Science in safe ways so that it

Design

Science Fiction Paper SynopsisA group of SpaceX astronauts compete with a group of Boeing Astronauts to land on the surface of Europa, drill through the surface and potentially be the first humans to find sentient life on another planet. We follow the SpaceX crew through the mission from the flight, to what they end up finding on the planet. In this story, I will highlight the technology of space habitability in relation to how the moon of Europa could harbor life.

I will also be talking about aspects of living in space for the long journeys that astronauts will have to endure in order to reach these planets. Some of the issues brought forth will be the availability of food, water, and a breathable atmosphere throughout the course of the expedition. I will also be discussing sun and space weather: The sun, its radiation, and its effect on the human body over long periods of time, propulsion, and orbital Mechanics, and the planetary characteristics of Europa compared to other planets and moons. In this research paper, I will be researching and discussing the issue with food, water, and oxygen in a long journey in space and on the surface of another planet I will also discuss the current methods we are using and researching to attack and conquer this problem. Research Paper: Habitability of SpaceSince we already have people living in space for a long duration of time we must already have some kind of system to make sure they are able to sustain themselves in space. Although the technology needed to grow vast quantities of food is fledgling, there are multiple different kinds of ways we have been able to store food in safe ways so that it will not go bad after a long storage period.

Some methods include thermostabilization, radiation, freeze-dried, prolonged shelf life bread, and even untampered food like almonds and brownies that do not go bad to the content of the food (Cooper, 2011). Most of these methods work on the basis of trying to eliminate the threat of microbes from the food. Thermostabilization works by heating the food up so hot that it kills all the microbes that could spoil it and denatures all of the enzymes that could assist with that.

Radiation works with the same concept but uses a slightly different method. Instead of using heat, like the name implies radiation treatment uses intense UV light to render the microbes incapable of reproducing so they can not spread at all. Freeze-drying is the process by which food is first frozen and then put in a vacuum chamber with heat. This causes the frozen water to sublimize as vapor immediately off the food (Fuseideas. com). Freeze Drying food has a couple of benefits: they can last for an extremely long time on the shelf and since they have no water they are both light and compact. Granted, they do require water to be eatable.

Bread can also be chemically manipulated to have a shelf life of up to 18 months, which vastly expands the variety of what can be made (Cooper, 2011). All of these methods work great for a crew stationed in the ISS, but for any mission outside of low earth orbit in which supply runs take years, the crew would have to be much more self-sustainable. A significant factor determining whether or not it is a good idea to take a food into space is the nutrient density of that food.

Some foods like soups and vegetables can be very healthy for your diet but pack many calories and take up a significant amount of volume in a spaceship. A step up from that are most entrees and grains. But the foods that pack the most fuel for your body into the smallest area are actually nuts! Nuts can reach almost 6 kcals per gram (Cooper, 2011), whereas most desserts, even though they are notorious for being high in calories, only pack about 3 kcal per gram. The higher the density of the food the more calories you can pack into a certain volume. Based on the figure to the left you can see that nuts, cereals, and entrees will make up the bulk of the caloric intake of the astronauts eating packed rations from the spaceship.

Aboard the ISS, NASA Astronauts Steve Swanson and Rick Mastracchio have been experimenting with more effective ways to grow plants in a Microgravity environment. They introduced the “ plant pillow” which is a device that helps the plant avoid the issues associated with growing without the effect of gravity. Without gravity, the roots of a growing plant will spread out randomly and the bud will never reach the surface. Watering is another issue because without gravity pulling the water into the soil, the water will just float out of the soil and the plant will remain without water (Foley, 2016).

plant pillow works by trapping water dirt and slow release fertilizer in a bag where they can not float away and placing the seed facing up so that the roots grow into the bad of soil and the stem goes straight out of a little slit in the top of the bag. LED lights are used to provide light for photosynthesis and to give the stems a sense of direction so they continue to grow upward. Currently, crops like tomatoes and peppers are being bred to be dense in nutrients while also being small in volume. Being able to grow vegetables

and other produce in space is very important not only to nutrition but for the psychological benefit of the astronauts. The sight and smell of freshly grown crops will add a more earth-like feel to the ship or station (ScienceAtNASA, 2016). Seeing as though organic produce would be the first to go bad, it is very important that they can be grown on the ship.

