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Out-of-This-World Thrills: The Psychological and Social Aspects of American Astronauts' Life in Space

ABSTRACT: *This article focuses on sixty years of space exploration (1960-2020) by analyzing the factors that push astronauts to seek such "out-of-this-world" thrills. Based on the astronauts' memoirs and footage from the International Space Station (ISS), it examines the selection and training of astronauts, addresses their daily activities, and discusses the future of space exploration. The author argues that space travelers derive their primary motivation from the extreme training they receive, from the adrenaline rush that comes with living in zero gravity, and from the assurance that their missions will be continued by future generations.*

KEYWORDS: *modern history; U.S.; National Aeronautics and Space Administration (NASA); astronauts; Apollo 11; Skylab; International Space Station (ISS); Buzz Aldrin; Michael Collins; Joseph Kerwin*

Introduction

On day three of *Apollo 11*'s 1969 lunar landing mission, as the space crew moved closer into the shadow of the moon, U.S. astronaut Buzz Aldrin recalls marveling at the "moon's protruding ridges and the impressions of craters, almost adding a 3-D sensation to our view."[1] Experiences like this are shared by all space travelers as they chase the thrill of life outside of Earth. Like the technology used, these experiences have evolved due to advancements that facilitate a more "Earth-like" environment in space. Yet, regardless of the surge in innovations, astronauts base their career choice on the notion that they will experience drastic differences in habitat: the expected change in environment actually increases their enthusiasm.

For this reason, every new objective set by the *National Aeronautics and Space Administration* (*NASA*) since its establishment in 1958 has ignited an increased interest in exploring new dimensions of space.[2] What we know about life outside of Earth is that it is arduous and requires many adjustments by and for the astronauts: from the food they eat to the way they carry out mundane daily activities, life in space is more challenging than we can imagine. Likewise, the selection process of astronauts replicates the trials of life in space. From every one of its missions, *NASA* gathers new data that facilitate more realistic training, allowing the agency to narrow the possibility of selecting an unsuitable person.

By looking at astronauts' memoirs, which contain anecdotes about the space explorers' life and time in space, in combination with streamed footage from the *International Space Station* (*ISS*), which shows us the realities that come with living in space, we can develop a deeper understanding of the thrill that pushes

[1] Buzz Aldrin and Ken Abraham, *Magnificent Desolation: The Long Journey Home from the Moon* (New York: Crown Publishing Group, 2009), 10.

[2] Neal Thompson, *Light This Candle: The Life and Times of Alan Shepard* (New York: Crown Publishers, 2004), 159.

astronauts into a career in space exploration.[3] Each individual, even those participating in the same mission, have a unique story. Also, each mission differs in many aspects, and by taking these differences into consideration, we are able to gain a deeper understanding of what drives each astronaut.

While life in space is not a major subject of historical scholarship (yet), it draws the interest of many other academic disciplines. For example, psychiatrist Patricia Santy[4] and psychologist Albert Harrison[5] have discussed the psychological aspect of selecting astronauts, and whether *NASA* is prepared to identify people for long-term missions that can take from several months to a few years. Psychiatrist Nick Kanas[6] and journalist Neal Thompson[7] both tackle the issues of life in space from a social viewpoint, discussing the types of behaviors that might arise when crew members interact in close quarters. Journalist Giovanni Caprara[8] and freelance writer John Catchpole[9] have attempted to map out the future of space exploration and what is needed to have sustainable life outside of Earth.

By examining the vetting and training process that enables astronauts to engage in communal living outside of Earth, as well as the prospects for habitable life in outer space with the continuance of programs such as the *International Space Station* (*ISS*), we can dive into the psyche of astronauts to learn about their motivation. This article argues that space travelers derive their primary motivation from the extreme training they receive, from the adrenaline rush that comes with living in zero gravity, and from the assurance that their missions will be continued by future generations.

I. Selecting the Right "Stuff"

Astronaut selection plays a significant role in the success of a mission, and for this reason the vetting process is complicated and consists of training and tests that push people to the extreme. It is here that the thrill of an adventure starts for future space travelers. Looking at the different psychiatric and psychological evaluations, simulation trainings, and environmental trainings helps us understand the

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[3] kW Space TV, "ISS - International Space Station - Inside ISS - Tour - Q&A – HD," *YouTube* video, 29:16, March 31, 2016.

[4] Patricia A. Santy, *Choosing the Right Stuff: The Psychological Selection of Astronauts and Cosmonauts* (Westport: Prager Publishers, 1994).

[5] Albert A. Harrison and Joshua Summit, "How 'Third Force' Psychology Might View Humans in Space," *Space Power* 10, no. 2 (1991): 185-203.

[6] Nick Kanas, "Psychosocial Issues Affecting Crews during Long-Duration International Space Missions," *Acta Astronautica* 42, no. 1-8 (January-April 1998): 339-361.

