UN OFFICE ON OUTERSPACE AFFAIRS PLUS

DIRECTOR

Raymond Wang

CHAIR

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DIRECTOR'S LETTER

Dear Delegates,

Welcome to Pacific Model United Nations 2019 and the United Nations Office for Outer Space Affairs Plus (UNOOSA+). My name is Raymond Wang, a senior at Interlake High School, and I will be serving as your Director for this committee. Accompanying me is my Assistant Director Margaret Guo, a senior from Inglemoor High School and my Chair Luke Jouflas, a junior from Bellarmine Preparatory School.

UNOOSA+ is not your ordinary committee. It is comprised of many organizations that must determine the future of humanity beyond this planet. As technology is being developed to explore space and its mysteries, the possibilities in space are only growing.

The two topics we chose are as follows: Outer Space Treaty and the Privatization of Space and Development of Sustainable Space Technologies. We believe these are the most important current issues to address and are critical in the development of future regulations regarding ownership of space.

Asteroids, minerals, and other resources are abundant in space. Nations, organizations, and corporations are eager to obtain valuable goods. As Earth's finite amount of resources dwindles, humanity must look for alternative sources and come to an agreement on the allocation of resources in the vast reaches of space. Coming to a solution will require agreement and compromise, as it will pave the path for the future of galactic commerce.

Additionally, sustainable space technology is integral in working with Earth's dwindling amount of resources in the future, especially considering the high resource cost of space missions. With space travel and missions being so costly, delegates must come together and find a way to promote reliable and safe practices across hundreds or thousands of miles.

The background guide created by us will serve as a handy guide in getting delegates prepared for important information that will be pertinent to discussion and debate. It should not serve as your only resource, but will be a very helpful one to have with you.

Feel free to email us at unoosa@pacificmun.com with any questions or concerns that you may have at any time. We look forward to seeing you all at PACMUN 2019!

Best wishes,

Raymond Wang

Director | United Nations Office on Outer Space Affairs Plus

Pacific Model United Nations 2019

COMMITTEE OVERVIEW

Welcome to the United Nations Office of Outer Space Affairs Plus (UNOOSA+) at PACMUN 2019! UNOOSA+ is responsible for overseeing and implementing all United Nations outer space affairs through collaboration with the United Nations General Assembly and the United Nations Committee on the Peaceful Uses of Outer Space. As the only committee with both commercial and national delegates, debate in UNOOSA+ will be distinctive and inspiring. In addition to a variety of government space agencies, positions will also include companies such as SpaceX and Blue Origin. To add another facet to debate and include the perspectives of even more entities in the space race, UNOOSA+ will also be comprised of notable private individuals such as Anatoly Yunitskiy and Sir Richard Branson.

Since UNOOSA+, as a fictional expanded version of UNOOSA, is not a part of the official United Nations, discussion in UNOOSA+ will be unlike that of traditional Model UN committees.The relationship and rights of government and company will be deeply explored in this committee. In addition to research about past United Nations actions, a thorough understanding of commercial interests and activities is required. As private individuals have been playing a rapidly expanding role in the development of space technologies, delegates will need to be knowledgeable regarding their positions as well. Furthermore, success in this committee will require a strong imagination, needed to find solutions to the often complex and recent problems associated with outer space. However, resolutions involving extraterrestrial life or banning of commercial entities from participation in outer space affairs are not permitted in UNOOSA+.

As the United Nations body responsible for formulating and orchestrating new policies, UNOOSA+ has a great deal of power and almost full jurisdiction over space. UNOOSA+ is able to implement all actions called for in most resolutions. However, one thing UNOOSA+ cannot do is order troops or peacekeepers. This privilege is exclusive to the United Nations Security Council. Additionally, UNOOSA+ cannot mandate economic sanctions, though they can certainly encourage them and provide frameworks for countries to enforce them.

Position papers are required for this committee and follow the same format as standard committees. They are required to be considered for awards and are a useful guide to position research. Delegates are encouraged to include their entity's stance on both of the topics, past UN action, useful case studies on the topics and their entity's stances on other prominent space groups. **Please submit position papers to the committee's email address, unoosa@pacificmun.com, by the due date as posted on the website.**

TOPIC A

Outer Space Treaty & the Privatization of Space

TOPIC INTRODUCTION

The Outer Space Treaty (1967) was created as the official document for laws and regulations around the usage of space with the first signatures of the document being the US, UK and USSR. As of 2019, 109 countries are in full agreement of the treaty while 23 other countries signed, but not ratified it. The treaty declares that any use of outer space shall only be for the greater good of all people; not limited to peaceful exploration. However, it does place restrictions on what actions can be taken in space, such as banning any militaristic claim or intent of attack on any celestial bodies.

As space travel becomes increasingly common and the technology becomes more readily available, the opportunities to acquire additional resources are multiplying as well. While outer space resources would be useful to any country that can collect them, there comes issues with potentially violating the treaty. It is critical to find a way to ensure all countries can obtain outer space resources while still maintaining the integrity of the treaty or altering it as needed.

