



PREPARING FOR THE NEXT FRONTIER

Considering a Modern Version of the Outer Space Treaty

Reid Herrera

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Introduction

Because it seems far and distant, most people do not think about space on a daily basis. Yet space is closely linked to the global economy and our lives. The commercial space industry alone was recently valued at nearly \$400 billion, and the same estimates predict it to be worth trillions in the next 30 years. In 2012, the year after NASA retired the space shuttle program, there were 7 launches licensed by the Office of Commercial Space Transportation within the Federal Aviation Administration; In 2018 there were 49. Launches have also been increasing at a global level since 2004, primarily driven by governments other than the United States (*Licensed Launches*, 2019). This increase in launches accompanies an increase in other activities in space. Some of this increase has been an expansion based on current capabilities. There are just over 2000 satellites currently orbiting the Earth, and more are scheduled to launch in the coming years (*UCS Satellite Database*, 2019). Companies including SpaceX, Amazon, OneWeb, and Facebook are planning on launching constellations of satellites numbering in the thousands to broadcast internet at broadband speeds across the globe. The proposed SpaceX Starlink satellite constellation alone has received regulatory approval for 12,000 satellites and has requested approval for an additional 30,000, and competing constellations are seeking to deploy similar numbers (Etherington, 2019). Earth orbit is busy and will certainly get busier, yielding economic and societal benefits from new resources like global internet access. As space becomes easier to access because of more launch companies entering the market and the development of cheaper, more reliable, and more powerful launch vehicles, for example SpaceX's Starship and Blue Origin's New Glenn, there will be new growth and a wider range of commercial activities in space. The scope of commercial activity may reach the Moon, Mars, and beyond. These new activities haven't yet occurred, but planning for them raises questions about authorization, regulations and how to stop careless or irresponsible actors and how best to protect access to space for the future.

A few international treaties form the foundations of modern space law, but the legality of actions in space is largely based on accepted and unwritten precedent. The treaties include a few obligations, such as rendering assistance to other astronauts, and excludes a few activities, like putting weapons of mass destruction in space, but on the whole don't limit the activities that are allowed in space. Instead they enumerate principles that nations should use when they operate or authorize others to operate in space. Legal concepts such as property rights are instead defined by a balance of precedent and agreed interpretations, that have given rise to an accepted way of

conducting business. As an example, satellites are given the rights to their orbits when they occupy them, not before. The International Telecommunications Union has grappled with the question of how to properly assign orbits at the same time it assigns the bandwidth for broadcasting to and from the satellite, because to assign rights to an orbit before a satellite operates there, or to assign them in such a way as to allow transfer or exchange of the rights, implies ownership of that part of space, which is explicitly forbidden by the OST (Buxton, 2004). The same is true for the Moon, yet no one is suing NASA trying to claim the lunar samples that they returned from the Apollo missions. These samples have been accepted as NASA property for decades, and so are an international legal precedent for ownership of extracted space resources (Buxton, 2004; Lussenhop, 2018). Even though there is no explicit agreement or treaty, this is accepted as binding by the international community simply because this is the way it has been done. This is one reason that it is important that future activities in space, especially those conducted by non-governmental entities, are appropriately vetted. It would be unfortunate if an actor in space were to claim a celestial body or determine that water and breathable air were not human rights for workers in orbital facilities. These things might be unlikely, but it is not unrealistic to think that they could happen if a nation with aspirations of becoming a spacefaring superpower passed extremely lax authorization requirements in order to attract companies and organizations. Already there is competition between nations to attract companies interested in harvesting resources in space. The United States is one of only two nations with laws providing property rights to resources extracted in space and returned to Earth. The other is Luxembourg, and the Grand Duchy has also set up a government-backed investment fund for companies with this mission ("Space Resources," 2019).

The international treaty system that is in place has prevented inappropriate actions in space by government actors. The space race between the Soviet Union and United States never became violent, and space is an arena of peaceful international cooperation and scientific exploration through ventures such as the International Space Station. The treaty system has also allowed non-governmental actors to develop under its loose requirements. However, as these non-governmental actors are starting to reach parity with some national space agencies, the weaknesses of the treaty system have started to become apparent. As nations grapple with how to properly authorize and regulate commercial space companies, having a robust treaty system to define the debate is important, both to provide guidance but also to maintain some degree of uniformity. What might such an update to the Outer Space Treaty of 1962 look like?