[7] Thompson, *Light This Candle.*

[8] Giovanni Caprara, *Living in Space: From Science Fiction to the International Space Station* (Buffalo: Firefly Books (U.S.) Inc., 2000).

[9] John E. Catchpole, *The International Space Station: Building for the Future* (Chichester: Praxis Publishing, 2008).

importance of scouting qualified candidates who can surpass their limits before being sent off on a mission.

Psychiatric and psychological evaluations are a vital aspect of astronaut selection. Joseph Kerwin served as a pilot for the 1973 *Skylab 2* mission. *Skylab* became America's first space station and functioned as a long-term space residency program. In his memoir, Kerwin discusses the time he was passed up by the *Mercury* astronaut selection process due to him failing the psychiatric examination. Kerwin recounts, "I'll show that son of a gun who's psychologically unsuited for what," as he discusses his immense drive of going to space even after his rejection.[10] Kerwin's psyche was positively affected by his initial rejection, and because of this, he was able to return and pass the preliminary psychological examination. In reality, this is the type of drive needed from astronauts to have successful careers in *NASA*. Michael Collins, Neil Armstrong, and Buzz Aldrin were the first American astronauts to embark on the first moon landing mission. Collins's primary role was to fly the command module that would take all three men back home after the lunar landing.[11] He discusses two psychological tests in his memoir, one being the "Wechsler Adult Intelligence Test," where the group's mean was 132.1, and the "Miller Analogies Test," which measures a person's verbal skills, in which he scored the highest out of the group.[12] Many astronauts see these tests as a hurdle, yet the tests make sure individuals are mentally fit for the rigorous, stressful, and detailed work they will do—work that, if done wrongly, can compromise the mission. Many who choose to apply never pass the initial mental evaluations. Only a select few can handle the intensity and rigor that comes with such the job of an astronaut.

Philosopher Thomas Brouwer discusses the psychological effect that rejection can have on a person. While many see rejection as a negative thing, for some individuals it changes their psyche and serves as an ideological enrichment.[13] Perhaps Kerwin needed that push to get him onto the same mental level as other applicants. In her research, Patricia Santy reviews the criteria used during the *Mercury* psychological selection, which consisted of establishing the job requirements, determining personal-characteristics requirements, devising suitable assessment strategies, and validating the selection criteria.[14] Candidates received eleven psychometric tests that astronauts for the *Apollo* missions were required to pass, and this gave applicants a determined rating which was then

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[10] David Hitt, Owen Garriott, and Joe Kerwin, *Homesteading Space: The Skylab Story* (Lincoln: University of Nebraska Press, 2008), 40.

[11] Michael Collins, *Carrying the Fire: An Astronaut's Journey* (Toronto: Farrar, Straus and Giroux, 1974), 268.

[12] Collins, *Carrying the Fire*, 42.

[13] Thomas N. P. A. Brouwer, "A Paradox of Rejection," *Synthese* 191, no. 18 (2014): 4451-4464, here 4452.

[14] Santy, *Choosing the Right Stuff*, 11.

broken down into subscales.[15] Different skills, aptitudes, and leadership potentials were identified during these psychological evaluations, allowing *NASA* to determine the competencies that each individual could potentially bring to a mission.[16] Recognizing superior aptitudes gives *NASA* insight into any potential problem that an astronaut might have during a mission. Once individuals embark on a mission, they must be prepared to react quickly to any potential problem that might hinder the completion of the task at hand. While everyone is different, finding the candidates with the right skillsets is something these psychological tests attempt to do. The evidence points to a system that still needs a lot of revising. However, overall, it has proven to be successful: the collected data give *NASA* engineers an idea of the human body's limitations and how much further it can be pushed. The vetting procedure is vital to ensure that the right group is selected. Even after rejection, people who truly seek the thrill and experience of life outside of Earth will continue to look for ways to make it into a space program.

Once astronauts pass the psychiatric and psychological evaluation process, the real work begins, as they embark on trainings and simulations that test their resiliency. Astronaut David Scott, the pilot for the *Apollo 15* mission, recalls his excitement as he was training: "[P]art of the beauty of flying is that feeling of becoming part of a beautiful machine which makes you more powerful, able to transcend the limitation of the human body."[17] Astronaut Michael Collins, command module pilot of the 1969 *Apollo 11* mission, recalls that "underwater simulation of weightlessness was just then coming into vogue, and proposals were made to duplicate all my EVA tasks in a water tank and analyze any difficulties which might develop."[18] Extravehicular activity (EVA) simulations are a valuable tool for *NASA* as they can recreate many possible scenarios that astronauts might have to face. They help *NASA* train astronauts to complete any repair needed to the outside of a spacecraft while on mission.