It is up to the United Nations Office on Outer Space Affairs Plus (UNOOSA+) to determine the best courses of action to protect the integrity of our planet and the universe.

HISTORY

During the twentieth century, space technology exploded in an unprecedented manner as a result of the competition between developed nations. Before this space race, in the 1930s and 1940s, rockets were developed at a rapid rate by Nazi Germany, the U.S. and the U.S.S.R. to combat foreign and domestic threats presented by the Second World War (i.e. Germany's V-2 missile). These technological developments lead to the use of rockets to orbit satellites as tensions rose between countries in the aftermath of the war as the military advantage of such became obvious. At this time, rockets finally reached the level of power needed to reach orbital velocity which kicked off the space race that defined the late twentieth century. Space agencies like the Chinese National Space Agency, European Space Agency, Indian Space Research Organization, Japanese Aerospace Exploration Agency and National Aeronautics and Space Administration were used to display the power of countries and increase their influence. This led to the fight of being "first" in every aspect of space- whether it be the first satellite, first man in space, or

the first man on the moon. Tensions rose as countries such as the U. S. and U.S.S.R. attempted to spy on each other's military forces. Despite the creation of the Committee on the Peaceful Uses of Outer Space (COPUOS) and United Nations Resolution 1348 (1993) that intended to end this type of militarization, many countries still used space technology in increasingly aggressive ways. For example, the U.S. used satellite technology to gain intelligence to aid in their decisive victory in the Gulf War against Iraq.

Disregarding these conflicts, the international community has been very involved in implementing international law that is relevant to all countries' use of outer space. In 1967, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (the Outer Space Treaty) was signed by 104 parties and outlined the general rules for militarization, liability, rescue, registration and ownership of property from space. This was put forth by both the United States and USSR and is by far the most long-standing document related to outer space affairs. This document was amended several times by UNOOSA+ in the following ten years after the treaty was signed and allowed for space travel to be as efficient and translucent as possible. This international cooperation continued with the building of the International Space Station in 1998 when the participating countries in the project (US, Russia, Japan, Canada and the ESA) convened to create a set of regulations regarding intellectual property rights, criminal prosecution and appropriate usage on the ISS. The United States led this coalition and provided the groundwork for any similar future space cooperation (i.e. colonization of Mars).

Despite laws that prevent any national appropriation of celestial bodies, some countries have ignored international law. The Space Treaty states that any items gained from outer space must be redistributed so that all countries can benefit from the "international treasure." However, the United States has brought back soil from the moon and has not redistributed it in an equitable way. While some of it was given away as signs of peace between their allies, they have given most of it to their own scientists. While this may seem trivial, if other countries continue these actions, international law will have no bearing. Furthermore, this harms all developing nations with no chance at gaining access to such information, which further limits their capacity to participate in space exploration in the future.

As of recent, there have been attempts to take advantage of the resources available in space without violating any international treaties, countries like the US and Luxembourg have legalized the private mining of asteroids and other celestial bodies (2015 and 2016 respectively). This relatively new development shows that countries are finding ways to increase their wealth and influence through their private sector: while this is in compliance with the Outer Space Treaty because the material is not technically the property of the state, these companies are heavily funded and subsidized by the government and poses a potential loophole in the

current international law. That being said, no company has brought back any material from space, so it is unclear how this will hold up in an international court. Through the usage of various observatories and satellites, nations such as Lithuania, Belgium, Israel, Luxembourg and Singapore have been strengthening their involvement in space examination and exploration; it is becoming increasingly apparent that space travel is becoming a necessary part of a state for both functionality and power. It has even become a serious issue of debate in Africa where the African Regional Centre for Space Science and Technology Education was held several times to help address their concerns as developing nations in an increasingly technologically driven world.

PAST UN ACTION

There are five major UN resolutions regarding outer space: the Outer Space Treaty, the Rescue Agreement, the Liability Convention, the Registration Convention and the Moon Agreement. Furthermore, for the purpose of this committee, there are three major declarations and principles outlined by the UN: Broadcasting Principles, Nuclear Power Sources Principles and the Benefits Declaration. These eight documents outline all international law for outer space travel, and will serve as the foundations for debate in committee.

The 1967 Outer Space Treaty was the first major step for international cooperation in space. This document ensures some of the most basic principles regarding space are upheld. Firstly, it guarantees that outer space is international property, and this means two major things for all countries: no government can claim a celestial body and bring back resources from outer space for their gain, and any space exploration must be carried out with the intention of benefiting all mankind. Furthermore, this document outlines a maritime-like system where each country and organization is responsible for any damage or contamination they cause and must not prevent others from possible space travel. Finally, it strongly states that no one may place nuclear weapons or weapons of mass destruction in space.

The 1968 Rescue Agreement is a more controversial document that elaborates on the Outer Space Treaty. In essence, it states that governments must use all feasible means to provide rescue for astronauts or space objects in need of recovering. The source of controversy is mostly due to states being required to rescue astronauts landing in their territories and to permit foreign space agencies into their territory if it would “contribute substantially to the effectiveness of search and rescue operations." While the agreement has been criticized, it provides a thorough approach to international cooperation in space, especially in unexpected landings of astronauts or space objects

The 1972 Liability Convention clarifies the original liability clauses in the Outer Space Treaty. It makes it indubitably clear that every member state must pay for any damage caused by its space objects, intentionally or accidentally; the document then provides a framework for how such incidents should be dealt with legally.