Background

Importance of Space

The concept of outer space is often considered as science fiction and distant from ordinary life. From Star Trek to the Apollo missions, the most commonly considered aspects of space don't have any bearing on the daily routines of people around the world. However, technology enabled by space is woven throughout of modern life. Many of the technological capabilities enabled by space have made their way into consumers' pockets in the ubiquitous smartphone. The Global Positioning System (GPS), which provides geolocation service to most of the planet, including navigation services such as Google Maps and Waze. That same navigation helps commercial airlines fly people and cargo around the world. Google maps and other Earth imaging services rely on satellites to take high resolution images of the planet and transmit the data for viewing, which can be used in a wide range of applications from weather forecasting to optimizing agriculture. Satellite phones allow communication in remote locations without build-up telecommunications infrastructure, and satellite television services are still common. Increased launch capability will enable more non-governmental actors to have access to space, and commercial activity in space will likely grow to take advantage of the easier access to space that these launch vehicles will enable. The military also relies on space for critical components of national defense. Nuclear launch detection, secure communication, surveillance, and navigation are all at least partially reliant on technology in orbit. Without space, American industry and security would lose critical advantages over other nations.

The widespread deployment of technologies reliant on space has caused the space economy to grow. In 2018, The FAA's Office of Commercial Space Transportation (AST) estimated the value of the global space economy to be 345 billion dollars. Some analysts expect it to grow to 2.7 trillion dollars within 30 years (*The Annual Compendium of Commercial Space Transportation: 2018*, 2018). Budgets from various government agencies are a part of this economy, in their own right and through commercial partnerships such as NASA's commercial cargo resupply contracts for the International Space Station. However, in total global government expenditures on space account for 83 billion dollars, about one-quarter of the space economy; the rest comes from private businesses. Though national space agencies are still a significant group of actors, it is clear that they are no longer the only relevant organizations conducting activities in space.

Companies based in and launching from the United States have taken an increasing share of the commercial launches, capturing 54% of the global space launch industry within six years (*The Annual Compendium of Commercial Space Transportation: 2018*, 2018). This puts a large amount of both current and future commercial activity in space under the jurisdiction of the American government. The federal government has been slowly reforming its regulations regarding commercial space activity, most recently proposing Streamlined Launch and Reentry Licensing Requirements. However, industry is poised to move beyond the scope of explicitly regulated activities. Some of the more realistic estimates have private astronauts landing on the Moon before NASA manages to return there (Mack, 2019). According to more aggressive timelines projecting the future development of space, within a few years companies will be doing far more than launching and operating satellites, which has already become routine. Companies attracted \$2.8 billion in investments in 2016. Operating in space is expensive, but these companies aren't drawing this kind of money by looking to keep doing business as usual. Some companies are looking to maximize the use of existing technologies. Planet Labs is seeking to take a high-resolution image of the entire surface of the Earth every 24 hours and combine it with data analytics to track important changes over time ("Using Space to Help Life on Earth," 2019). SpaceX is currently in the process of deploying a satellite constellation to provide wireless internet to the entire world (Etherington, 2019). Other companies are pushing the boundaries of their capabilities to accomplish new types of missions. Virgin Galactic is looking to take passengers to space ("Mission," 2019). Made In Space is developing the technology for orbital manufacturing ("The Space Manufacturing Company," 2019). SpaceX is trying to reach other planets ("Making Life Multiplanetary," 2017).

The limiting factor for these companies is their technological capability, but despite this limit they have already generated billions of dollars of economic activity and helped transform modern life. As they push the boundaries of current technology, these benefits are will increase in predictable ways. But as they develop and refine new capabilities, they will be able to pursue new missions in space that will benefit life on Earth in ways that can't be known for sure until the technology is fully formed. And as new frontiers open, the opportunity for profit will likely attract more entities, private and governmental, who want a piece of the action. All of these actors and the operations they undertake will need to be adequately regulated to ensure that proper attention is paid to the public interest and that these benefits from space are passed on to the people of Earth.

