

**The Benefits of Space Exploration: Why it is Essential.**

Alex Nielsen

Brigham Young University - Idaho

Advanced Writing and Research

Kristen Brereton

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### **The Benefits of Space Exploration: Why it is Essential.**

Space is a vast and amazing place full of wonders still far beyond our comprehension. The workings of this mysterious space around our Earth remain largely unknown. For literal thousands of years as a civilization we have been interested in the bright lights we see over our heads at night. From the relatively ‘nearby’ moon, to distant moving planets and even other galaxies, we have been mapping and studying the cosmos for millennia. In the last century, we have made a bridge between the ground and the sky, in the form of Rockets.

Rockets are an incredible feat of engineering that have been improving every year for the last century. With rocketry, we have the opportunity for the first time in human history to ‘enter’ space. Since we as a civilization began studying space, it has only been as a distant observer. However now, thanks to rockets, Humans have achieved what was once thought impossible, and left Earth, in a sense. We have large satellites and telescopes outside of Earth’s atmosphere, or even sphere of influence. We have permanent human presence around Earth orbit, and we have human footprints permanently imprinted on the moon, 240,000 miles away.

In a relatively short period of human history, we progressed from wishfully looking at the moon, to standing on it. Imagine for a moment the incredible possibilities if we continue this technological advancement. Before long we could have humans on another planet millions of miles away, we could create colonies, large space stations, and literal human civilizations in space. We could begin using resources not just on our own planet, but from all the celestial bodies that surround us. We could harness more energy than ever before, cleanly, and safely. These are the steps needed to move human civilizations into the dreamy futuristic worlds that until now, have seemed so far out of reach.

Although many now begin to question: why? Certain people say it is too expensive, a waste of time and money. It is impossible, or too far out of reach. It's 'just science fiction'. To this I argue, not anymore. Look back 100 years from now, at the end of the First World War. Do you think anyone would have believed humans would possibly be landing on another celestial body anytime soon, or even leave the atmosphere? Likely not, yet in just 50 years, we did exactly that. New technology after technology led rise to what we know now as rocket science. In the midst of the cold war, the space race took place, and we had one of the largest scientific and technological booms in human history. Suddenly humans were in space, reaching further and further and learning more than we could have imagined. This is what humans do, learn and progress. The most exciting part: we do not need another war. In fact, the unified goal to continue our progression can bring the opposite. The dedicated desire to explore further will bring rise to more technologies, better societies, and progress the knowledge of mankind.

It is essential that we continue to dedicate time and resources to progressing our ability to reach the stars. Rocketry and the technologies associated bring rise to more advanced knowledge, faster learning, expansion, and security for our species. Many say we should focus on saving our planet. Space Exploration is one way we can do exactly that. The innovations we create to progress our presence in the universe will only lead to benefits to our home planet as well. Space exploration is a vital aspect of our advancement as a species.

### **Benefits**

The exploration of space is sure to yield incredible benefits that improve our knowledge, technology, and way of life. There are many reasons why rocketry and this development is so important, and why it will be so beneficial. We are, in theory, still a very primitive species, and

we have a lot to learn, but exploring the cosmos is the best way to do so. Our technology needs improvement to do just that. Rocketry and human presence in space will bring rise to amazing innovation that we could not begin to imagine now. Our societies here at home will also benefit. Our nations could be unified, our economy improved, and society made better.

## **Knowledge & Exploration**

We have already learned much from the long-term studies on the international space station. There have been astronauts coming and going for months at a time to the international space station performing incredible amounts of research. First and foremost, it has given us information on how to keep humans healthy in space for extended periods of time, and we have learned more about the physiology of ourselves (Keeter 2018) We have also begun to understand how we can adapt to living in the unnatural conditions in space (Logsdon 2018).