Jim Lovell, command module pilot of the 1968 *Apollo 8* mission, writes,

> [o]n tap for the compliant pilots over the next seven days were blood studies, cardiac x-rays, electroencephalograms, electromyograms, electrocardiograms, gastric analyses, hyperventilation tests, hydrostatic weighing test, vestibular balance test, whole-body radiation tests, liver function test, bicycle stress test, treadmill stress test, visual perception test, pulmonary function test, fertility test, urine test, and intestinal tests.[19]

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[15] Santy, *Choosing the Right Stuff*, 33.

[16] Timothy R. Brock, "Training Nasa Astronauts for Deep Space Exploration Missions: A Research Study to Develop and Validate a Competency-Based Training Framework" (PhD diss., Capella University, 2017), 137.

[17] David Scott, Alexei Leonov, and Christine Toomey, *Two Sides of the Moon* (New York: Thomas Dunne Books/St. Martin's Press, 2004), 29.

[18] Collins, *Carrying the Fire*, 193-194.

[19] Jim Lovell, and Jeffrey Kluger, *Lost Moon: The Perilous Voyage of Apollo 13* (New York: Houghton Mifflin Company, 1994), 180.

The examination process can be brutal and both physically and mentally stressful for the astronaut. In many cases, the body is injected numerous times with different medications that let scientists know how strong and resilient an individual is. Yet, while the examination process might seem rough, once completed and knowing one has been selected can be a huge ego boost, as it suggests that one's body is capable of withstanding the challenges of space.

With regard to the astronauts' adaptability to the type of work they do, Albert Harrison emphasizes that "adaptation is a function of the person and the environment," adding that individual factors, such as predispositions, help astronauts excel during their training.[20] Timothy Brock, in his Ph.D. dissertation, stresses the significance of these high-level examinations, writing that "this research is important because it addresses a neglected domain for the potential application of competency-based training research and practice—space exploration."[21] Astronauts cannot have any physical limitations, and creating examinations that will catch any issues before they are being sent off on a mission is essential. In his M.A. thesis, Michael Johnson describes the training of *NASA*'s *Mercury* and *Gemini* programs as being "complicated and with a steep learning curve."[22] Tyler Peterson's doctoral dissertation also focuses on the *Mercury* program, highlighting the benefits that the physical evaluations of astronauts provide *NASA* in their mission success.[23] All these studies show that, despite the discouraging extremes that many astronauts face as they train to be space cadets, the results are rewarding. Life in space needs to be handled with a unique delicacy, and a person must be prepared to address the challenges that come with it. A spaceship could be hit by a meteor at any moment, power could go out due to solar bursts, and there is a high chance of floating off into space during spacewalks. These considerations, while challenging, are motivators for astronauts. Training induces a profound connection to the type of work astronauts will be performing, and it is during this time of training that we see the excitement push individuals to new extremes.

A considerable portion of the training process is conducted in areas which best resemble the environments and atmospheres the astronauts will face, and this plays an important role in ensuring that trainees are prepared for the intense situations they will encounter in space. Dr. George Muller discusses his 1969 training experience at *NASA*'s Marshall Space Flight Center in Huntsville, Alabama, and he recalls the extreme fatigue he felt with every movement inside

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[20] Albert A. Harrison, *Spacefaring: The Human Dimension* (Berkeley: University of California Press, 2001), 26.

[21] Brock, "Training Nasa Astronauts," 25.

[22] Michael P. Johnson, "Skylab: The Human Side of a Scientific Mission" (master's thesis, University of North Texas, 2007), 20.

[23] Tyler David Peterson, "A Fire to be Lighted: The Training of American Astronauts from 1959 to the Present" (PhD diss., Texas A&M University, 2017), 5.

his space suit as he tried to maneuver his tools in an atmosphere of weightlessness, all of this while being underwater.[24] According to *Apollo 11* astronaut Michael Collins, "the heavy emphasis on the western United States lies in the fact that this region tends to be less densely covered with obfuscating vegetation, and more nearly resembles the moon."[25] Trips to geological terrains that resemble those in outer space create a true-to-life training environment that can be helpful in a dire situation while on mission.

Psychologist Mary Connors has researched the challenges of trying to simulate space-like environments on Earth, and one point she brings up is the need to gather sufficient data to help astronauts have an almost real experience.[26] Historian Tyler Peterson has examined the U.S. Air Force Survival School which puts astronauts through a five-day program: each individual receives a survival kit which resembles the kit they would have in their space shuttle, including "first aid supplies, distress signals, a signal mirror, a radio, matches, a whistle, 10 feet of nylon cord, a knife, a flashlight and six pints of water."[27] They are then sent into the desert where they must learn to survive in heat that can exceed 105 degrees. One of the main reasons for doing this, besides preparing the astronauts for danger, is to analyze their potential. The way people react in simulations is different from how they react in real-life scenarios. There are only a few areas on Earth, such as subaquatic dwellings and polar stations during the winter months, that can be used as training stations to collect data for future space missions. Therefore, scientists cannot predict all future problems that might occur during manned space missions, including those that last for longer periods of time. Much of the data for the latter are collected in submarine and artic bases, which gives us an idea of the risks astronauts might face during long periods of isolation and confinement. Even with such data, it is still difficult to pin-point the exact problems that might arise during longer space missions as technology advances.[28] The astronaut selection process provides us with a deeper understanding how men and women are pushed to have a successful mission. The ability to adapt to space is essential, and having this skill is crucial to secure selection.