Risks in Space

Low-Earth orbit has become crowded with satellites and debris. Some experts think that we have reached the critical mass necessary for Kessler Syndrome, otherwise known as collisional cascading. If there were to be a collision between two satellites in a congested orbit, the resulting debris could go on to hit other satellites, creating a chain reaction that could damage other satellites and create even more debris (Corbett, 2017). Hopefully, no one company would intentionally do something that would cause a collision, since that would limit their own ability to access space. However, operating in space is inherently a risky venture; rockets are just an advanced way to control a powerful explosion. A collision or other nightmare scenario might happen by accident, and the chances of such accidents occurring will almost certainly increase as the thousands of proposed satellites are launched. The more objects there are in space the more opportunities there are for an accident to occur. By undertaking activities in space, an entity assumes that the risks associated with a failure are so unlikely to occur that they are outweighed by the benefits.

Different actors have different risk tolerances. What might be an acceptable risk for a private company might be too high for a government agency, or vice-versa. If those actors are spread across different nations which have different regulatory regimes, then the heterogeneity of risk tolerances will likely increase. When different companies operate under the same regulatory regime, they all operate with the same maximum risk tolerance, which is whatever the authorizing body will allow. If regulated properly, this maximum allowed risk will be high enough that it permits operation in an environment as uncertain as space, but not so high as to risk the safety of spaceflight participants or society as a whole. But if nations differ in how they regulate actors in space, or if they have different technical abilities for evaluating the risks of those actors, then it is possible the risks of authorized activities are different. With more operators conducting activities at different risk levels, the chances of an event go up even further. This variance might be acceptable for now, but space is going to get even busier in the future as more companies take advantage of smaller, cheaper, easier to launch satellite and rocket technologies.

There are also increasing concerns of armed conflict in space, and the damage such an event would cause. The United States is taking steps to develop a new branch of the military focused on space, and China is investing heavily in technologies designed to counter or eliminate satellites (Feldscher, 2019a). Should a shooting war happen in space, the destruction and resulting

debris would be catastrophic. In late March of 2018, the Indian government conducted an anti-satellite missile test that destroyed an orbiting satellite, becoming only the fourth nation to demonstrate such capability alongside the United States, Russia, and China. That weapon test created 400 pieces of debris, 60 of which are large enough to be tracked by NASA and 24 that cross through the orbit of the International Space Station. As NASA administrator Jim Bridenstine said in Congressional testimony, “If we wreck space, we aren’t getting it back” (Lewin, 2019).

Potential Solutions

Activities in space are guided and influenced by a web of factors beyond the international treaty system that serves as the foundation. These other factors influence actors in different ways compared to the OST and subsequent treaties, and they represent alternative means of addressing the uncertainties and risks associated with the projected development of space.

Free Market Solution

Many actors in space now are commercial companies. The Commercial Spaceflight Federation, the industry trade group representing commercial space companies in the United States, has over 80 members (“Members,” 2019). Though they sometimes work jointly on projects, these commercial companies have a different set of priorities than national space programs. While the government space agencies are usually focused on science and exploration, private companies are profit driven entities. For example, NASA has awarded contracts to 14 companies to deliver NASA payloads to the surface of the Moon (Foust, 2019). For the companies, this is a profit-making government contract, but for NASA this is a method of outsourcing work to support its scientific mission. By extension, if companies are driven to compete with each other, those that are unsafe or fail in their missions will fail as a business. No commercial space company wants to be known as the one whose rockets explode, because no one wants to purchase rides for satellites or astronauts on unsafe rockets. Thus, the market eliminates those actors who might be the source of accidents and other issues. The problem with relying on companies to regulate themselves in this way is that it supposes that some amount of accidents is acceptable, as they are what weed out the incompetent and dangerous entities. However, there is little margin for error in space. As mentioned previously, a collision or major accident in low-Earth orbit could trigger collisional cascading, and accidents during spaceflight don’t have a good track record when it comes to astronaut survival (Borenstein, 2014). For

companies, low odds of an accident might be enough, but for governments and the citizens they protect, any chance of an accident is likely too high.

