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The Next Small Step

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“THE NEXT SMALL STEP”

A Research Paper for the 2022 URSS Project:

“One Small Step”

An Ethical and Universal Approach Towards Space Exploration

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PROJECT OVERVIEW: THE NEXT SMALL STEP

One of the main missions of the project, “One Small Step,” is to re-establish an international set of laws for space settlement. Every person, nation, or private company wanting to participate in space travel should reach consensus when it comes to the enactment of space laws intended to protect the rights of *all* people. The Universal and Constitutional laws outlined in this project demonstrate plausible processes that will help to achieve this goal.

As of 2020, "One Small Step" has produced a new source of laws, called the “Space Bill of Rights” (Bill). The Bill outlines important matters like: trading resources, medical care, electing government officials, and ensuring the preservation of our physical and figurative footsteps in space. The Bill has two main sections: universal laws and laws pertaining to medical ethics. In drafting this Bill, worldwide communities were engaged to supplement the industries that have already contributed to the “space race;” Doing so, helped to prevent impoverished countries from being excluded when it comes to weighing-in on the colonization of space. The “community” consisted of: Africa, Italy, Portugal, Spain, the Philippines, and the United States.

In May 2020, survey questions were generated from a review of various constitutions and sent to the “community”. Participants provided responses they deemed most important for the Bill. For example, the questions touched upon issues at the root of social justice, such as the right to vote. The majority of those surveyed wanted to protect one’s right to vote in the new world on Mars and/or the Moon. They also wanted a Democratic Republic type of government.

The responses were proof that people from around the world are eager to have a say in how space is governed. Therefore, I propose that before modern space laws can be enacted, further research behind space governance and medical ethics must be studied and understood.

"HOUSTON, WE HAVE A PROBLEM"

Scientists from the National Aeronautics and Space Administration (NASA) and other space enthusiast are working to have man "vacationing" in space within the next five to ten years. Effective trajectories are being calculated, the best landing sites are being analyzed, and some of the most valuable resources found in space are being studied and mapped out. However, several more steps must be taken before mankind can vacation in space. The industry needs to ensure human rights are outlined and that medical ethics are intact.

The once "big steps" taken by the United Nations during the Cold War to create international treaties (ex. Outer Space Treaty, 1967) and form space-focused sub-committees (ex. The Committee on the Peaceful Uses of Outer Space) have become so small they are now stagnant. These treaties and committees are what is needed in order to make space exploration possible.

Barely any steps have been taken to create a set of principles regarding the medical and physical needs of humans once they embark on space travel. The lack of a stable international committee or set of laws that incorporate modern advancements in space exploration negatively affects the further development of space governance. In addition, the modern space race has players that are fueled by private companies, with private interests. A more modern approach to space governance must include the views of all people so that space exploration is seen as a collective humankind project, not a competition between corporations.[1] This change in mindset, along with the revival of international space committees and the revision of space laws, to include modern needs and medical ethics, are the "next small steps" that need to be taken in order to achieve success both on Earth and in space.

THE HISTORY BEHIND IT ALL

Global Space Governance references the collection of international, regional, or national laws as well as regulatory institutions and actions, manners, and processes of governing or regulating space-related affairs or activities. It also includes institutions, national laws and regulations, codes of conduct, and confidence building measures between space-faring participants.[1] Global Space Governance was established during the Cold War era, a time where the Soviet Union and the United States (US) were the only two nations capable of spaceflight. Today, there are over 72 nations with some tie to a space agency, 14 of which are capable of orbital launch.

Space governance and law is primarily facilitated by the United Nations (UN) and its space-focused committees. The United Nations Office for Outer Space Affairs (UNOOSA) was established in 1958 to support governments in building legal, technical, and political infrastructure to support global space activities. It helped states understand space law and develop their own national state policy.[2] It has a registry of objects launched into Outer Space and plays an essential role in the formation of additional international organization to address specific issue areas in space regulation.

The Committee on the Peaceful Uses of Outer Space (COPUOS) was formed as a Committee within the United Nations to govern the exploration and use of space for the benefit of all humanity: for peace, security, and development.[2] Once it became official in 1959, this committee became responsible for the creation and implementation of the five UN treaties and other international agreements (Figure 1), all of which pertained to space and space activities. The efforts this committee made were divided into the Scientific and Technical Subcommittee, and the Legal Subcommittee. They would meet annually to discuss issues relating to the major space treaties and international mechanism for cooperation in space.