II. There Is No Place Like Home?

Even though life outside of Earth is challenging and requires adjustments to ensure a successful mission, many astronauts find themselves chasing the thrill of living in space time and again. As *NASA* scrambles to create technology that helps ease the transition into a comfortable life in zero gravity, it is impossible, at the

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[24] Hitt, Garriott, and Kerwin, *Homesteading Space*, 1.

[25] Collins, *Carrying the Fire*, 79-80.

[26] Mary M. Connors, Albert A. Harrison, and Faren R. Akins, *Living Aloft: Human Requirements for Extended Spaceflight* (Washington: National Aeronautics and Space Administration, 1985), 11.

[27] Peterson, "Fire to be Lighted," 60.

[28] Connors, Harrison, and Akins, *Living Aloft*, 16.

moment, to exactly replicate life on Earth in space. While this might divert many from pursuing a career as an astronaut, it becomes a new challenge that generates a plethora of new skills, sensations, and experiences unlike any here on Earth. These challenges include the carrying out of daily tasks, social-interpersonal stressors, and physical stressors that might arise both internally or externally.

Life in zero gravity captivates the imagination. However, for astronauts, it is a reality full of exciting and innovative challenges. In a 2016 *NASA* tour video posted on the kW Space TV *YouTube* channel, American astronaut Sunita Williams gives us a walkthrough of her (then) home aboard the *International Space Station*, where she excitedly provides details of her daily activities such as brushing her teeth, sleeping, and even using the restroom.[29] As we see her floating in zero gravity—her hair shooting straight up, Williams explains mundane activities and how they are done in space. The video communicates some of the uneasiness of life in space. When discussing the restroom situation, Williams points out the color-coordinated process: she pulls out a tube with a yellow tip, intended to receive urine, and then shows us a small hole, intended for defecating. The whole time, she is joking about the process and shares what could happen if this is not done correctly.[30] In another section, she takes us to the location where food is stored, saying, "we have all this type of food, some of it is dehydrated, so we have to hydrate it and fill it up with water, and some already made, so all we have to do is heat it."[31] Williams describes the food they carry, which is stored in plastic pockets on the side of a module wall. Sleeping arrangements in space are unique, and Williams shows us the small compartments where they have to strap themselves in to avoid floating away while they sleep. Outside of these compartments is the area where they brush their teeth. Williams then begins to brush her teeth, showing us the difficulties of placing water on the toothbrush. As some bubbles float up into the air, she is forced to catch them with her mouth.

In a 2008 article, physician-astronauts Joseph Kerwin and Rhea Seddon discuss the importance of food selection for astronauts during long space missions: "[T]he fact that for any nutritional regimen to work, it must consider the limitations and taste buds of the individuals involved […] the best diet design generated by their work may never become consumed."[32] Space-Bio-scientist Funmilola Adebisisi Oluwafemi and other scholars have researched food for long-term missions, focusing in particular on the importance of keeping astronauts "alive, jolly, and healthy."[33] Creating comfortable living conditions for space residents is extremely

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[29] kW Space TV, "ISS - International Space Station - Inside ISS - Tour - Q&A – HD," 02:17-06:14.

[30] kW Space TV, "ISS - International Space Station - Inside ISS - Tour - Q&A – HD," 05:13-07:27.

[31] kW Space TV, "ISS - International Space Station - Inside ISS - Tour - Q&A – HD," 07:50-09:20.

[32] Joseph Kerwin, and Rhea Seddon, "Eating in Space-from an Astronaut's Perspective," *Nutrition* 18, no. 10, (2002): 921-925, here 921.

[33] Funmilola Adebisi Oluwafemi, Andrea De La Torre, Esther Morayo Afolayan, Bolanle Margret Olalekan-Ajayi, Bal Dhital, Jose G. Mora-Almanza, George Potrivitu, Jessica Creech, and

important. Management scholar Erica Varese and food commercialization manager Paola Cane have examined the benefits of investing in space-food research. Not only can we make food more savory for astronauts, we can simultaneously find new ways to feed humans on Earth in the future.[34] While in space, astronauts must also maintain a healthy regiment to avoid getting injured or losing muscle mass. Food scientist Elena Venir and others have developed a freeze-dried yoghurt that carries the needed amount of calcium to fortify the bones of astronauts while on mission.[35] Scientist Sara Zwart and others discuss a two-way analysis that directs astronauts toward creating a balanced meal with the nutrients and supplements needed to ensure good health.[36] Carrying out daily tasks must include a modicum of enjoyment for the astronauts, especially as missions extend over longer periods. Therefore, scientists are developing technological innovations that help improve the life of astronauts in space, giving them a more pleasant stay aboard.