National Regulations

Another possible approach is to focus on national regulations. Because every actor in space is based somewhere on Earth, with some combination of construction, control, launch, or business operations facilities, they are in some way subject to a national authority. This is the method under which the Outer Space Treaty operates. Nations which are signatories to the treaty are given the mandate to provide “authorization and continuing supervision” of non-governmental actors (*United Nations Treaties and Principles on Outer Space*, 2002). This gives nations flexibility to design their regulatory schemes in the most beneficial way to their circumstances and space industry. The United States has taken advantage of this flexibility, most recently with the Federal Aviation Administration’s Office of Space Transportation’s Streamlined Launch and Reentry Licensing Requirements reform effort. Additionally, the U.S. Commercial Space Launch Competitiveness Act passed by Congress grants property rights to entities that obtain them, but only after the resources are extracted and returned to Earth (Sterling Saletta & Orrman-Rossiter, 2018). This legislation has not been tested against the Outer Space Treaty, but it attempts to tread the line between the obligations of the Treaty and the need to provide certainty for commercial investment. As non-governmental entities continue to develop new technologies and seek new activities in space, more laws such as this could be implemented to provide certainty at the national level. However, this could lead to different and possibly competing legal schemes depending on where an entity is operating. Without a unifying international framework to rely on, nations must rely on their own judgements to handle new legal situations in space so might adopt different laws based on their own values and needs.

Just as worrisome as a variety of legal frameworks in space is the ability of private space companies to move across international borders to nations with friendly regulations. The roots of this are already visible. Returning to the previous example of returning resources extracted in space to Earth, the United States is not the only nation to encourage asteroid mining and other extractive activities in space despite the ambiguity of the Outer Space Treaty. In 2016 Luxembourg launched the Space Resources Initiative, which includes a law similar to the United States that guarantees property rights to resources in space, as well as funding from the

Luxembourg Space Agency to promote the development of companies to develop those resources ("Space Resources," 2019). The objective of this program is clear – to turn Luxembourg in to the most desirable nation for these companies to operate in. By itself this is not necessarily an issue; commercial space companies have long relied on government support during their early stages. However, this illustrates the problem of flags of convenience that could easily arise from relying solely on national regulations. Private space companies could shop around different nations and select the one that offers them the best incentives to operate within their borders, or the one that has the laxest regulatory scheme. A more extreme example of differences in regulatory tolerance occurred as recently as November 24, 2019 when a booster rocket from a Chinese launch crashed returned to Earth and crushed a rural home downrange from the launch site. Launches in the United States head out over the sea to avoid passing over inhabited areas, but the Chinese government launches west, which is optimal for orbital insertion, and simply issues evacuation orders for areas downrange of the launch (Jones, 2019). As more companies seek to do business in space, it is important they not be able to take advantage of such different definitions of what is acceptable.

International Arrangements

A number of alternative arrangements that don't suggest a new treaty have been proposed, but they have not been seriously pursued by any international actor. These proposals build on the current system instead of addressing its challenges at the fundamental level. Since one of the primary concerns about future commercial space activities is the role of property rights to resources in space, a separate international organization could be created to assign property rights on a case-by-case basis to interested parties. By virtue of bringing together nations interested in pursuing this category of activity, this organization could also become a forum for settling disputes and codifying the responsibilities of the non-governmental entities it oversees (Fountain, 2002). There are alternative mechanisms by which this organization might assign property rights. It could provide some rights to private entities and keep others for its own use, or it can lease the extraction rights for a percentage of the value (Fountain, 2002; Sterling Saletta & Orrman-Rossiter, 2018). Both options generate some revenue for the regulating organization, which could address equity concerns and be distributed to developing nations or nations without space programs. Doing so in this way skirts the problem of the "common

heritage of mankind” principle without having to redefine it by ensuring that all of humanity benefits from the use of space resources.

However, these solutions still require a solutions to the problems baked in to the Outer Space Treaty, either by amending some of its key concepts or building new international organizations to support it. Given the lack of movement on international space issues, it is unlikely there is political will to undertake projects of that magnitude. Further, by creating such a detailed framework that would likely require extensive rules, these proposals could limit future endeavors by locking non-governmental actors in to a fixed paradigm. Though it has weaknesses, the flexibility of the Outer Space Treaty has also allowed non-governmental actors to even enter space from a commercial side. Shedding too much of this flexibility might be counterproductive and stifle the pursuit of missions that might otherwise be beneficial.

