Report on Risks of Human Space Travel

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Abstract

There are many risks and problems that must be addressed in order to send manned missions to space. Scientists and engineers must plan and design solutions to obstacles such as effects of microgravity, oxygen production and proper nutrition. When in microgravity, an astronaut does not need to use his muscles very often and over time, the muscles lose mass and the bones lose their density. By providing astronauts with special exercise equipment, they can maintain their physique and health. Oxygen is needed and required for humans to survive, and providing oxygen is vital to any manned space mission. Bringing plants to purify and recycle the carbon dioxide made when humans exhale would result in the much-needed oxygen. Plants serve a double purpose because they also provide foods with the nutrients needed by humans to survive.

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When it comes to long journeys and voyages in a spacecraft and bases on different planets such as Mars, there are many factors to consider. Three main issues will be discussed in this report: The effect of microgravity on the human body, the need for oxygen, and the requirement of nutrition. Human space travel contains many risks and dangers that must be thought about to ensure the safety of the astronauts.

Living in microgravity for long periods of time can lead to physiological problems such as muscle mass loss and bone density loss. Due to the lessened gravity in space, there is a lot less resistance on the body, and the result is less strain on the muscles. On earth, muscles constantly resist gravity when they support the body’s movement. Gravity as a force “tells the muscles and bones how strong they must be” (ThursdayScienceClassroom.com, 2001). When the body is not constantly fighting the pull of gravity, then the bones lose density and the muscles start to lose mass, which then weaken the body upon return to the earth’s gravity. This is a serious problem for astronauts when they return to earth. Since Mars’s gravity is 38% of earth’s gravity, the lessened gravity can affect the human body. Humans do not need to exercise as vigorously on Mars as they would in transit, but they still need to exercise daily to keep the human body physiologically fit to return to Earth.

One method that can be applied to help mitigate bone density loss and muscle mass loss is to exercise regularly while in space. Increasing friction enables users to engage in strengthening exercises rather than repetitive heavy weightlifting. Using special exercise equipment that have settings for increased friction to provide increased resistance can be beneficial to the physical strength of the astronauts and their ability to adjust to earth’s gravity immediately upon return.

Possible constraints with resistance exercises involve maintaining the equipment and making sure that there are replacement parts if something breaks. Replacement parts can be created by using a 3D printer that can print the parts that need replacing.

Oxygen is the most critical gas that must be provided if humans are to ever travel in spacecrafts and establish bases on other planets. It supports cellular respiration required by humans to survive. Carbohydrates are compounds of oxygen, carbon and hydrogen, and are used to provide energy for the body. Oxygen is also needed for the immune system to function properly (Cancaster n.d.). Oxygen is vital both in transit and surface stay (Strickland, 2020). One method that can be used to produce oxygen in space is by splicing H2O molecules into oxygen, but this method requires a supply of water, which may not be in ample supply on Mars. When humans breathe out, they expel carbon dioxide, which is harmful to breathe back in. Plants are capable of converting carbon dioxide back into oxygen. Using photosynthesis, they take in the carbon dioxide and then produce the oxygen needed to survive. A possible solution that can be applied to missions in spacecraft and planets such as Mars is to bring and grow plants and algae in the shuttle and then use pumps that take in the oxygen and spread it throughout the spacecraft and future colony habitats. Plants do not require anything but water and light to function. Water can be provided by recycling the water of the astronauts aboard and cleaning it out as well as taking the condensate from the exterior of the spacecraft. There will also be a locker with blocks of ice that can be melted. Plants are effective at recycling the air and environment and can survive in a closed loop setting, helping humans survive in a closed terrarium ecosystem such as a spacecraft (Masters, 2016). Sustaining and nurturing plants on a spacecraft requires space for the roots of the plants and the growth, as well as water and light for the plants to grow. It is vital to make certain that there are enough plants to provide sufficient oxygen all the humans to survive. If there are not enough plants to produce oxygen, additional oxygen sources will need to be identified to prevent any fatalities. Another potential risk is if a plant has a disease, and that disease spreads rapidly to other plants. The solution to that is to grow the plants in secluded areas to contain any potential spread.

Nutrition is also an important and key factor of survival for both transit and surface stay. Humans need to eat and receive a balanced nutrition in order to survive. The nutrients required from food cannot be naturally produced by the human body and therefore need to be taken from outside sources (Ferriera, 2018). Studies have shown that it is possible and even healthier to have a plant-based diet. In transit on a spacecraft, there will not be enough space and resources that can be dedicated to animal products, but plants for example, require a lot less and have many benefits to survival of humanity (Sisson, 2019). Various vegetables and fruits can be grown in a spacecraft to sustain the astronauts while at the same time, they can benefit the astronauts with producing oxygen for breathing. Another benefit of plants is the fact that they improve the mental health of people (Abgarian, 2019). Plants help reduce anxiety and stress. People feel better when they see green and smell the relaxing scents of various plants. This could benefit greatly in space when people are inside a spacecraft and away from earth for prolonged periods of time. One constraint with growing plants for nutrition in a spacecraft is the amount of space needed for plants such as trees and grains to provide enough food every day. There is a need to research how much plant life will be needed and how much water is required for its survival.

Of the three issues that were addressed in this report, the most critical is ensuring there is sufficient oxygen in the spacecraft and future colonies to maintain human life. Keeping the balance between the rate at which plants recycle the carbon dioxide and the rate at which humans expel carbon dioxide is important for survival and. If humanity wants to expand to other planets, it needs to have a viable source of oxygen for humans to breathe.

In conclusion, in order to ensure the safety of manned missions to space, risks such as effects of microgravity, oxygen and proper nutrition must be solved. The effects of microgravity can be solved by building special equipment that enables astronauts to maintain their health. Risks associated with oxygen production can be solved by bringing plants that recycle the carbon dioxide into oxygen. Proper food and nutrition are made possible by growing plants that produce the necessary nutrients for the astronauts to live.

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YOU CAN BREATHE, EAT, AND EXERCISE ON MARS

March 8, 2020 -Annandale Virginia

Today, space agencies such as NASA have the ability to send missions out to space. Living in space brings with it some challenges that we take for granted on earth: oxygen to breathe, nutrition to function and healthy exercise regimen to ensure no muscle mass loss or bone density loss occur.

Astronauts in space must take proper care of their bodies by making sure they eat healthy and exercise enough so they can return back to earth from a place like Mars. Scientists and engineers have taken great strides in finding ways to ensure the health of the astronaut is maintained while in transit to Mars, on Mars and upon their return.

By taking plants and seeds of vegetables and fruits, astronauts are assured to benefit from not only the nutritional value that plants can provide, but also the oxygen they produce in the photosynthesis process. Additional benefits can be achieved from plants in space by creating an environment similar to the one on earth.

NASA engineers are also developing new exercise equipment to counteract the physiological changes that occur in space, to ensure people can return back to earth and function normally immediately after landing.

If you are ready to join this mission and want more information, please feel free to contact us at info@nasa.gov