Forming a sense of comradeship in space is part of the experience. The tight, cramped quarters, as well as isolation from family and friends, can have a significant impact on a space traveler. Astronauts' memoirs allow us to better understand their social behaviors. David Scott, commander of the 1963 *Apollo 15* program, writes, "we became a pretty close-knit bunch during the first year," and he recounts social details of his mission both in space and with the crew below, describing the deep connections he made.[37] Forming a strong team is imperative for the success of space missions, and this includes creating the kind of relationship that surpasses that of just coworkers with your travel companions. Buzz Aldrin, a member of the 1969 *Apollo 11* moon landing mission and the second person to set foot on the moon, remembers, "this was no time for celebration, but in the exhilaration of the moment, I reached over and gripped Neil's hand […] we made it!"[38] Sharing significant moments like this can build a strong connection between people, and in Aldrin's case, this connection occurred during their landing on the moon. Such moments can galvanize a life-long friendship and bond via the shared experience. However, not every mission goes smoothly. Astronaut

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Aureliano Rivolta, "Space Food and Nutrition in a Long-Term Manned Mission," *Advances in Astronautics Science and Technology* 1, no. 1 (2018): 1-21, here 1.

[34] Erica Varese, and Paola Cane, "From Space Food Research and Innovation to Immediate Advantages for Earth Eating Habits: An Aerospace-Food Producer Company Case Study," *British Food Journal* 119, no. 11 (2017): 2448-2461, here 456.

[35] Elena Venir, Manuela Del Torre, Mara Lucia Stecchini, Enrico Maltini, and Paolo Di Nardo, "Preparation of Freeze-Dried Yoghurt as a Space Food," *Journal of Food Engineering* 80, no. 2 (2007): 402-407, here 402-403.

[36] Sara R. Zwart, Vickie L. Kloeris, Michele H. Perchonok, Leslie Braby, and Scott M. Smith, "Assessment of Nutrient Stability in Foods from the Space Food System After Long-Duration Spaceflight on the ISS," *Journal of Food and Science* 74, no. 7 (2009): 215-216.

[37] Scott, Leonov, and Toomey, *Two Sides of the Moon,* 91.

[38] Aldrin and Abraham, *Magnificent Desolation*, 22.

Michael Collins, who flew the command module of the 1969 *Apollo 11* moon landing, gives details of the disagreements between him and the crew: "[W]hen it came time to sleep, an argument usually ensued about the cabin temperature, which was too cold for the commander and too warm for the space walker."[39] Such arguments are bound to be more common during longer missions, but astronauts nonetheless push forward to work together for the success of the mission.

Physician William Douglas explains the social stressors that might manifest themselves in the course of long-duration missions, such as cultural differences, gender differences, and even the amount of work allotted to each individual.[40] Neal Thompson remembers the competition between Allan Shepard and John Glenn before *NASA* selected the person who, in 1961, would become the first American in space. Thompson talks about the similarities and passions these men shared that made them compete against each other, even calling them the *yin* and *yang*.[41] Nick Kanas and others have discussed the cultural differences between crew members, for example, the difference in communication styles between an American and Russian astronaut. Russian astronauts tend to discuss their problems more openly, while Americans tend to keep things to themselves.[42] Such cultural differences can potentially cause issues that can lead to mission failure. Differences in personality also play a considerable role. Groups in space are even more affected by this than groups here on Earth due to the close quarters they share, as well as other stressors that might impact them individually. As crewmembers become increasingly diverse, missions like the *International Space Station* serve as hosts for a wide range of individuals from all over the globe. This has a potential for conflict but can also lead to lifelong friendships.

On long-duration missions, external and internal physical stressors must be recognized. According to Buzz Aldrin, remembering his *Apollo 11* mission to the moon, "we were trained to accept such risks, even the risk of not returning."[43] Jim Lovell, the command module pilot of the *Apollo 8* mission, writes, "for the next two hours, the fatigued crew in the busted ship performed the chores the ground ordered them to perform, only afterward getting the O.K. to go to sleep."[44] In this instance, Lovell is depicting a stressor—the lack of sleep—that can severely hinder a mission and its completion. Joseph Kerwin, a member of the 1963 *Skylab* space station, recalls, "we are farting a lot but not belching much," as he describes the

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[39] Collins, *Carrying the Fire*, 119-120.

[40] William K. Douglas, "Psychological and Sociological Aspects of Manned Spaceflight," in *From Antarctica to Outer Space: Life in Isolation and Confinement*, ed. Albert A. Harrison, Yvonne A. Clearwater, and Christopher P. McKay (New York: Springer, 1991), 81-88.

