Move to Mars**

While the shift in motivation driving innovation in the field of space exploration has indicated moving the human race to a new planet may be necessary, many argue of the ethicality of these innovations, both in terms of what humans may endure on the surface of Mars and in terms of what they leave behind on Earth.

## *Biological and Technical Obstacles*

It is common knowledge that Mars houses a particularly difficult atmosphere for humans to survive in. Mars lacks the oxygen levels that are required for humans to breathe without technological assistance, and the acceleration due to gravity is significantly less than that of the Earth. In addition to these, an often-overlooked aspect of life on Mars is the increased exposure of radiation which would require significant shielding to maintain the health of the colonizers on the planet's surface (Straume et al., 2010). In one example, over-exposure to radiation on Mars has been stated to increase the chance of developing cataracts in the eyes of colonizers. This is compounded with multiple hardships that the body and eyes endure even on the long flight to reach the planet in the first place (Aleci, 2020). These biological limitations pose significant obstacles to colonizing another planet that must be overcome in order for humans to guarantee their survival. Some experts have offered that biological enhancements could improve upon human anatomy and nature to allow them to survive more easily, though these ideas have often been met with skepticism and hesitancy as it would require a degree of experimentation and trials on the human body (Szocik et al., 2020). In many instances, these biological limitations can be solved with technological advances. The bigger concern, however, is figuring out the ethicality of doing so. Early colonists may be willing to endure the experimentation and testing of helpful technology, but as the general population moves to Mars, more issues would arise in convincing everyone to use these technologies for their own safety. This goes against their autonomy of being able to make their own decisions about their lives and futures. However, coordinated programs from both the governments of the nations mobilizing to the Red Planet and the companies that made the innovations would help satisfy the worries of the public while convincing them to adopt the technology for their own benefit.



### *Political Obstacles*

The biological issues limiting human inhabitation of Mars are a significant barrier, though often overlooked are the social and political concerns that accompany the colonization of new land as well. The Outer Space treaty formed in 1963 dictates that any and all colonies should be made in peace and that land claimed on extraterrestrial bodies cannot be acquired by natural means of claiming sovereignty or through occupation (*Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, 2021). The question then becomes: how will colonies on Mars will be governed? In order to establish effective colonies on Mars, it is likely that this treaty will have to be altered in some way to accommodate the colonization efforts of leading countries. Another proposed solution would be to assign a “Mars Secretariat” to facilitate communication between the countries engaged in colonization. Laws themselves would also have to be different than those on Earth because of the different circumstances on another planet. Sharing homes, food, and other amenities within a smaller population compared to Earth requires different solutions in order to ensure the colony is functioning as it should (Levchenko et al., 2018). Another concern is the cost of colonizing Mars, which is significantly higher than any one company would be able to achieve. Jones states that the only feasible way for humans to form a permanent settlement on Mars would be in the event that it was a direct government operation, as opposed to serving tourist or mining needs which are attractive to many companies (Jones, 2017).

### *Social Obstacles*

Coupled with these political concerns are social factors that play a significant part in the establishment of a permanent settlement. The article *Mars Colonization: Beyond Getting There*

lists several human rights issues associated with creating a new colony on Mars. The prospect of leaving a known world and settling permanently on a new planet can take a heavy toll on the mental health of the passengers. This, coupled with very limited privacy in a newly established “home base” and a lack of traditional freedom and independence, compound to create difficult living conditions on top of the already barren environment. Additionally, issues arise concerning childbirth and the growth of the colony’s population. Beyond potential biological risks, there could be a debate of whether or not the child is a citizen of the parents’ country of birth, as they may not apply to reproductive rights of a given nation. The most difficult part is that colonists must weigh these options entirely before leaving the Earth to settle on Mars, as once they arrive on the planet it may be difficult, if not impossible, to get them back to the Earth (Levchenko et al., 2018). Similar to the biological concerns discussed previously, forcing humans into these undesirable social situations may seem ethically unjust, even if the motivation behind it would ensure their safety and survival. It is the responsibility of the leading governments and companies paving the way for colonization to invent technology that can improve living conditions on Mars so that the humans living in the colony can do so comfortably.