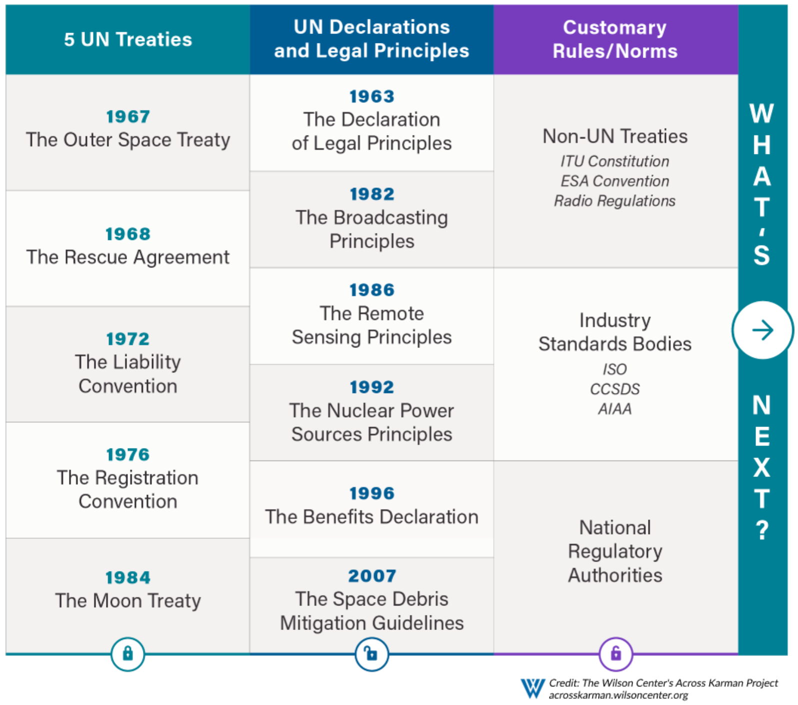

Figure 1 *–This is a chart displaying the several treaties, principles, and "norms" outlined by the United Nations and their space sub-committees during the Cold War Era.*[2]

The five foundational space treaties that COPUOS helped implement worked towards preventing the militarization and colonization of space. The Outer Space Treaty (OST), established in 1967, was signed by the United States, United Kingdom, and the former Soviet Union, making it the first of five space treaties created by the United Nations. The OST made it clear that no party apart of the treaty had the right or ability to make claim over any of the objects or celestial bodies (planets, the sun, moons, etc.) present in our solar system, and that all participating players are responsible for monitoring the activities of their nations in space.[2] As a result of this treaty being signed during the Cold War, any actions made towards the weaponization of space were completely forbidden by the OST. [1]

In 1968, the Rescue Agreement was established by the UN. In the event of an accident or emergency, each nation was responsible for taking the proper measures to rescue, assist, and return the astronauts to their launching state.[2] In addition, nations have the responsibility of helping states retrieve space objects that return to Earth outside of their state's parameters. The Liability Convention (1972), originally known as the Convention on International Liability for Damage Caused by Space Objects, is the third space treaty. This was put into place in case damage was caused by a nation's space object either on Earth or in space. On the basis that each nation is responsible for any space object launched from within their territory, the Liability Convention states that the state where the object was launched from is liable for any damages caused by that same object.[2]

The Registration Convention of 1976 had a single purpose: to register all space objects in order to help fulfill the Liability Convention. While the registration of all objects was first outlined in the OST, the Registration Convention clearly states that all launching states must form a registry of their space objects and inform the UN of descriptions of these objects they plan to launch.[2] The last of the initial UN space treaties is the Moon Treaty (1984). This treaty elaborates on the laws outlined by the OST but puts them in the context of exploring the Moon and its resources. It claims that the Moon is only to be used for peaceful purposes, forbids weapons of mass destruction from being used or placed on the Moon, and prohibits the establishment of any type of military bases or maneuvers being formed.[2]

Progress towards the improvement of the original space governance framework has become stagnate, negatively impacting the further development of space. After the creation of the five UN treaties, no international agreement has been made since the 1970s. The only "laws" created over the past few decades have been non-binding principles that have barley any effectiveness to them. Even international organizations like COPUOS and UNOOSA have not furthered their space governance mission. In the modern-day space race, the private companies looking to partake in space governance are not bound by any of the pre-existing agreements or treaties. Additionally, another modern issue is that the priorities of all the players in this race are different, and any efforts to reach consensus are interrupted by competing economic and military interest.

MEDICAL ETHICS AND BIOMATERIALS

One body of law that has barely had an appearance in the original agreements of the Global Space Governance concerns medical ethics. Medical ethics can be defined as the set of moral principles and beliefs that act as a guide when making choices about medical care.[4] When it comes to medical care, the ethics behind each choice made is dependent upon the patient and the nature of the decision. There are four main universal principles that outline the ethical responsibility that every patient is owed: honoring the patients right to make their own decisions (autonomy), helping the patient improve their health (beneficence), do no harm to the patient (nonmaleficence), and to treat all cases with the same amount of care (justice).[4]

All four of these aspects need to be understood and factored into modern-day space law to ensure the safety of humans in space. Medical Ethics needs to be addressed in order to create comprehensive laws within the field of biomaterials science. Biomaterials science is a field where the scientists are unaware of the challenges space presents to the human body.