The ideal solution would be to fix the problematic portions of the Outer Space Treaty, while leaving the framework and spirit of the document intact. This would allow nations the flexibility to continue to develop their own rules and commercial space industries, while more adequately marking the boundaries of what is minimally acceptable to the international community. The Outer Space Treaty set the rules of space; A clearer, more detailed Outer Space Treaty would make those rules easier to interpret and apply. It is important to note that this solution assumes to resolve the ambiguity of commercial actors in space in such a way as to allow their continued activity and future plans. This is what industry wants, because it allows them to exist, and governments including the United States seem inclined to support. However, it is possible that some environmental, scientific, or safety concerns might rise to prominence and point toward a framework that promotes different values to preeminence.

Deficiencies of the Current Treaty Regime

Ambiguous Nature of Non-Governmental Actors

Space law treats space, broadly defined as both outer space and other planetary bodies, as “the province of all mankind”. In practical terms it is akin to international waters of the oceans, in that all nations are allowed access so long as they abide by rules of good conduct. However, the international treaty regime under which the United States and other space-faring nations operate is designed for a fundamentally different market of only government actors, and there is concern that the commercial space industry is on a trajectory to enter uncharted legal territory. The Outer

Space Treaty and subsequent treaties include only a few specific stipulations, almost all of which are directed at the state signatories. That is because at the time the treaties were negotiated only state space agencies were capable of conducting missions; it was inconceivable that private actors would have the technical or financial resources that only the Soviet Union and United States had. The specific requirements are focused on keeping space peaceful. They include: no weapons of mass destruction in space, assist other astronauts in distress, no claiming space or celestial bodies for any one nation, and astronauts should be ambassadors for all of humanity. While these are all worthy aims, there also isn't much of a question that the entrepreneurs running commercial space companies aren't trying to deploy nuclear weapons in orbit. On the topics that are of concern to commercial entities - ownership, liability, resource extraction, settlement, debris mitigation – the treaties don't have much to say. Instead, the nations that authorize their activities under Article VI of the OST are the relevant jurisdiction.

Property launched in to space is clearly defined in the Outer Space Treaty as owned by whoever launched it, but the status of space the object occupies or any celestial bodies where that property might end up is less clear. Part of the “province of all mankind” doctrine is that space cannot be claimed by a sovereign nation. But, because the treaty does not explicitly address commercial activity in space, it is unclear if private companies are also forbidden by law from claiming space or celestial bodies, including near the Earth. By their nature, satellites have distinct orbits. Because every object in orbit is moving at thousands of kilometers per second, avoiding any sort of collision is of paramount importance. This means that once one satellite is in position others cannot insert themselves in to the same orbit without risking both satellites being damaged or destroyed in the event of an accident. This kind of exclusion suggests some sort of property right to the orbit, yet the only processes to make sure satellites aren't in conflicting orbits happens at the national, not international level. This first-come-first-serve system has worked well enough with the current volume of satellites in Earth orbit, but as that number increases there might be increases competition for specific orbits. Additionally, this system can't be directly applied to celestial bodies. If a private company were to construct some sort of base on the Moon or another celestial body, how much of the surrounding terrain would they also be able to claim? Certainly they shouldn't be able to claim the whole celestial body, but they might be able to claim more than just the ground under the four walls they build. The Outer Space Treaty gives no guidance on how to answer this question, but there are companies whose stated missions will require it be answered.

Space Exploration Technologies (SpaceX) and Planetary Resources are two examples of companies with stated goals that might conflict with the principle of “common heritage”. SpaceX aims to send a mission to Mars for “building a propellant depot and preparing for future crew flights” by 2024 (“Making Life Multiplanetary,” 2017). Planetary Resources’s, which has since been acquired by another company, had goals of “identifying, extracting, and refining resources from near-Earth asteroids” (“Timeline,” 2018). Both companies, if successful, would at least challenge, if not run afoul of, the current international framework governing activity in space.