### *Counter-Arguments and Limitations*

Clearly there are several factors that stand in the way of successful colonization. Many argue against supporters of space travel by claiming it is too costly or too dangerous (Jones, 2017). The Red Planet is a foreign location to the human race, and as such the act of reaching it and subsequently colonizing it pose significant risks to those involved. On an ethical note, others feel that humans must attempt to fix the Earth before focusing efforts on a new planet, as there is an obligation owed to future generations to protect their home (Kramer, 2011). The latter is an example of a technological fix, which is a technical solution to an otherwise social, political, or

economic problem that often creates more issues as it resolves the original (Newberry, 2005). Kramer's claim indicates that he feels using new technology to colonize Mars would not fully address the concerns on Earth, and for this reason even more problems would resurface on the new home world. Other concerns discussed above create further deterrents that may push public opinion away from attempting to colonize another planet. It is clear that the technological, social, and political factors that can impact the potential for colonization efforts to succeed are important, but they should not fully discourage any movements to establish settlements on Mars.

### **Justification for Colonization**

In spite of the concerns described above, it has become increasingly important for humans to begin focusing their attention on colonizing Mars. The technological factors, although costly, can be solved with increasing focus in the field of space travel. Private companies are already showing how contributions can come from multiple sources and work hand in hand with existing programs. The clearest example of this strengthening relationship is the launch of the SpaceX Crew Dragon with NASA astronauts aboard on May 30, 2020 (Potter, 2020). The act of a government agency working with private companies like SpaceX and Boeing is significant, and those involved know that the effects reach beyond simply sending more astronauts into space. NASA Administrator Jim Bridenstine claimed that the launch of this spacecraft was “an important step on our path to expand human exploration to the Moon and Mars” (Potter, 2020). Political focus lies on the actions of the governments of the world who feel that colonizing Mars is the best chance of human survival. Already, there have been several instances of unity on this front, where in the past there was only competition. The International Space Station is strong evidence of this unity. Since the station's establishment, 242 astronauts from 19 different countries around the world have visited the station. The two largest contributors to these

numbers are the United States and Russia, which were the largest of competitors at the time of the first moon landing (Garcia, 2020). The United States has also cooperated with China in many instances. In 1996, a Chinese Long March rocket was developed with a US satellite attached to it. However, this ultimately resulted in US technical data being leaked to the Chinese government which would improve their missile programs. The Chinese civil and military programs are not separated like the United States, meaning that cooperation with them could be risky, as they still may have political motivations (Harrison and Thomas, 2016). Cooperation in the field of space travel is extremely important; however, the selection of which countries and companies are chosen as partners is equally key. Though the shift in motivation behind developing more space-oriented programs and technology has largely gone away, there are still cases where one country's nationality is placed before the common good of the human race, as seen by China's manipulation of the United States in 1996. Still, cooperation is necessary. By uniting private companies and a multitude of different countries in a combined effort to explore space and colonize Mars, technological innovation can occur faster and the costs of doing so will be spread out over multiple entities.

This shift in context is impactful in many regards. Had the motivation for forming an extraterrestrial colony simply been political in nature with the goal of proving another nation's ideology to be inferior, then it is difficult to justify spending trillions of dollars on an industry. The competition between countries and companies would also make the costs, both in time and money, of reaching the planet that much higher because of the lack of cooperation. However, the context has become one of necessity. Aaron Ridley claims that humans do not want to "go to the moon or Mars because of population pressure" so much as they simply wish to explore the planet (Jones, 2017). However, population control is only a small factor in the motivation behind

increasing colonization efforts. Climate change and increased global warming are taking their toll on the planet, and in due time it will become less and less habitable for an ever-increasing human population. Increasing numbers of endangered and extinct species, as well as compounding effects on the environment indicate that humans are the root cause for all of these issues (Levchenko et al., 2018). This directly opposes Kramer's assertion that colonizing Mars should be avoided because it neglects the issues on Earth. According to experts, such as Stephen Hawking, the problems on Earth can no longer be fixed, and expending more resources for attempting this would only delay the technological innovation required to traverse space.