The knowledge that we gain in this way is one of the primary benefits of exploring the vast unknown of. Currently, there are only 5 interstellar probes, the only man-made objects to have left the solar system. The most famous of these are the voyager 1 & 2 probes. They were sent in 1977 to take close fly-by pictures of the planets in our outer solar system. Now they are continuing onward into space beyond our small solar system. In the grand scheme of the universe, our solar system is a tiny spec, much less our planet. There is still an endless number of galaxies, stars, nebulae, and black holes to be reached, and we haven't scratched the surface. While we are likely a long way away from coming near to any star but our own, the several planets in our own system are well within reach.

Moving away from our own planet, we have sent many rovers and probes to study planets surrounding us, in particular the red planet mars. Mars has incredible opportunities for human

discovery and robotics. Daines (2018) suggests mars had conditions long ago suitable for life, and it may be able to quickly answer the question humans have long answered: is there life outside of Earth. The collection of rovers that we have already sent has brought us considerable knowledge already on the origins of the red planet, and our own. It has helped us understand the conditions for life to form, and how to create them. This is paving the way for future human explorers to begin life on the red planet. To do this, we must continue to push ourselves as a race as we work toward this goal.

## **Innovation**

One of the largest technological booms, not only in rocketry, but in fields such as imaging, medicine, and robotics, was the result of the space race. The push for humans to reach the moon and more led to a large portion of the modern technology we benefit from today. NASA has a 'technology transfer program' dedicated to using NASA rocket technologies to improve consumer products. These commercial products based on NASA technology are called spinoffs.

There are all kinds of spinoff technologies that have improved and even saved lives. Rouse, Winfield, & Canada (1990) explained some of the amazing benefits of these spinoffs. From NASA technologies we got digital imaging processing, used to photograph the moon in high definition. It has been adapted to improve and innovate modern cameras and telescopes. Modern monitoring systems for vitals and health evolved from monitoring the health remotely of astronauts on various spaceflight missions. Robotic technologies such as artificial limbs and rehabilitation stemmed from NASA research as well.

There is another major and obvious byproduct that is the result of space exploration: Satellites. Satellites completely changed the game in terms of communication. Thanks to satellites we are able to get near-instant world-wide communication (Gayrard, Balty, & Agnieray 2009). The development of constellation satellite systems such as Starlink has also opened the door for global fast and easy internet access. Satellites are an amazing technology that has connected the world, and they are only possible because of rocketry and space exploration.

## **Society**

Since its introduction to this world as a field of science, rocketry and space exploration have led to countless societal benefits. By developing ways to send people away from Earth, we have inherently improved life here on Earth.

Space exploration is a global industry, and as long as it has been around, has led to global partnerships. Haubold & Wamsteker (2002) is a report on a United Nations and European Space Agency conference. The report details the committee on Peaceful Uses of Outer Space (UNISPACE III). Throughout the report Haubold & Wamsteker explain how the conference was to ‘promote collaborative participation among Member States at both the regional and international levels.’ This is an amazing example of how the research and development of Space Exploration technologies has and will lead to international peaceful relations. Bringing humans beyond Earth is a united front for the world. The most obvious and significant international partnership is the International Space Station. Led by U.S. with NASA, the ISS has been a project with Russia, Japan, Canada, and the entire ESA involved. Launched initially in 1998, there have been several expansions and additions to make a large habitable station in permanent

orbit around the Earth. It has been a universal project to improve relations, and collectively work towards the expansion of mankind's knowledge and abilities.

The ISS is still being used heavily for research purposes today, and in the last couple years, a major development has been made in the world of human spaceflight: a commercially owned spacecraft brought humans to the international space station. Commercial company SpaceX's Crew Dragon capsule launched by their Falcon 9 rocket, has brought U.S. NASA astronauts to the International Space Station. The commercialization of spaceflight is a milestone that will rapidly develop our knowledge in the field and stimulate economic growth (Barron 2011). In his article in the development of space exploration Barron advocates for commercialization in order to have additional support in bringing humans further, faster.