Liability

Property rights are not the only shortcoming of current treaties regarding conduct in space. The OST and subsequent treaties are predicated on national responsibility but give no guidance on how to determine which nations are liable when multiple are involved. Article VII of the OST states, “Each State Party to the Treaty that launches...is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons”. When national space programs were the only entities capable of manned spaceflight this was not a problem; the country launching was launching its own citizens, and they were government personnel too. But as commercial ventures become more international, which could include launching pilots with nationalities different than the launching company, these questions of liability will become more convoluted. Under proposed rules from the FAA, private launches require insurance coverage, but it is difficult to acquire insurance if it is unclear who or what the insurance needs to be able to cover (*Streamlined Launch and Reentry Licensing Requirements*, 2019). Any uncertainty regarding liability could be a barrier for activities that are already difficult and expensive to insure.

Space tourism is a particular concern because of the ambiguity of nationalities of those that might be involved between the launching company, sponsoring nation, crew, and passengers (Ryabinkin & Com., 2004). This ambiguity in nationality could also cause problems in assigning liability - does a private spaceflight crew belong to the nation of their citizenship, the nation from which they launch, or the nation authorizing the company’s operation? Determining nationality, and therefore liability, would be important in the unfortunate event of an accident or fatality involving a manned, private space flight (Freeland, 2010). Hopefully such an incident never occurs, but if it does it would be a legal quagmire under the existing rules. Similarly, the payloads of commercial space launches might be from different nations, which means that there could be

conflicting or overlapping requirements. The nation authorizing the launch might require a payload review, and the nation authorizing the activity once the payload deploys might have a different set of requirements. Currently, there isn't likely to be much difference between the two because most commercial payloads are satellites focused on some form of communication or Earth-imaging (*Licensed Launches*, 2019). However, when a sticky legal situation arises and there are two nations with some form of jurisdiction, it would be beneficial to have a common foundation or tool to resolve the situation. The document that should fill this role is the Outer Space Treaty, but it is antiquated and ill-suited for modern space activities and so is not as useful as it should be.

Inability to Adapt

Attempts to add modern treaties to the existing treaty regime have encountered significant obstacles in recent years. There are serious differences between three of the major space-faring nations – The United States, Russia, and China – on space-related arms control. China and Russia have advocated for broader language banning weapons in space. The United States has objected, due to the lack of verifiability and the unaddressed question of ground-based anti-satellite missiles. It is unlikely that these security concerns will disappear in the near future and they will likely stall any future negotiations on binding treaties related to the shared use of space (Xu & Su, 2018). Additionally, the 1979 *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies* was soundly rejected by the international community. The Moon Treaty was rejected because it stipulated that activities in space should be “for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development” (*United Nations Treaties and Principles on Outer Space*, 2002). That is, the economic benefits from the Moon would have to be shared by spacefaring nations with those that do not have space programs. It has only 11 signatories, none of which are spacefaring nations. This suggests that the international community might have reached the limits of its willingness to adapt and update the current regime based on the OST, and that perhaps an entirely new treaty system is required.

Analogous Treaties on Ocean Dumping

In legal discussions regarding space, parallels are often drawn to the international treaty system in place for the oceans. The high seas are not the domain of any one nation, yet nations are bound by agreements that outline how they and their citizens should conduct themselves at sea. In

the United Nations Law of the Sea Treaty there is a concept of “common heritage for mankind”, which is similar to the “province of mankind” concept found in the Outer Space Treaty. Though international law regarding the oceans is more developed, the concept that no nation may claim the sea to the exclusion of others is similar to the treaties regarding space. More specifically, some legal scholars also point to agreements on extracting resources from the seabed as a model for future resource extraction in space.

A set of agreements of particular interest are those on dumping in the oceans. The *Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter of 1972*, colloquially known as the London Convention, is an agreement limiting the substances that are permissible to dump in the oceans. It also sets standards for how states should regulate and report the activities of their citizens regarding dumping waste in the ocean. The regulation of private entities is a major part of this treaty, as most ships at sea are not government owned. The London Convention accomplished with greater specificity and detail for ocean dumping what the Outer Space Treaty might do for activities in space – set limits on acceptable practices and requirements for states that enforce them.

Beyond the similarity in goals with the Outer Space Treaty, The London Convention is also a useful comparison because the two treaties were written near the same time. The Outer Space Treaty was ratified in 1967, and the London Convention was approved only 5 years later in 1972. While the impetus for drafting the two treaties, fears of blowing up the Earth with space-based weapons of mass destruction and concern for the health of the oceans, are quite different, the circumstances under which they were negotiated are quite similar; The geopolitical order didn't drastically shift during the 5-year interim period. For both treaties, the United States and the Soviet Union were the two superpowers and wielded the most influence when negotiating the treaty.