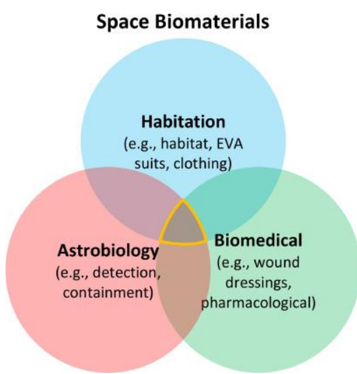

Figure 2 *– Biomaterials pie chart showing the aspects of the field that relate to space and may be helpful during space travel.*[3]

Recent research has led scientists to believe that biomaterials will advance towards lightweight radiation protection, wound healing, creating microbe resistant surfaces, and other advancements (Figure

2). These findings are relevant to space travel and can bolster the creation of space laws. Biomaterials can be defined as any kind of material (synthetic or natural) that serves a medical purpose and comes in close contact with biological systems or components.[3] The most common uses for biomaterials are to replace, treat, evaluate, or augment any tissue, organ or bodily function. Doing so could help prevent or address some of the human body complications that can occur in outer space. Researching this field further can even lead to improvements in Earthly health care as well.

The environment of space allows for the creation of new biomaterials that cannot be produced on Earth. Designing biomaterials to assist with any challenges that may arise in space may also lead to the creation of new biomaterial. Both sources of new materials can not only help solve the challenges of space travel, but also may be the next step to help solve Earthly health problems. For example, one main issue with space exploration is ensuring that all objects launched into space meet certain requirements such as the proper weight, durability, resilience, and multifunctionality.[3] Requirements like these affect the materials used for anything from spacecraft construction or health care. Monitoring our adaption to the new space environment and comparing them to life on Earth leads to the evolution of new biomaterials, which can be used to support future explorations in space.

As biomaterials are being studied to support human health, in addition to enabling research investigations, there are several goals scientists have: to determine the areas in space exploration where biomaterials will provide unique benefits; review existing biomaterials and test if they can be used in space; present a framework to help identify key characteristics of biomaterials that benefit human and inhumane issues, and define "space biomaterials."

Space biomaterials relates to how space missions are designed, built, analyzed, and implemented.[3] Each mission is designed around a certain system; Therefore, each system designer must consider all possible benefits that may come from the use of biomedical materials. The reason a new definition is needed is because on Earth, a material is either a biomaterial or not. However, in space the status of a material is dependent upon how it is used. Defining a new word to help separate various types of materials is crucial in identifying the materials that will or will not work for certain missions.

The environment outside of Earth's atmosphere is inhabitable for human life; Therefore, in order for mankind to vacation in space, information regarding the affects that space may have on the human body must be researched, understood, and shared with all people. Space affects every major organ system within the human body (Figure 3). These bodily systems and organs aren't affected by the weightless environment (ex. floating in outer space). It is when a person enters a gravity environment (ex. Returning to Earth from the International Space Station (ISS) or entering Mars' atmosphere) that their body will start to feel the effects of outer space. Some adaptations happen immediately while others take time to progress during the period the person is in a zero-gravity environment.