[41] Thompson, *Light This Candle,* 181.

[42] Nick Kanas, Vyacheslav Salnitskiy, Ellen M. Grund, Daniel S. Weiss, Vadim Gushin, Olga Kozerenko, Alexander Sled, and Charles R. Marmar, "Human Interactions in Space: Results from Shuttle/Mir," *Acta Astronautica* 49, no. 3-10 (August-November 2001): 243-260, here 257.

[43] Aldrin and Abraham, *Magnificent Desolation,* 4.

[44] Lovell, and Kluger, *Lost Moon*, 248.

immense intestinal gas he experienced during his mission.[45] Problems like gas, nausea, or cramps are common in space. They can impact the astronauts' performance and, thus, the quality of their work and their overall mission

Physician Stefano Geuna, psychologist Francesco Brunelli, and scientist Maria Perino discuss the concept of stress and the consequences of long-duration space missions, including physical illness, that might deter people from considering a career as an astronaut.[46] Other potential forms of stressors are emotional responses to anxiety, hostility, and depression.[47] Being in confined quarters for long periods can cause both physical and psychological issues. According to studies done both on Earth and in space, such physical issues can include insomnia, stomach problems such as diarrhea or constipation, and extreme fatigue.[48] The stressful scenarios that astronauts have to face daily can have a lasting impact; however, astronauts make a career out of this stressful way of living—to them, it is a life full of adventure and change, very much unlike an ordinary life on Earth.

Looking at how astronauts cope with life in space shows the extremes to which they push themselves to complete their missions. Once individuals are up in space, it is very hard to bring them back to Earth prior to their scheduled return. No matter how much training—both physical and psychological—someone receives, numerous issues can still arise. Yet, from adjusting to life in space via creating connections with crewmembers to overcoming stressors, astronauts will look past all these to catch a glimpse of their home planet as they chase the thrill of space.

III. To Go Where No Man Has Gone Before

Understanding the potential future of space exploration can help us visualize how astronauts will have to adapt as we venture into new worlds. Pushing further into space will require cutting-edge technology to deliver a successful mission. Likewise, ensuring the safety of astronauts in every possible regard will play a crucial role in the continuance of space programs. While *NASA* increasingly utilizes artificial intelligence and rovers as explorers, we cannot downplay the significance of human involvement in interplanetary missions. Looking toward the future of space travel, we must consider space stations as research models that help scientists and engineers discover new ways of making space missions feel more like life on Earth. Civilians are also interested in living in outer space, which creates a new wave of public demand that works in favor of *NASA* when requesting funding. As we set our eyes toward new horizons, we also continue to devote a vast amount of research toward the possibility of sending humans to Mars. All these programs give us a keen awareness of the thrill that space travel

[45] Hitt, Garriott, and Kerwin, *Homesteading Space*, 265.

[46] Stefano Geuna, Francesco Brunelli, and Maria A. Perino, "Stressors, Stress, and Stress Consequences during Long-Duration Manned Space Missions: A Descriptive Model," *Acta Astronautica* 36, no. 6 (September 1995): 347-356, here 347-348.

[47] Geuna, Brunelli, and Perino, "Stressors, Stress, and Stress Consequences," 349.

[48] Connors, Harrison, and Akins, *Living Aloft*, 13-14.

continues to provide, and why our human instinct of exploration will be the driving force in ensuring that these plans, and many others, come to fruition.

Space stations like *Skylab* and the *International Space Station* play an essential role in helping us understand the impact of long-duration missions on humans and address how we can create a more hospitable environment for future space explorers. Astronaut Joseph Kerwin, whose experience stems from his work with *Skylab* in 1973,[49] has emphasized the importance of space stations in comparison to interplanetary missions: "[I]t was so much more valuable, I felt, as far as understanding the future of spaceflight and taking the next step."[50] Before *Skylab*, space missions were short, not really allowing scientists to collect data on the effects of long-duration space missions. Kerwin adds, "*Skylab* was medicine's first, best, chance to unravel the mysteries of weightlessness."[51] When it was decided to launch a space station program, a lot of the information on the effects that space could have on humans was speculative. Thus, having a space station became a powerful tool to deconstruct the complexities of humans living in space. Because of space stations, we begin to push the boundaries, as we develop new programs in which human involvement plays a vital role. Kerwin writes, "[i]f *Skylab* taught the world nothing else, that one legacy alone would have made possible the future of human spaceflight."[52] In addition to *Skylab*, other stations—like the *ISS*—now serve as catalysts for scientific research.