The 1976 Registration Convention provides an extensively desired addition to the Outer Space Treaty that adds accountability to all nations and organizations concerning space objects. All signatories agree to create their own national registries of space objects and to register each object to the United Nations, with the UN retaining the ability to spread the information publicly. This document has proven to be incredibly effective with 88% of all spacecraft being registered and publicized, reducing the chance of collision and unintentional interference significantly.

The 1984 Moon Agreement furthers the sentiments of the Outer Space Treaty's stance on national appropriation and acceptable use of celestial bodies. While it reaffirms that the moon and other outer space bodies can only be used for peaceful reasons, with any natural resources being the property of all mankind, it also recommends an aggressive amount of UN involvement. It states that the UN should be notified of, "[T]he location and purpose of any station established on those bodies" to ensure that all outer space affairs are in the best interest of humanity. Secondly, it states that when it becomes efficient and plausible to obtain resources in space for a profit, an international organization must be appointed to govern it, although there is yet to be such an organization.

The 1972 Broadcasting Principles enforce international law on all outer space objects, most of which are satellites. Firstly, it ensures that television broadcasting must not interfere with the sovereign rights of states, nor the basic human right of being able to freely exchange information. Secondly, it prohibits the throttling of information and states that all broadcasting should be with the intent of allowing free exchange of information of all subjects, in all places, especially as it concerns helping developing nations. Thirdly, this document states that such broadcasting should be with the sole purpose of international peace and security, and that all activities should reflect this. Furthermore, it mandates that all states report on any new broadcasting device, its purpose, location, as well as any potential signals that could disrupt other outer space operations.

The 1982 Benefits Declaration essentially states that outer space exploration and use should be for the overall benefit of mankind, in all its forms. It highly recommends that organizations and developed nations aid developing nations through various partnerships in a fair and equitable manner. Furthermore, it encourages outer space appropriation and scientific developments to be shared to encourage international cooperation and the furtherment of all peoples. Overall, the document suggests that to encourage international cooperation, outer space and the possible scientific developments and resources that stem from it should be

shared so that various research institutions, universities and developing nations can benefit from it.

The 1992 Nuclear Power Sources Principles help prevent catastrophic accidents due to the usage of nuclear power in space, often used to power satellites. It strictly outlines that all states using nuclear must take steps to use appropriate radiation protection and precautions for all potential situations. It also clearly states that in the event of catastrophic failure, the spacecraft must be designed and located so that the impacts on the area where it lands will not exceed an average of 1 mSv every 80 years . Similarly, all nuclear reactors in orbit must be high enough to supply enough time to decay all radioactive materials so that it does not put any current or potential space missions in jeopardy, nor potentially enter Earth's atmosphere in any significant way. Finally, it requires all member-states to publicly declare any time a nuclear reactor will be entering through Earth's atmosphere, as this could be a potentially catastrophic operation.

Overall, while the UN cannot enforce any of these laws rigorously, it does present a logical and strict approach to outer space affairs. However, while these guidelines are well intentioned and help promote equity throughout the international community, their restrictiveness does pose potential problems for both the private sector and nations as they attempt to expand their markets into the vast resources of space.

CURRENT SITUATION

Ratified in 1967, the Outer Space Treaty has since formed the basis of international space law. For decades, this treaty has served as an effective form of legislation, clearly defining what behaviors are acceptable from government entities. However, with the recent rise of global space commercialization, the acceptable activities dictated in the treaty have become problematically ambiguous.

Arguably the most significant piece of the treaty is Article IV, which states that "states shall be responsible for national space activities whether carried out by governmental or non-governmental entities". This essentially means that a country is responsible for all actions taken by all entities that are located in it, as well as for any space objects launched by those entities. For countries that have multiple commercial space corporations such as the United States, this is especially complicated. As each corporation is competing against the others for more profit, conflict within a country's space entities is likely to occur.

Currently, the Outer Space Treaty only states that any intra-country disagreement and its international consequences are at the responsibility of the country's government. In addition to putting countries with more commercial space entities at a significant disadvantage, leaving complex issues such as disagreements between a country's entities completely up to its government is not efficient. The

rest of the articles remain largely followed and there is broad global consensus on their necessity, such as the article prohibiting weapons of mass destruction being launched into orbit.

Regarding the creation of commercial space entities, the United States leads the world in both the amount of and sophistication of commercial space entities, including names such as SpaceX and BlueOrigin. Other developed countries have space corporations either based in or founded in their territories, such as Denmark's Copenhagen Suborbitals and the Australian Gilmour Space Technologies. The technological sophistication of these space corporations is largely not at the level of state-sponsored space departments, with the exception of very large corporations such as SpaceX. Currently, no space corporations have yet reached celestial objects, but many have sent objects into orbit and are planning or developing crewed missions. Clearly, regulation on this topic is needed before technology improves enough for space corporations to reach celestial objects.

