Space Exploration and its Advancing Future

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Writer's Statement

My whole life I have loved astronomy. It has been my favorite form of science. I constantly stay up late just to look at the planets and stars. The reason I'm so interested in the future of space exploration is because as a kid I fell in love with the movie *Interstellar*. In this movie humanity has abandoned space exploration in hope to focus all of their attention on a dying Earth. They do what they can, but it only puts off the problem for the future. It is then that a former pilot and a few more crew members are sent out to find a more habitable planet. Through their journey they find information and data that they send back to Earth, which allows for a solution to save humanity. This movie is the perfect representation of what we are dealing with now. Many people don't see space exploration as "useful" or "contributing to humanity." They also claim that everything that has been useful is in the past and it's not helping anymore. That is because they don't see the full picture of what it has given us and has to offer. This article hopes to show people that space exploration is useful and not only that, but it is still advancing and is contributing to humanity in more ways than they think. It may not seem like it but when the time comes, we will turn to the vast cosmos for answers, and you may find that it's not as dark and empty as you would have guessed.

Space exploration has been part of human history for hundreds and even thousands of years. Throughout time it has achieved many great feats attributed to large portions of human life, and advanced technology further than early humans ever could have imagined. Originally, humans were only able to study the heavens by observing it from Earth. But now, after years of technological improvements, such as space telescopes and rockets, humanity can study space through an array of different methods that give us the ability to have hands-on experiences. But what can we expect for the future? How else can space exploration be advanced? What can we gain from space exploration? These are all very popular questions and have led people to constantly question if we should continue space exploration at all. If we aren't getting anything new from it, is it worth spending time and money on it? There is a very common misunderstanding about space exploration though. That would be the belief that space exploration has stopped advancing. On the contrary, it is still advancing, reaching new heights, and it is still contributing to society. From basic contributions to major advancements, space exploration is making a difference in this world, and it may even be cheaper than most have expected. This article hopes to prove that space exploration is advancing rather than halting.

Defining space exploration is a good start because it will help avoid confusion as to what is and isn't space exploration. Space exploration, defined by the Earth and Space Expedition Center of Arizona, is the investigation of celestial bodies outside Earth's atmosphere using a variation of different methods (2024). Some of these methods include the use of telescopes, satellites, manned missions, or just the human eye. Each of these methods provides large amounts of information to astronomers. Astronomers then use the information discovered through these studies to help improve human life and to grasp a better knowledge of how the world works. There are also many different areas of space exploration. Some of these include the study of other planets, stars, moons, and even galaxies. Each of these areas combine to make up the overarching study of space exploration. Most of the studies are so people can understand more about the universe, but space exploration also contributes to the economy. In fact, a source from The European Space Agency states, "Space economy is defined by OECD

as the full range of activities and the use of resources that create value and benefits to human beings in the course of exploring, researching, understanding, managing, and utilizing space" (2012). This, and in many other ways, is how space exploration can help humanity. When astronomers discover information, that info can be applied, in some way, to humanity. Some of the ways that it is applied to humanity are through the use of technology, or another is by providing information that can change the way humans live their life.

To address the history of space exploration I will only be covering a brief overview of it. Although it may not seem like it, space exploration has been involved in human history for a very long time and would take quite a long time to cover entirely. To start, space exploration has been involved since the time of Aristotle, Socrates, and many other great philosophers. In fact, it was involved even before that point. People would constantly study the stars, moon, and sun to try and understand how the world functioned. Some of the things we were able to develop throughout the studies were: a daylight cycle, how the solar system functions, etc. As astronomy continues to advance, so does technology. The telescope was invented and used by the famous Galileo, rockets launched satellites which we still use today, and a man landed on the moon. The difference between just studying space by the human eye and what we can achieve now is staggering. Humanity only dreamed of reaching the stars someday, but humanity was able to achieve this dream. In 300 BC humans used just their eyes to study the universe, but in 1961 Yuri Gagarin was launched into space by the Soviet Union. He was bound for a one-orbit journey around Earth on April 12 (Logsdon, 2024). Compared to only using a telescope to observe the universe or making guesses on how the solar system worked based on the sun, this achievement was, in simple terms, a pretty big deal. This is just one of the major milestones shared by the Encyclopedia Britannica, which is known for its extreme range of information on a large variation of different topics. Because of these major milestones, humanity is now able to use satellites to predict weather, advance day to day technologies, and better understand how the cosmos works. Humanity originally thought that the Earth was the center of the solar system and even the universe, but due to research we were able to discover that we are only a small part of a major system of planets, stars, and galaxies. Each of these advancements and achievements are the backbone to how humanity's understanding of the world has greatly increased since the time of Aristotle.

Currently there are many different major space organizations working to achieve different goals, but there are a few common goals that they share. One of these goals is to establish colonization on moons or other planets such as Mars. Another is to make space exploration available to the public. Some of the most common major space companies are NASA, SpaceX, and Blue Origin. NASA is most known for its incredible history of achievements, one of which was landing a man on the moon. NASA is America's largest space exploration company. It has done a large array of things for the people of the world including ongoing research for healthcare that has helped improve certain breathing treatments for those with asthma (Guzman, 2023). SpaceX is currently working on reusable rockets to lower the cost of space exploration and to make interplanetary travel possible. NASA often faced the problem of cost when trying to get an astronaut to the moon. Rockets are not cheap and require lots of design, testing, and money to develop. SpaceX's research will help slash the cost of expensive rockets. Blue Origins is currently working on making space flights open to the general public, but it is expensive and is only available to those who can afford the flights offered. Each of these companies are working on and contributing to achieving some major goal for the future. This begs the question, what can we expect next in space exploration's story? One of the greatest goals for those involved in space exploration is to hopefully inhabit Mars. To do this there are multiple steps. First, we need a way to get humans there. Second, we need to find a way to sustain life on the planet. Third, we need to put it into action. These are only the most basic of steps and each have their own sub-steps. As one can tell, it is a very large task, but humanity is working hard to hopefully try and accomplish it. For example, NASA plans to launch a new