John Catchpole has discussed the immense input that astronauts have as scientists design space stations for future generations, and being involved in this design process can also fuel the drive toward becoming a space cadet. Catchpole describes *Skylab* as a "mixed blessing," considering the data it provided for long-duration space missions, the immense amount of maintenance that was required to keep it running, and the (alleged) first organized astronaut strike.[53] Catchpole also addresses the medical research conducted in space—gone are the days when only military pilots were chosen to serve as astronauts.[54] More and more scientists are taking an interest in research that extends past the effects that space has on humans. Freelance researcher Paul Hardersen, for example, mentions global warming studies that are currently being conducted.[55] Astronauts today are not "just" experiencing life on a space station, in microgravity, they also experience the vastness of space as they routinely conduct spacewalks. In addition, they

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[49] Skylab became America's first space station, a program directed by NASA, and operated for 24 weeks between May 1973 and February 1974. Hitt, Garriott, and Kerwin, *Homesteading Space*, xi.

[50] Hitt, Garriott, and Kerwin, *Homesteading Space*, 463.

[51] Hitt, Garriott, and Kerwin, *Homesteading Space*, 399.

[52] Hitt, Garriott, and Kerwin, *Homesteading Space*, 461.

[53] Catchpole, *International Space Station*, 5.

[54] Catchpole, *International Space Station*, 347.

[55] Paul S. Hardersen, *The Case for Space: Who Benefits from Explorations of the Last Frontier?* (first published 1996; Shrewsbury: ATL Press, 1997), 100.

engage in scientific research that will empower future generations. All these sensations become encapsulated in the continuance of space missions.

Astronauts are not the only stakeholders in space exploration, as there are many civilians who want a taste of the invigorating thrills of life outside of Earth. Astronaut Buzz Aldrin remarks, "I believe mankind must explore or expire," as he reflects on the future of space exploration and possibly having a comfortable life outside Earth for the common man.[56] Since the beginning of humanity, embedded in our DNA is the need to explore, and today we continue to gaze at the possibility of life outside of Earth. Walter Cunningham, the lunar module pilot of the 1968 *Apollo 7* mission, pens, "Many people—astronauts among them—have compared that first trip to the moon with Columbus's voyage to the new world."[57] This comparison is striking because it juxtaposes the idea of space travel to past exploration. Cunningham explicitly names Columbus, then seen as the person who discovered America, as an antecedent of *NASA*, an American program. However, Cunningham reminds us that, "it not only faces the usual technical risks, but it also has a high potential for further eroding *NASA*'s credibility with Congress,"[58] meaning that *NASA* must continuously innovate to ensure funding. Raising funds is a crucial part of the space program because it is what pays the bills. This plays into the idea of having civilians jump on board the space adventure. Public interest plays a vital role in the allotment of funds. At its inception, *NASA* had the public hooked in amazement and awe, as rocket launches were broadcast on live TV. Today, there are numerous launches, and we often have no idea that they are going on. For this reason, *NASA* must find a way to captivate us once more and entrance us with the mystique of life outside of Earth.

Giovanni Caprara considers the idea of space colonies capable of sustaining life, not just for astronauts but also for their families. Taking inspiration from science fiction, we look toward the future to ensure the survival of human life through space exploration.[59] From this perspective, the idea of life outside of Earth would take on a whole new meaning. Perhaps in the future, we will not be subject to microgravity, and we will be able to walk and go about our day as we do here on Earth. Human-performance scholar Jingning Ao has examined the idea of space exploration becoming a marketable touristic attraction. She points out the different factors that would push people to seek space as a future travel destination, including physical motivators, cultural motivators, interpersonal motivators, and prestige motivators.[60] A combination of some or all of these motivators could have

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[56] Aldrin and Abraham, *Magnificent Desolation,* 312.

[57] Walter Cunningham, and Mickey Herskowitz, *The All-American Boys* (New York: Macmillan Publishing Co., Inc., 1977), 295.

[58] Cunningham, and Herskowitz, *All-American Boys*, 305.

[59] Caprara, *Living in Space,* 196-197.

[60] Jingning Ao, "Ride of a Lifetime: A Netnographic Research to Unveil the Leisure Experience Attached to Orbital Space Tourism" (PhD diss., Middle Tennessee State University, 2018), 31.

a massive marketing effect when trying to capture the public's attention. Ao also considers the potential infrastructure of space tourism with resident populations, as well as the idea of space tourism as a thriving industry.[61] The notion of having civilians in space is refreshing in the sense that it combines the thrill of adventure with that of a family getaway. Future generations may be able to tour the solar system and possibly reside in exotic locations that, today, we can only imagine. Including the public in all this can also create a more technologically advanced world. While life in space may still seem far-fetched, we are closer to launching civilians into the cosmos on a regular basis than ever before. This can help fuel the public passion for space travel and generate funding for a future mission.