CASE STUDIES

CASE STUDY 1: THE UNITED STATES IN SPACE

The United States Space Force (USSF) is a planned branch of the United States Air Force intended to oversee any and all military actions in space. It was proposed by President Donald J. Trump on June 18, 2018 to the Pentagon. On August 9, 2018, Vice President Mike Pence released more information on the United States Space Force, claiming it would be fully established sometime in 2020. A $750 billion budget was proposed by the Senate Armed Services Committee to fund the United States Space Force. Construction for a 26000 square foot facility at Kirtland Air Force Base has gone underway in early June of 2019.

The urge for the United States to begin the creation of the United States Space Force was due to the incredible technological advancements from China and Russia, which have both started investment in hypersonic technology that may potentially disrupt or destroy the United States' satellites. Pence said in an interview that "it's not enough to merely have an American presence in space, we must have American dominance in space. And so we will." As the Outer Space Treaty only bans the placement or use of weapons of mass destruction in space and does not limit the expansion of military power into space or other weapons, the United States is quickly taking advantage and attempting to stay one step ahead of other nations.

Additionally, on August 20, 2019, Pence announced the reformation of the United States Space Command (USSC) on August 29, 2019, a program created in 1985 for joint control over the Air Force, Navy, and Army's space protocol. After 9/11, homeland security became the main focus for the United States and the militarization of space became less of a priority. But now with the creation of the

United States Space Force, the American presence and power in space is seemingly unparalleled. In the words of Air Force Col. Eric Felt, “space is now a war-fighting domain. That doesn’t mean we want war in space... If our adversaries attempt to counter us in that domain, we need to have the capabilities and tools for our nation to counter that.”

While some see this space program as excessive and a waste of money, many fear that in the near future space warfare will become a reality. As this planet faces more and more humanitarian hardships, international warfare may be forced to move into space to minimize civilian casualties or permanent natural damage. The USSF and the USSC may also be seen as a threat or act of aggression to other nations, prompting global militarization of space.

CASE STUDY 2: THE PEOPLE’S LIBERATION ARMY STRATEGIC SUPPORT FORCE

The People’s Liberation Army Strategic Support Force (PLASSF) was created on December 31, 2015 in China. It is responsible for all cyber, electronic, and space related issues regarding the military. It is responsible for multiple launches of Chinese satellites primed for electronic and cyber warfare. The Chinese government has maintained a tight level of secrecy on information about the PLASSF, but there have been multiple leaks. Official sources are limited, but not impossible to find.

China sees the future of modern warfare as “system versus system,” meaning the country with the most capable technology and machinery being the strongest in terms of firepower. It has the capability to cause satellite destruction and interference against potentially hostile nations and other counterspace attacks. Sources say that the PLASSF is highly capable at “sabotaging the enemy’s war command system-of-systems” and can “paralyze the enemy’s operational system-of-systems.” Long-range strikes may be in development.

The lack of information on what the Strategic Support Force is capable of could be highly concerning to nations such as the United States and Russia, which are actively competing for power and influence. Even though enough is known about the general structure of China’s space force, its relatively high level of secrecy could harm foreign policies or unintentionally escalate tensions in the race for the advancement of technology and militarization of space. This could open an entirely new field of informational warfare, where leaked top secret or classified documents could have the power to topple or weaken a nation. The militarization of space by these highly developed nations has extended the battle of dominating global influence to dominating universal influence.

BLOC POSITIONS

Bloc 1 - Countries with Many Private Companies: United States, United Kingdom, Australia, China

Countries that contain many space corporations will want an amendment to the Outer Space Treaty, specifically Article VI. Article VI states that all non-governmental space entity activity must be approved by the state. According to this law, the government of a country must review and approve the plans of every space company in its country before the plans can be carried out. In countries that contain many companies, this would be a very resource-intensive task and could result in conflict between individual companies and the governing body. In addition, the treaty also states that the country's government also assumes responsibility regarding all company actions. This is problematic because in these countries, it is nearly impossible to control all company actions. Countries with many private companies would want to amend parts of the treaty in order to decrease the expected responsibility of a government on the commercial entities in the government's country and promote further growth of private space companies.

Bloc 2 - Countries without Private Companies: Iran, Cyprus, Israel

Countries without private companies would not feel as strongly towards the Outer Space Treaty as the ones with private companies. However, they would still support a treaty amendment which clearly outlines the role and expectations of commercial entities as this would allow them to reduce the number of potentially harmful conflicts with commercial entities and decrease responsibility of the state in case of private company development. Although they would advocate for a treaty which fully addresses commercial entities, some nations within this bloc might work to restrict the capabilities and rights of these entities to decrease the amount of competition their domestic space agencies would face.

Private Individuals and Companies: SpaceX, Sir Richard Branson

The private individuals and companies would agree with their respective governments, stating that a change to the Outer Space Treaty must be made in order to increase their amount of independence. These entities would also largely believe that they should be subject to the same laws governing other corporations, where the nation where they are based out of will not face consequences for the corporation's actions, as this would decrease pressure on the corporation by their host nation. These corporations would also want as much freedom as possible to

make profit, which in some cases could extend as far as wanting to enable harvesting of resources from celestial bodies to sell for profit.