It is also important to note that many of the political and social issues depend both on the technology invented to permit humans to live on Mars as well as the political and social institutions instilled by the colonists and the respective governments. Levchenko et al. describe how the issues of which government and laws must be obeyed would likely be changed to some degree with a self-sustaining governing body on the planet itself, capable of adapting to the variable and foreign conditions that the colonists may face (Levchenko et al., 2018). In other situations, technology could enhance the human experience on Mars to more positively affect the colonists by giving them new means to essential resources, areas to retreat to for privacy, or enhance the comfort they experience in their new home. It is the combination of effective technology and proper institutions that would allow humans to better live on Mars.

Many of the solutions to the technological, political, and social issues discussed before have been framed as projects that would require a great amount of spending and time in order to develop. However, other, likely less costly, options could also be chosen to serve as preventative measures against the extinction of the human race on Earth before humans form a permanent colony. One example of this is a recent idea by a team of researchers, led by Jekan Thanga, who

propose that 335 million seed, egg and sperm samples should be sent to the Moon as a safety plan in the event of a catastrophe on Earth. Although other instances of these banks exist, such as the “doomsday vault” in Norway, global disasters such as climate change, nuclear fallout, and a deadly global pandemic could make use of this bank more difficult. Hidden caves and the cold climate on the Moon would be ideal for preserving the samples for hundreds of years (Lewis, 2021). A similar solution could be proposed as a fallback on Mars. By sending samples of human eggs and sperm to the other planet, if disaster were to truly occur on Earth, then human fate would not be fully jeopardized and a colony could be started on the planet because it lacks the same issues that existed on Earth. Sending these samples to Mars acts as a method of preserving human life for the future without having to send a colony of people to the planet before appropriate innovations have been made.

Other programs are used not as safety measures, but as means to study the planet further to guide the creation of technologies that can be used in the future. The use of rovers and drones to survey the planet are equally important to ensure that when humans arrive, they can find the most hospitable location to survive. The Perseverance rover, in its brief time on the Red Planet, has already given insight about the terrain and environment, as well as helped educate innovators attempting to design a vehicle to land on the planet what type of hazards stand in the way of success. For example, both it and its predecessor, Curiosity, experienced turbulence on the descent into the atmosphere, so developing a deeper understanding for the causes of this rocky landing may help in future spacecraft design (Wall, 2021). Through test flights and other preventative measures, it is possible to begin the process of exploring and colonizing Mars without committing to sending humans to a foreign planet. Eventually, a time will come when

sending humans to the planet is necessary, but continued experimentation would reduce uncertainty and the likelihood of failure when the time comes to start a colony.

## **Conclusion**

It is important to understand both the historical context of space exploration as much as it is to comprehend the social and political obstacles that stand in the way of achieving it. This shift in context highlights a change in the way that space travel was perceived by citizens of the world. Where once it was considered to be a political statement against those of opposite ideologies, it is now seen as a means to guarantee human survival. It is through this context that efforts to study space have been redoubled, as the stakes for success are higher than ever before. Because of the worsening conditions on Earth and the irreversible damage that has been done, moving to Mars has become the best viable solution to preserve human life. It justifies an ethical debate and provides a potential, albeit expensive, solution to the issues humans created on Earth. The obstacles in the way of colonization are important to consider, as they directly affect human ability to survive and establish a society on the Red Planet. The human body was not created to endure conditions on a foreign planet that exhibits lower gravity and increased radiation. Social and political factors such as the topics of privacy and governance of the first colonists have often been overlooked but are vital to address. However, it is equally important to note that programs have already begun to develop in an effort to reduce the sudden impact of establishing a colony. Government institutions and initiatives could address these social and political issues while increased innovation may find new and unique ways for humans to survive on Mars. Through thorough exploration, preventative measures, and continuous innovation, it is possible to overcome the ethical dilemmas posed by this problem.

The colonization of Mars offers an optimistic yet distant glimpse into a new home for the human race. Experts suggest that the Earth is nearing the end of its ability to support life, and if this is the case, then the only option is to turn to a new world. Mars offers a solution to this debate, but it depends entirely on the technology invented and the systems that international governments choose to put in place.



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