New technologies like these will be crucial in making sure that the astronauts can be self-sufficient for long periods of time. Astronauts also need to be able to breathe in air that is the same as our atmosphere, or do they? It turns out that Nitrogen, which accounts for 78% of our atmosphere is practically useless to us physiologically, so actually, its only use would be to maintain the pressure of 1 atm.(Because we need oxygen to breathe and carbon dioxide to be disposed of there must be a series of reactions we can use to achieve this goal and there is! Right now on the ISS oxygen is stored in a cryogenic tank and new supplies come up so that the air can be breathable. But a new method of recycling air is soon to come to the ISS. This system called the “ Out of this world” cycle (https://www.

nasa. gov/pdf/146558main_RecyclingEDA%28final%29%204_10_06. pdf). This process uses the Sabatier reaction and electrolysis to take care of carbon dioxide and hydrogen and to create oxygen. Not only removes carbon dioxide and adds Oxygen, but also recovers drinkable liquid water, and produces methane, which for now is a waste product, but future technology could use methane as a fuel to propel the ship (https://www. nasa. gov/pdf/146558main_RecyclingEDA%28final%29%204_10_06.

pdf). If this could be employed on a spacecraft it would significantly reduce the number of resources needed to be stored on the ship itself which lower costs of fuel. Although the craft would not be entirely self-sufficient, it could still last very long time due to its high efficiency. Its new technology like this that is going to extend our reach into the solar system. This system would also prove to be extremely useful for planets like mars that have massive amounts of water in their polar regions, allowing us access to breathable oxygen through the process of electrolysis. This would make a long-term stay on mars much easier to imagine.

If we were to try to set up an outpost on mars growing plants on the surface would be crucial to surviving. Mars's atmosphere is mostly carbon dioxide (https://www. nasa. gov/pdf/146558main_RecyclingEDA%28final %29%204_10_06.

pdf), and plants need carbon dioxide to conduct photosynthesis. Having plants on the surface of Mars would not only provide us with nutrients from fruits and vegetables but would also produce oxygen from the carbon dioxide in the Martian atmosphere. Although having a greenhouse like construction on Mars is something seen in science fiction films, it turns out it really is not that far off. Studies from the numerous robotic missions to Mars show strong evidence that Mars once has plenty of water, has a alkaline soil, and could be more suitable for growing crops then we had originally guessed.

(Herath, 2010) Scientists at the University of Arizona's Controlled Environment Agriculture Center (CEAC) have created a lunar greenhouse

that could be applied to mars as well. The prototype is an 18-foot long tube that is placed underground to protect the plants and the astronauts from multiple things that could harm them coming from outer space like solar flares, micrometeorites, and harmful rays from the sun. These long tubes would be lit by sodium vapor lamps that are cooled by water. Seeds would be primed inside to sprout hydroponically. (Herath, 2010) When a seed sprouts hydroponically it means it does not need soil to grow, it is surrounded by water vapor and the nutrients it needs to grow. This process requires much less water and is just as effective as growing it in soil (Herath, 2010).

Currently, we have methods of sustaining life in space for semi-long durations as long as they are within reach of constant resupply missions. These methods include pre sanitized food that can last year of shelf life. The only issue is that humans eat a lot of food so we look for food with the densest calorie content.

But resupplying is always necessary. We are currently developing ways to grow plants in space like the “ plant pillow” which would provide a good source of nutrients and fresh food instead of the freeze dried or processed food they would be eating otherwise. The “ out of this world” method is a combination of multiple chemical reactions that can help us create oxygen, convert co2 into water, and the only waste product of this reaction is methane, which could be used as fuel in the future. Looking at the Martian surface to begin growing plants on another planet, we found that Mars’ soil has more nutrients than we thought. Furthermore, prototypes of lunar and martian greenhouses are beginning to surface in labs. All of these facts point

to a bright future ahead of us in making other planets and moons in our solar system habitable to us and the other types of life we need to exist.