A byproduct of this rapidly growing commercial spaceflight industry is the global economic growth and stimulation that it produces. The space flight industry allows for the general consumer to be in less of an observer standpoint and take some of their own control. While products in the industry are far from the average consumers reach, the goal eventually is for space tourism to be a commonality in our future world. SpaceX has also unveiled future plans for the potential of city-city travel using rockets, just as one would an airplane. In the not-so-distant future rockets may have a turnaround time similar to today's airplanes, as a result, one could purchase a 'rocket ticket' for travel. Imagine being able to go anywhere on Earth in less than an hour: This is just some of the potential of rockets. There are indeed safety and environmental concerns for exactly this form of travel, in the same manner there are safety and environmental problems using airplanes. However, solving these issues is one of the primary goals in mind in the design process. The amount of redundancy and safety precautions on a rocket is astounding, for obvious reasons. As we progress in this industry, we will continue to

find more solutions for increasing safety. Additionally, rest easy knowing the vast majority of the ‘smoke’ that you see being released from the business end of a rocket is water vapor.

Rocketry development is not only good for the economy: the amazing work accomplished by people in this industry has been a source of wonder and inspiration for millions. Monastersky (2009) refers to a survey of hundreds of scientists in all fields. The survey was meant to collect data on the influence and impact of the apollo program on future generations. Half of the respondents said that apollo missions and the moon landing(s) inspired them to pursue science. 90% of the respondents believed that the moon landing still inspires younger generations today to pursue sciences, and not just rocket science or astronomy, most of these respondents belonged to the physical or life science fields.

### **Opposing Views**

Despite the countless and undeniable benefits yielded by human spaceflight and the development of these amazing rockets, many continue to argue that space exploration should not be an important aspect of human development.

### **Earth is in Danger**

People often argue that we should ‘focus on our own planet first’. There are large and growing concerns on the health of our planet, concerns shared largely by me as well. It is true that we should be focusing efforts on aiding and preserving the planet we currently live on. However, using this as an argument against human spaceflight resides in one major flaw: the assumption that looking up to space is ignoring our own planet. The development of space exploration and the preservation of our planet are not mutually exclusive. In fact, studying other



planets, their origins and potential, is yet another way we can learn far more about our own planet. It is also worth remembering that there are now hundreds of satellites in orbit dedicated to the monitoring and research of our own planet for the sake of its salvation. Space exploration is not ignoring Earth's problems, it is a solution to them. The very best example: the amazing satellites mentioned earlier. The only reason we are able to closely monitor the Earth's health, climate, and study it with a 'big picture' view, is the hundreds of satellites all dedicated to doing exactly that.

### **Waste of Money**

It is easy to see the billions of dollars spent on expendable spacecraft, fuel, and R&D. However, the money is spent, not wasted. Given the many aforementioned benefits, the costs are money well spent. Nor is it as much as one might believe. Only 0.5% of the U.S. budget is spent on NASA and space exploration (Monastersky 2009), a considerably small fraction compared to other government spending. The private space industry is also pushing and funding the way for far more space exploration without taking money out of government's pockets. Mendell (2000) also explains the opportunity for future missions to use the resources found on asteroids, the moon, or other planets that we explore. In the future when we are able to reliably and consistently travel to other celestial bodies, we may as a race expand and regain the resources we expend today.

### **Just Science Fiction**

Many people remain unbelievers of the possibilities of space travel, claiming that a future with human colonies on other planets and fast space travel is impossible, and only a thing of

stories. This argument is inherently flawed, however. The spaceflight industry has been around for less than a century and we have already gone leaps and bounds. Another hundred years prior we were using horses to travel. It is difficult to imagine the kind of innovation and technology that will be available to us one hundred years from now. Humans innovate very fast, and while it may be science fiction today, it will be a guarantee tomorrow. Our innovation in rocket technology is not only a thing of the past; In the last 20 years we have learned to land a rocket autonomously using the same engines that brought it to the sky. This feat was thought impossible at the beginning of the 21<sup>st</sup> century, and now it is performed every week without fail. Ceylan (2018) points out how science fiction has already inspired now very real inventions and technologies that run our world. In many cases as Ceylan argues, science fiction is not wishful imagination, it is in part prediction.