Moon exploration ignited a passion for exploring the night skies, and a similar passion will accompany our future missions to Mars. American astronaut David Scott, the pilot of the *Gemini 8* aircraft, explains that "maybe future plans for a mission to Mars will once again ignite enthusiasm for this most extraordinary sphere of human endeavor."[62] The same way space travel to the moon once created intrigue, an interplanetary mission to Mars would do the same. American astronaut Michael Collins, command module pilot of the 1969 *Apollo 11* mission, claims, "the only thing that could have titillated the public and gotten the momentum back was a human-crewed expedition to Mars."[63] This statement is especially true when comparing the start of the space program to the situation today. While the public attention may not be there, there are still many astronauts who are willing to risk their lives to get a taste of life outside of Earth. Collins notes, "someday in the not-too-distant future, when I listen to an earthling step out onto the surface of Mars … I hope I hear him say: 'I come from the United States of America.'"[64] For this, the U.S. must continue to lead the space exploration efforts, and *NASA* must focus on developing a successful mission to Mars.

Hardersen discusses the problems that *NASA* faces as they scramble to secure funding for future missions. This is important to understand, because what was once a heroic career is now seen as just another job, and this decline in public fascination plays a key part in securing a mission to Mars.[65] As *NASA* gets wrapped up in bureaucracy and politics, it loses the public's trust. By creating a manned mission to Mars, *NASA* would once again capture the hearts of America, as well as an interest in space exploration. In a 1998 article, Robert Parkinson discusses the different responses when he talks to children about space exploration. When he asks them about being the next person on the moon, they say they would love to go to the moon. On the other hand, when asked about Mars,

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[61] Ao, "Ride of a Lifetime," 32.

[62] Scott, Leonov, and Toomey, *Two Sides of the Moon,* 375.

[63] Collins, *Carrying the Fire*, 465.

[64] Collins, *Carrying the Fire*, 478.

[65] Hardersen, *Case for Space*, 163-164.

they simply respond by saying, "that hasn't been done yet."[66] Understanding children's perspectives is significant, because they are the future of space exploration. If they remain skeptical when it comes to manned space missions, there is a good chance they will hold on to the same sentiment in their adulthood. Aerospace engineer C. Mark Hempsell argues that the lack of media exposure is to blame for the decline in *NASA*'s popularity.[67] While this may be true, serious planning for a manned space mission to Mars will play a huge role in regaining that much-needed media attention. Space exploration, especially a mission to Mars, will require funding from different sectors to make it possible, and with this comes the need to cast astronauts as heroic American figures, much like they were portrayed in the 1960s during the moon landing. Such an image would further push STEM thrill-seekers to consider careers in interplanetary exploration.

As we reflect upon different ways how *NASA* could re-captivate the public's interest, this does not mean that the future of space exploration is in jeopardy. By continuing to conduct research via space stations, by pushing the limits to have civilians join space travel, and by planning for a manned mission to Mars, we can expect a resurgence in public intrigue—to go where no man has gone before.

Conclusion

The three aspects of space exploration considered in this article—the training and vetting process, the details of life in space, and potential future missions—help us understand what it is that drives astronauts to chase the thrill of space travel. All three are steps toward attaining the goal of being able to live outside of Earth. At one point, being an astronaut was almost considered the equivalent of being a superhero. While it may have decreased in popularity, being an astronaut is still regarded a highly exciting profession. A career as an astronaut comes with a lot of pressure and extraordinary requirements. However, all this recedes into the background when astronauts peek through their small window on board their ship and see the planet they are leaving behind. In that moment, euphoria takes over, and they realize that all they have been through has prepared them for this precise moment. The image of Earth from a distance is enough to leave them wanting more, which is why many astronauts seek to venture off into space again.

This article leaves ample room for future research on missions that are currently taking place, as well as the long-term health issues that might arise as more astronauts seek a more permanent home aboard space stations. On February 6, 2020, at 4:42 a.m. Eastern Time, astronaut Christina Koch set a new record by spending a total of 328 days on board the *ISS*.[68] The ongoing push for new records

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[66] Robert C. Parkinson, "Review of Rationales for Space Activity," *Journal of the British Interplanetary Society* 51 (1998): 275-280, here 277-278.

[67] C. Mark Hempsell, "A History of Space and Limits to Growth," *Journal of the British Interplanetary Society* 51 (1998): 323-336, here 335.

[68] Christian Davenport, "Astronaut Christina Koch Returns to Earth After Record-Breaking Stay on International Space Station," *The Washington* Post, February 6, 2020.

bodes well for the future of the program. Future generations will seek to join a space task force that will lead us to pursue interplanetary missions. Thus, it is imperative for *NASA* to continue to be a significant platform and attract the next generation of STEM majors who are willing to risk their lives to be the next American astronauts. Today, rovers are the ones sending data from Mars, but in the near future we will have the capacity to send humans instead, and—with the same excitement that Neil Armstrong felt in 1969 when he set foot on the moon—the world will once again be captivated by man's achievement in space.

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