GUIDING QUESTIONS

1. Should the Outer Space Treaty be ratified every 5 years?
2. How can we balance private space exploration using all discoveries from space to benefit mankind?
3. What are the implications of allowing the militarization of space?
4. Do we prioritize taking care of Earth or exploring space? Will this priority ever shift?
5. How do we retain accountability for accidents or contamination in space?

FURTHER RESEARCH

1. UNOOSA+ has compiled the most major resolutions regarding space for convenience and visualization
   HTTP://WWW.UNOOSA.ORG/OOSA/EN/OURWORK/SPACELAW/TREATIES.HTML

2. This article weighs some of the pros and cons of privatizing space
   HTTPS://PUBLICPOLICY.WHARTON.UPENN.EDU/LIVE/NEWS/1619-THE-IMPLICATIONS-OF-THE-PRIVATIZATION-OF-SPACE

   HTTPS://SCIENCE.HOWSTUFFWORKS.COM/10-MAJOR-PLAYERS-IN-PRIVATE-SECTOR-SPACE-RACE.HTM

3. Outlines the most major players currently in the space race
   The MIT technology review states that mining asteroids could be highly beneficial for the environment and our economy, despite obstacles.
   HTTPS://WWW.TECHNOLOGYREVIEW.COM/S/612311/ASTEROID-MINING-MIGHT-ACTUALLY-BE-BETTER-FOR-THE-ENVIRONMENT/

4. This article elaborates on the effects of asteroid mining on our economy
   HTTPS://BIGTHINK.COM/TECHNOLOGY-INNOVATION/ECONOMIC-IMPACT-OF-ASTEROID-MINING?REBELLTITEM=1#REBELLTITEM1

5. The Atlantic explains why President Trump is pursuing the privatization of the ISS and how “space tourists” could become plausible
   HTTPS://WWW.THEATLANTIC.COM/SCIENCE/ARCHIVE/2019/06/NASA-ISS-PRIVATE-ASTONAUTS/591421/

TOPIC B

Development of Sustainable Space Technologies

TOPIC INTRODUCTION

Space is a mysterious and dangerous place. Humankind has explored barely any of it, and each time we venture into space it costs billions of dollars, thousands of hours, and huge quantities of earth's resources. While the focus may be on space technology, we must remember that the source of it all comes from the earth. The struggle is maximizing efficiency of space technology when both creating and maintaining it. Unsafe practices in space, such as detonating off-course satellites, also waste precious resources. As a committee, finding ways to ensure that every country or corporation is practicing sustainable methods of exploring space and preserving the life of space for as long as possible is a top priority. Not only can the technology provide data about Earth, but it can also help individuals through satellite communication. The development of more sustainable space technologies has great implications for Earth as a whole by conserving precious natural resources and maximizing humanity's space exploration potential.

HISTORY

While the space industry has exploded in the past hundred years, environmentalism was not the primary concern during this boom. Throughout the space race (primarily between the Soviet Union and the United States), a precedent was set for all space travel: waste and environmental contamination is not an issue. Fuel was ignited but not quenched by those who are liable. Debris, left clustering around our atmosphere, has yet to be collected. And pools of oil continue to taint our ocean. Dominance over others in the ongoing space race came at the cost of our ecosystems. For example, testing of anti-satellite technology in the Soviet Union and the United States destroyed twenty satellites between 1968 and 1982, causing more than 700 major pieces of debris with many of them still in orbit today. Hydrocarbons were used to fuel all space missions as no source of sustainable energy could provide the amount of thrust needed for these types of endeavors. Today, these unsustainable methods present a significant problem: the atmosphere is being plagued with an incurable amount of space debris and current technologies for performing rocket launches have not been altered to meet today's green expectations.

This can be traced back to the beginnings of space travel. After the rapid development of missiles during and after WWII for military purposes, the urge to use outer space as a means of influence increased. In 1957, Sputnik 1 was sent into space as the first artificial satellite, and Vostok 1 carried a Russian into space for the first time in 1961. The US fired back in 1958 with the Explorer 1, which was their first satellite; and they launched John Glenn shortly after the Soviets in 1962. However, the United States recovered from this loss and delivered Neil Armstrong to the moon in 1969: but this space race never truly ended. Unmanned spacecraft continued to be sent out into space, with varying degrees of success, to gain intelligence and to help with communications services abroad. While many crafts failed, polluting both the atmosphere and the oceans, the few that did enter space successfully and orbited stably soon become unoperational and were left orbiting Earth permanently. However, in 1981, the Columbia space shuttle proved to the world that reusable space shuttles were possible. While there were several drastic accidents in the development of this technology, it proved that it was no longer necessary to continually waste rocket shells and send them plummeting to the ocean or up in orbit after use. However, due to the amount of deaths and accidents presented by the use of these space shuttles, the program had to be terminated in 2011.