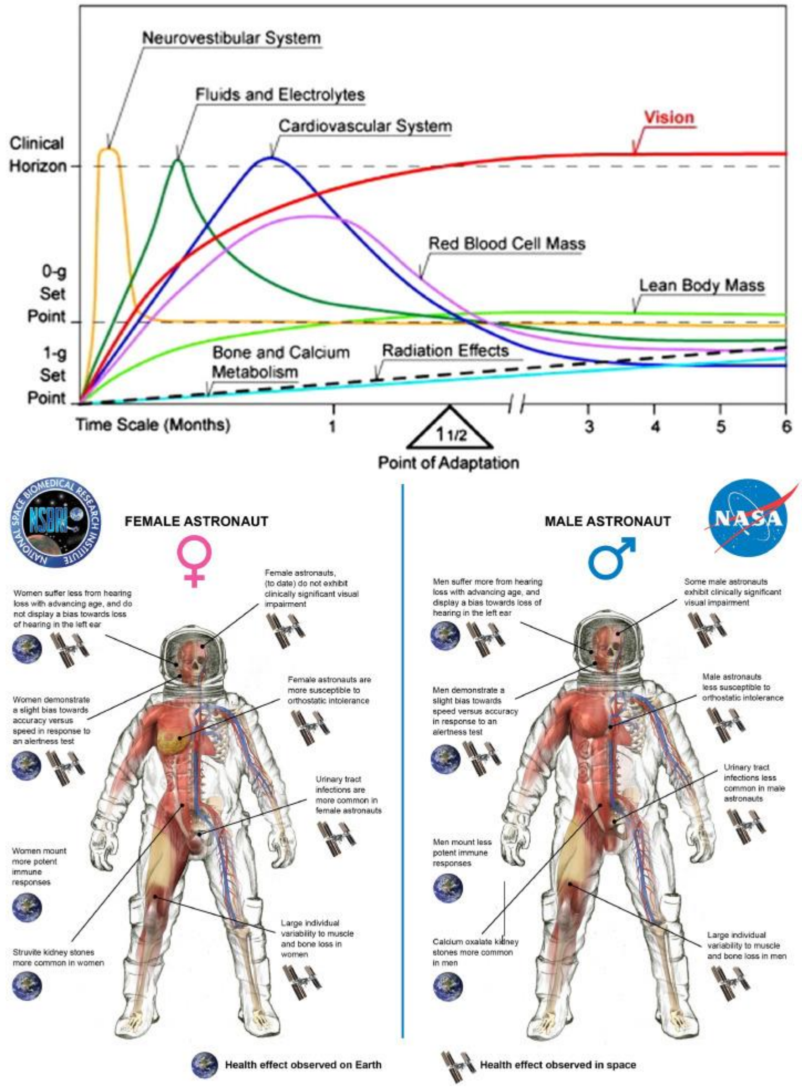

***Figure 3** –Display of the affects that space travel can have on the human body over time.*[3]

The idea that any body type could go into space means there will be a greater variation in the health and fitness of the space travelers. Meaning, there could be pre-existing conditions that need to be addressed. This is another prime instance where medical ethics comes into play. NASA developed the Integrated Medical Model (IMM) to help provide insight into the most common medical conditions that may arise from space travel (Figure 4). These conditions were narrowed down from data gathered during past missions like Apollo, (40% of which were experienced during Apollo), Space Shuttle, ISS, and Mir missions.[3]

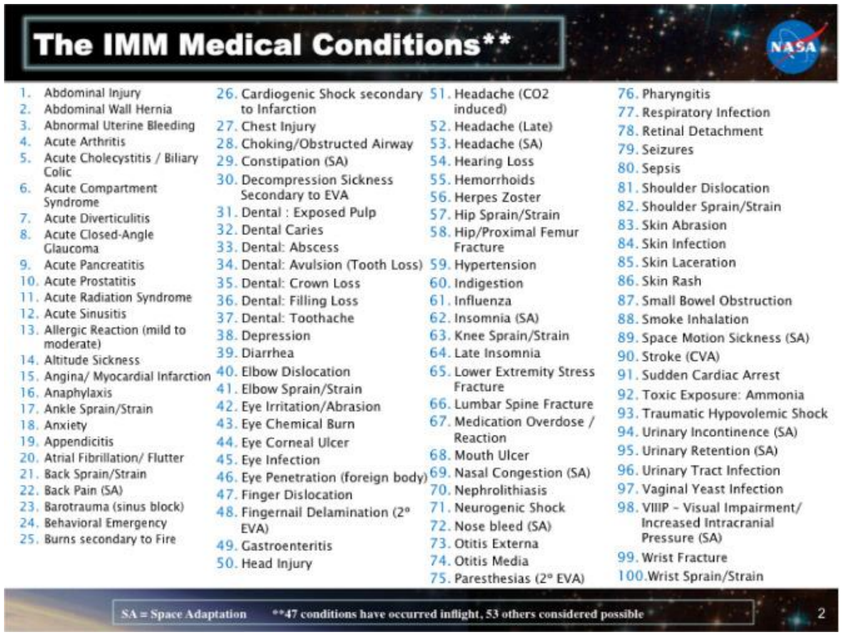

***Figure 4** – NASA's IMM chart, displaying the most common and probable medical conditions that space may cause on the human body.*[3]

The research behind the benefits of biomaterials needs to be explored further. Space exploration can be successful if the following characteristics of space are considered: radiation, microgravity, microbes, fire resistance, and weight to launch. Studying these five factors, along with the newfound information about space and the creation of new biomaterials, is how medical ethics will further develop space laws and space exploration.

CONCLUSION

The "Space Bill of Rights" is just a small step towards re-establishing the space laws and space committee that were present in the UN during the Cold War when Space Governance first became popular. Having this draft as a foundation (no matter how small), along with continuing the research conducted above will further develop the modern-day space race so that man can vacation in space with the comfort of knowing that medical ethics played a part of the space travel journey.

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