### **Conclusion**

What does this mean for us here on Earth today? We all get to witness these amazing feats of engineering and science unfold before our eyes. We have been inspired by space exploration in the past, and we will continue to be inspired in the future. The awe-inspiring vehicles that will make humans interplanetary are being made today, and we can witness, or help. If we don't continue this push for space exploration and rocketry research, we will miss out as a species on amazing technologies that will better our lives today, just as they have been for a century. We are not just putting our way of life at risk however: We are risking our own planet. Space exploration may be the key to learning everything we can about Earth, and how to save it from ourselves and other natural disasters.

However, if we do progress and proceed with this amazing research in spaceflight development, we will witness the benefits in real time. Countries will work together to pursue this ambitious vision. Our economy will gain another crutch to support it. Our technology will continue to boom, not just in quality of life, but in medicine, manufacturing, and energy production. The innovation that will result from this can save individual lives, and the planet as a whole. The next time you see many millions of pounds of an engineering marvel being lifted into the air with a complex combustion reaction: appreciate it with awe, since that beautiful piece of machinery is another step towards the future of mankind that we all dream of.

## References

- Balcerak, E. (2013). The Future of Space Exploration discussed at science policy conference. *Eos, Transactions American Geophysical Union*, 94(28), 248–248.  
<https://doi.org/10.1002/2013eo280004>
- Barron, E. (2011, June 3). *U.S. vision for space exploration: Who benefits?*. AGU.  
<https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2005EO140001>
- Ceylan, S. (2018). Space, architecture, and science fiction: An architectural interpretation of space colonization. *The International Journal of the Constructed Environment*, 9(2), 1–17.  
<https://doi.org/10.18848/2154-8587/cgp/v09i02/1-17>
- Daines, G. (2015, February 13). *NASA's Journey to Mars*. NASA.  
<https://www.nasa.gov/content/nasas-journey-to-mars>
- Gayrard, J.-D., Balty, C., & Agnieray, P. (2009, April 21). *Communication satellites to enter a new age of flexibility*. *Acta Astronautica*.  
<https://www.sciencedirect.com/science/article/pii/S0094576509000253> ]
- GOTTlieb, J. (2019). Space colonization and existential risk. *Journal of the American Philosophical Association*, 5(3), 306–320. <https://doi.org/10.1017/apa.2019.12>
- Haubold, H. J., & Wamsteker, W. (2002). Report on the Tenth UN/ESA Workshop on Basic Space Science: Exploring the Universe - Sky Surveys, Space Exploration, and Space Technologies. *Astrophysics and Space Science*, 282(1).
- Keeter, B. (2018, December 4). *Space colonization*. NASA.  
[https://www.nasa.gov/centers/hq/library/find/bibliographies/space\\_colonization](https://www.nasa.gov/centers/hq/library/find/bibliographies/space_colonization)
- Logsdon, J. M. (2018.). *Human beings in space: Debate and consequences*. Encyclopædia Britannica. <https://www.britannica.com/science/space-exploration/Human-beings-in-space-debate-and-consequences>
- Mendell, W. (2000). The moon: Resources, future development, and colonization. *Eos, Transactions American Geophysical Union*, 81(1), 4–4. <https://doi.org/10.1029/00eo00006>
- Monastersky, R. (2009, July 15). *Shooting for the Moon*. Nature News.  
<https://www.nature.com/articles/460314a>
- Rouse, D. J., Winfield, D. L., & Canada, C. (1990, December 14). *NASA SPINOFFS TO BIOENGINEERING AND MEDICINE*. Science Direct.  
<https://www.sciencedirect.com/science/article/pii/009457659190067F>