That being said, SpaceX has recently been developing technology in the United States to combat the amount of waste presented by non-reusable rockets. Although they are still using hydrocarbons to fuel their missiles, they have developed sophisticated reentry programs so that space travel can be cheaper and less wasteful in the future. This is the first of many steps to ensuring that the world can continue to use space as a resource throughout our existence. However, these reusable rockets present their own problems. Firstly, they need to have considerable fuel reserves and extremely complex systems for reentry to be possible in many possible conditions. This means that the rockets have to carry more fuel, making them less efficient, and have a higher chance of failure due to their innately sensitive systems. On the other hand, SpaceX claims that the amount of energy and resources saved using their system far exceeds any resources wasted in the process. They are setting the precedent for the possibility of reusable rockets with their Falcon Heavy that carried a whopping 5% payload (materials being delivered into space) which far outnumbers that of any other rocket currently. These rockets also are incredibly cheap to launch at only 1.2 million USD per payload and burn more efficiently than previous rockets.

However, the rise of private companies in the space industry poses a major threat to Earth's carbon emissions. SpaceX is approaching 4,400 tons a year of carbon emissions, which by itself isn't incredibly significant. However, if other private corporations begin to follow suit, carbon pollution could skyrocket. Furthermore, rockets release soot and alumina, which have unstudied effects on the atmosphere. These chemicals may have extremely detrimental results on our ozone layer or

human health, but scientists are still unsure of their properties after decades of research.

Ideas outside of massive fuel burning rockets are few and far between. However, Anatoly Yunitskiy began work on alternatives to such methods in 1987 with SkyWay Technologies. He suggests an electrically powered Global Planetary Vehicle (GPV) that would allow for materials to be sent out to space as cheap as 1000 USD per ton. The GPV would work by driving goods up on a conveyor belt-like system that could feasibly stop in hundreds of locations on its way to the ISS and would allow manufacturing to occur in space instead of Earth which would further decrease the pricing of space travel. While private groups in Tokyo are suggesting similar ideas, it is extremely costly at 2 trillion dollars, and therefore is slightly far-fetched.

However, Space debris is an extremely pressing issue that could potentially prevent all parties from participating in space travel in the future. The first collision between satellites occurred in 1991 between a retired Russian satellite and debris from its sister satellite and was not even recognized by the Russian government until 2005. In 1996, one of NASA's upper stage rockets completely fragmented leaving just short of a thousand pieces of debris floating in the atmosphere. Most rocket stages in recent history have been sent into a low earth orbit that will eventually burn them up—solving the problem of space debris, but not pollution. Furthermore, the debris in space has been increasing exponentially due to an increase in collisions. These collisions create more pieces of smaller debris that becomes harder to track and exacerbate the issue. In the twenty-first century this is becoming a more prevalent issue: the ISS was required to move for the first time in history in 2000 to avoid debris, the Chandra Space Telescope was struck by debris in 2003 and countries like China are testing their own ballistic missiles on their own satellites, further creating more debris. Solely due to the destruction of Fengyun-1C, space debris has increased by 75 percent in low earth orbits, showing just how serious each individual's actions are. The Space Surveillance Network is the only current organization that helps different space organizations cooperate to avoid collisions, but it is obvious that the problem is only worsening.

PAST UN ACTION

The United Nations has been a leader for sustainable development in all areas, not just space; however, it has also been active in ensuring that space travel maintains the best practices possible, allowing all parties to continue to participate in space exploration well into the future. Many resolutions specifically target the problems of debris and energy used in space, but it is unclear how those issues can be solved more effectively and how states can be incentivized to participate.

The UN has made significant progress in many areas with several resolutions that target many different groups. The UN has utilized Sustainable Energy for All forums for several years now that help move developing nations in the right direction: resolution A/69/15 specifically helped supply sustainable energy to small island nations who had no other way of attaining it. At the center of this and many other initiatives is the UN Energy department, which oversees the majority of international emissions agreements and has been working with countless NGOs, businesses and governments to negotiate fair terms and best practices. However, most famously, the United Nations Climate Change Conference in Paris set international standards for all developed nations and has been relatively effective in reducing carbon emissions, even with the United States' absence.

Despite this concern for CO_2 emissions globally, rockets seem to have been left out of the conversation. While it is unclear how many rockets are launched every year, it is known that rockets burn incredible amounts of fuel. SpaceX's Falcon 9 rocket, after only 9 launches, burned 1,116,000 kilograms of kerosene, creating 2,902,000 kilograms of carbon dioxide. While this represents a relatively insignificant contribution to global CO_2 emissions, considering there are several space organizations who are launching rockets far more often presents a potential problem. While at the moment, carbon dioxide emissions due to rocket launches are not of particular concern, as the private sector grows, this could be potentially counterproductive to the UN's action on sustainable development.