space station in the late 2020s or 2030s, because of this one can expect more future hands-on studies from space exploration.(The School's Observatory, 2022) This will allow scientists to research ways to live in space as well as gather information about it. If we can find a way to live in space, we are one step closer to inhabiting Mars. Humanity has tried to push towards great achievements like this but they each require hard work and small steps to be accomplished. There are also many missions planned for the future, some of these include: the Artemis missions where astronauts will go back to the moon, new rovers being sent to mars for research and study of its elements, and the development of affordable and sustainable rockets to make space exploration cheaper. In the future, we can expect greater advancements of technology and new ways to study outer space, along with the increase of knowledge that accompany it. With the information provided above we can see that space exploration has not come to a halt and it doesn't seem to be stopping anytime soon. There is always something new to study or research that can give us something back.

It is a very big dream to someday achieve long distance space travel. The Artemis missions contribute to this by trying to make travel to and from the moon easier. They are currently involved in sending manned missions back to the moon for the first time since 1972. While doing this the scientists can study the effects of low gravity and find ways to provide sustainable energy, food, water, resources, etc. SpaceX is also helping with this because if NASA wants to travel to and from the moon they will need rockets. They can't keep building new rockets that aren't reusable because the cost would be extremely immense. With SpaceX's help NASA would be able to make it to and from the moon at a low cost. One day technology and research from Blue Origins may allow the public to travel to the moon. With all the goals and dreams of the people here on earth there is plenty to be working towards in the field of astronomy and science. The large corporations and scientists involved in space exploration are as eager as any other person to one day achieve these great goals.

Now all these new hopes are interesting but are they possible to achieve? Well to be short, we don't know. We can't tell from this point. NASA is constantly doing research to try and find a way to achieve these dreams. Some of them seem to be absurdly unachievable though. There is a large portion of humanity that is interested in being able to live on Mars. While there are many that are hoping for such an accomplishment the article "Could we really live on Mars?" by Patrick Moore states a personal view on its probability and it isn't very promising: "Astronauts will be unable to live on Mars except in very restricted conditions; they will have to stay inside their capsules, inside a base or inside their space suits. Mars is not suited to human visitors" (2005). Mars is not suited for life and that is why it is a barren wasteland, but NASA continues to research it in hopes of finding a solution to this problem. This is the basis for all goals. Discovering problems and searching for solutions. Right now, it may seem impossible to live on Mars but maybe in the future it will be possible. So there is not only something to work towards that is helping space exploration advance, but there is a reason to keep the studies going as well. If we wish to someday colonize Mars, the research must continue so that we will find an answer to the problems that we face. After all, Galileo never would have thought a person would walk on the moon some day and we accomplished that. Because of humanity's determination and hard work, we were able to accomplish a task that seemed out of the question.

As I mentioned earlier, cost was a large factor that played in space exploration and NASA is a public company. This begs the question; aren't public funds being spent on space exploration? It's great to be researching things and achieving great feats but should people's money be spent on this when there are so many other things that could help. Alisha Ramani writes how she believes space exploration shouldn't be continued, "we are putting time and money into finding out if there was a droplet of water on Mars at some point in time thousands of years ago, but for what purpose? Being human should mean prioritizing our society and our

planet over the enormous universe above us" (Ramani, 2023). Ramani offers a very important point, there are so many problems here on earth that need to be taken care of. Is space exploration really providing for humanity if it's taking money from the people and spending it on a rover to explore mars. Some say that the best way space exploration can help is to stop and let its money help solve other problems.

This is a very important thing to consider but there is one large problem. There already is money that is being put toward the problems Ramani is talking about. Tax money goes to hospitals, police services, and homeless shelters. Another problem with their argument is that space exploration doesn't get as much money as it seems. NASA is only provided with around 0.5% of the government's taxes a year (The Planetary Society, 2024). In 2023 America collected around 4.4 trillion dollars in taxes (Congressional Budget Office, 2024). So the 25 billion dollars Ramani talks about is much smaller than it seems. NASA may be given a large amount of money compared to other public facilities, but space exploration returns quite a large amount of useful information and technology. With only 0.5% of the US budget NASA gives people satellite imagery of the world, technology advancements such as CT machines, and much more. This tech can be used to save lives. It may seem that space exploration isn't providing for the better of humanity, but you must look at the full picture to understand why it's important.

If humanity thinks that space exploration isn't providing worthwhile returns for its input time and money, they usually aren't putting in enough time and resources. To get results and returns it takes time for them to appear. A person can't put in one day's work and expect a return of a full year. To get a person to the moon it took years of research and hard work. To keep making such immense advancements from space exploration we need to keep up the hard work. It takes time to get good results, and it currently seems that space exploration isn't doing much, but one day it will show that all the work put in now was contributing to a larger purpose. We need commitment for space exploration to advance and based on past experiences when hard work and time is put into this field there are major results.

In conclusion, our plans for the future of space exploration involve many tasks such as new missions to the moon, establishing life on Mars, and general increase of technology/knowledge. Some of these goals seem out of reach from our current standpoint but by continuing research and studies, humanity may one day achieve these goals. Humanity can expect continued advancements in technology, knowledge, and new achievements in space exploration's future. It is indeed advancing, sometimes slow, sometimes fast, but it has yet to come to a halt.

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