What is more concerning than the CO_2 emissions, however, is the space debris present. There are more than 500,000 particles currently being tracked, travelling at immense speeds around earth; due to many rocket stages and abandoned satellites. Many of these objects are colliding and causing an exponential increase in the amount of debris in orbit, presenting a significant safety hazard to all spacecraft. The UN Committee on the Peaceful Uses of Outer Space recognized this problem in 2007 and created a set of mitigation guidelines in a resolution, in addition to a massive compendium on the topic. The seven guidelines presented include suggestions to limit the debris during normal operations, minimize the potential for break-ups during operational phases, limit the probability of accidental collision in orbit, and avoid intentional destruction of spacecraft. These guidelines should help mitigate the current space debris situation, but is unclear if it will be effective.

The 1972 Liability Agreement states that every government and party is responsible for damage that they cause, intentionally or not. However, despite several reported accidents involving space debris, no such prosecution has occurred, and the resolution remains largely unenforced. There is little to no accountability for the debris floating around in our atmosphere currently, making the Agreement ineffective.

The UN has been adamant that space is the property of all mankind, as is stated by the Benefits Declaration of 1982. That being said, despite this push for equal opportunity for all and an inclusion of developing nations, developed nations may be unintentionally prohibiting others from participating in this new space race. In direct conflict with this resolution, countries are contributing to the exponentially increasing space debris issue; it is possible that if the space debris continues to accumulate at the rate it is now, future space travel will be impossible because of the danger. This is not fair to developing nations who have not participated in space yet may be limited in their ability to gain their share of the resources from space in the future.

As with any new market, the explosion in participation has brought us significant technological advances at the cost of environmental damage. If space travel is to continue to grow and be a part of our world, the use of sustainable energies and practices will be vital. Globally, the UN has the power to help limit the damage that we are doing to our atmosphere currently because of our desire to ensure that all countries, present and future, have an equal opportunity to explore celestial bodies.

CURRENT SITUATION

Ever since the beginning of space exploration, there have been many motivators for the development of sustainable space technologies. As entities are constantly trying to reduce mission costs, creating reusable or more resource-efficient technologies would help cut costs. Another major motivation would be making efforts to reduce the amount of space debris, especially debris in low earth orbit, which would allow for further opportunities to launch rockets and greater profit for commercial entities.

Most of the current development of reusable and resource-efficient technologies have originated from private corporations. One of the most significant projects is the Falcon 9 rocket system, created by the United States' Space X in 2012. This rocket is a two-stage rocket designed for transporting both satellites and spacecraft into different levels of orbit. Falcon 9 is also the first rocket that can be reused and relaunched multiple times, allowing for a significant reduction of cost and materials over time. A more efficient rocket propellent is also being researched, with gel propellent being one of the newer technologies that may replace the

current popular use of liquid propellant in the future. Liquid propellant currently is highly toxic and difficult to store, increasing costs for space exploration and environmental hazards in case of rocket crash-landing.

Especially recently, the issue of space debris has become increasingly relevant. With over 8400 tons of space debris, according to the ESA, issues such as expensive satellites being jeopardized due to debris collisions are becoming more frequent. Currently, the solutions being investigated have focused on helping satellite operators avoid space debris collisions instead of removing debris from space. Some ideas that are currently being developed include the use of a space traffic management system, the creation of a space object location database and moving space debris to orbits not used by active missions.

CASE STUDIES

CASE STUDY 1: LUXEMBOURG'S SPACE SECTOR

Luxembourg's commercial space sector is rapidly developing and has recently invested €50 million in space research. Luxembourg's wealth and positioning in Europe makes it the perfect country for space research and development as it can export and import products from other nations in the European Union with ease and efficiency. Just in 2018, the Luxembourg Space Agency was created with the purpose of pioneering the development of the commercialization of space in Europe. There are estimated to be around 50 companies in Luxembourg's private space sector.

An important rule to collecting space resources is that no celestial body can be contaminated, meaning that mining and collection must be thorough and clean. As alien lifeforms have never been extensively studied and earth-based lifeforms have not had proper or adequate research to their behavior in space, there must be many safety precautions when it comes to space mining and resource collecting.

The Outer Space Treaty does not limit the commercialization of space as long as it benefits the interests of all of mankind, which is seemingly easy to get away with. But with countries like Luxembourg pooling money and resources into the development of space at such a rapid race, it is plausible that in the near future the competition for asteroid mining and space resources will explode, leaving less developed countries in the dust and unable to obtain valuable resources. This would technically violate the Outer Space Treaty, as private corporations and select countries are gaining a vast amount of expensive and rare minerals while the rest of mankind gains nothing. Sustainable practices and ensuring that all people, regardless of income or location, can benefit from advancements in space technology is crucial to keep in mind for the future.

CASE STUDY 2: HAYABUSA

Hayabusa/Mu Space Engineering Spacecraft C (MUSES-C), Japanese for the Peregrine Falcon, was a spacecraft launched by the Japan Aerospace Exploration Agency (JAXA) on May 9th, 2003. Its purpose was to investigate asteroids and collect samples to return to Earth for analysis and close studying.

Hayabusa's mission was to intercept and explore an asteroid named 25143 Itokawa, a small asteroid near earth, although it was initially meant to launch in the 1990s and explore the asteroid 4660 Nereus but was postponed due to rocket failures. It was also the first spacecraft of its kind and served as a pioneer for the technology needed for sample return missions.

Hayabusa was a landmark spacecraft because it was the first of its kind to bring back any kind of sample from space that didn't come from the moon. The problem with collecting samples from the moon for scientific progress about the history of the Milky Way Galaxy is that large celestial bodies undergo extreme changes frequently due to natural thermal processes, so their samples don't serve as a fully accurate record of the Milky Way. On the other hand, samples from asteroids are believed to safely preserve samples that represent the early stages of our solar system, to the point of being called "celestial fossils". While Hayabusa's mission was far from smooth with frozen pipes, leaks, glitches, and engine failure, ultimately it did bring back untainted samples from 25143 Itokawa to Earth on June 13, 2010.

The commercialization of space will inevitably lead to more spacecrafts similar to Hayabusa that are aiming to progress scientific research or look for more sources of minerals. While by 2019 space exploration and sample return missions have not been extensively researched, they are increasing steadily (Hayabusa 2 is even planned for launch in the near future). Finding a sustainable way for countries to mine from asteroids and other celestial bodies is critical.

BLOC POSITIONS

Bloc 1 - Private Space Corporations and Individuals: Anatoly Yunitskiy, Bigelow Aerospace, Blue Origin, Yusaku Maesawa

Due to the high cost of space exploration, developing sustainable space technologies is a reliable way to gain investor support and increase profits. As a result, many private companies are currently focused on this, such as Space X's reusable rocket development. However, because the primary motivation of private companies is to make maximum revenue, any beneficial technologies developed by them will not be as accessible as technologies in the past, which were mostly government developed. For example, images and data from the Hubble Telescope, a government project, has been accessed by millions of researchers, resulting in the creation of new development. This restriction of ideas due to economic reasons could actually be detrimental to overall scientific development and result in much redundancy. Private space corporations would want to continue to be allowed to develop sustainable technologies and use those technologies to make them more competitive but would not want any requirements or obligations to share those technologies with other entities.

Bloc 2 - Government Space and Research Entities: Brazilian Space Agency, Canadian Space Agency, Indian Space Research Organization, Luxembourg, Mexico

Government and research entities would be heavily in favor of developing sustainable space technologies, but they would also be in favor restrictions on the amount of information that corporations and other bodies are allowed to keep private. They would also want to ensure that access to these technologies will remain accessible to everyone and would advocate against requiring payment in order to utilize the developments. These entities would likely be in favor of a mandatory reporting system or database in order to ensure that all technologies developed are publicly accessible to all.

GUIDING QUESTIONS

How do we distribute goods from space exploration back on earth?

1. When is venturing into space for resources more advantageous/viable than finding resources on earth?
2. How does your organization/country's use of natural resources affect the possibility for space exploration?
3. How can corporations balance the need for sustainable space technology with profit?

FURTHER RESEARCH

1. Space debris mitigation guidelines as outlined by the UN HTTP://WWW.UNOOSA.ORG/RES/OOSADOC/DATA/DOCUMENTS/2010/STSPACE/STSPACE49_0_HTML/ST_SPACE_49E.PDF
2. The UN's Sustainable Development Goal 7 is explained on this website, and links are provided to all relevant documents HTTPS://SUSTAINABLEDEVELOPMENT.UN.ORG/SDG7
3. This article dives into how SpaceX and Blue Origin are leading the way to sustainable space travel with their reusable rockets. HTTPS://SPACENEWS.COM/OP-ED-REUSE-AND-SUSTAINABILITY-IN-DEEP-SPACE-EXPLORATION/
4. The Huffington Post calculates how much fuel is used in a rocket going to the Moon HTTPS://WWW.HUFFPOST.COM/ENTRY/HOW-MUCH-FUEL-DOES-IT-TAKE-TO-GET-TO-THE-MOON_B_598A35B5E4B030F0E267C83D?GUCCOUNTER=1&GUCE_REFERRER=AHROCHM6LY93D3CUZ29VZ2XLLMNVBS8&GUCE_REFERRER_SIG=AQAAADHNBMOHIT-7J29YOYUCX8PBBF-X12SUL0KRWOLPANWTRDVXSDXM00XJVWU0R5N3YUBCRX4PSN6Q4_7MYO9PYO5VLLGUXT4T-GY28GFEIBUTX5AYGXFTWVXACDXZKOVHJWOAY_OGAXRJGKXDIMTV4YX-PHKOFCVPSDELYRO1PQA1
5. The National Geographic expands on the space debris situation with a fantastic visual. HTTPS://WWW.NATIONALGEOGRAPHIC.COM/SCIENCE/SPACE/REFERENCE/SPACE-JUNK/
6. Space.com suggests a few solutions to the growing space debris problem HTTPS://WWW.SPACE.COM/19445-SPACE-JUNK-THREAT-ORBITAL-DEBRIS-CLEANUP.HTML

CITATIONS

TOPIC A

- http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html
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TOPIC B

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- https://www.universetoday.com/140120/a-new-solution-to-the-space-junk-problem-spacecraft-with-plasma-beams-to-force-space-junk-to-burn-up/
- https://www.space.com/19445-space-junk-threat-orbital-debris-cleanup.html