But the bipolar international order that developed these treaties has drastically changed. There are now many nations with competing interests and power to influence international politics. Fortunately, the London Convention already has a modern version. The *1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972* is an updated version of the London Convention that is commonly called the London Protocol. This new version included, among other things, stricter limitations on what can be dumped and a rework of the method that states use to collect information and authorize certain types of dumping.

It is a modern treaty that includes a more detailed methodology for regulating private entities, something that the Outer Space Treaty sorely lacks, and was negotiated in an international setting more similar to the present day, without the bipolar United States - Soviet Union dynamic, and with a greater focus on private actors.

Overall, this means that the London Convention and London Protocol form a treaty system that deals with some of the same issues as the Outer Space Treaty, that was originally created under similar circumstances to the Outer Space Treaty, and that was updated relatively recently to strengthen the treaty. This relationship is represented graphically in figure 1. By comparing the Outer Space Treaty and the London Convention and then examining in detail how the London Convention was updated in the London Protocol it is possible to craft an updated version of the Outer Space Treaty that provides additional guidance and structure to deal with the issues that are arising or will arise in space activity in the 21st century. Basing this new treaty on the mechanisms of the London Convention and London Protocol will help to ensure that it maintains the requirements necessary for safe, sustainable operation in space while still empowering nations and other space actors to undertake new and challenging missions by being flexible in the implementation.

		Related Subjects	
Similar Time Period	Outer Space Treaty (1967)	? (2019)	
	Convention (1972)	Protocol (1996)	

Figure 1. Relationship between treaties

Though the treaties are similar, they are not identical. A full discussion of how the Outer Space Treaty was mapped to the London Convention is included in Appendix 2.

Discussion of Proposed Treaty Changes

The proposed treaty text of the modern Outer Space Treaty is included in Appendix 1. The most important updates will be discussed here. Full details of the significant changes made in the London Protocol, on which the proposed modifications to the Outer Space Treaty are based, are included in Appendix 3.

Introduction statements

All three of the treaties begin with a series of formal statements which give context to the circumstances that necessitate the treaty and the goals of the agreement. In the 1967 version of the

Outer Space Treaty, many references are made to specific resolutions of the United Nations, as these were the only previous international agreements that were relevant to space. Some of the text of the OST was directly lifted from the resolutions, for example the first statements of the Treaty up until “Recalling Resolution...” were included in the previous resolution “Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space”. Several of these resolutions concerned specifically the militarization of space, as the United States and the Soviet Union were in the midst of the Space Race at the time and there were fears that it would become a military endeavor instead of one based on science and prestige. Taking the United Nations resolutions and combining them into a more complete treaty served to put “rules” on the race, to the benefit of both nations that were spending billions of dollars, and these introductory statements reflect that this is part of the purpose of the OST.

However, the modern circumstances are much different. Though national space programs continue to conduct space activities, they are not the only ones, nor are they the only significant actors in space (*The Annual Compendium of Commercial Space Transportation: 2018*, 2018). Modern space features a heavy presence of commercial companies that are utilizing space for economic benefit. This change in realities is reflected in the suggested modifications to the statements at the beginning of the New Treaty. Instead of referencing each United Nations Resolution, the 1962 Treaty as a whole is referenced. Since the OST contains the same imperatives and content as the original resolutions, condensing the reference allows for new material to be added so that the balance more accurately reflects modern concerns.

In addition to recognizing the changed circumstances necessitating a new treaty, some language is added to reflect different attitudes toward space activity. Particularly, a statement is added which reads:

“Believing that the exploration and use of outer space has produced great benefits to many aspects of modern life, and should continue to be safely carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development”

This statement affirms the benefits of commercial development of space, so long as it is developed in a safe manner. It reflects the change in the ecosystem of space actors and highlights the importance of the economic benefits of space. Space has been identified as important to the United Nations Sustainable Development goals, and adding these statements help to shift the focus of the

treaty toward economic sustainability instead of keeping states from deploying weapons of mass destruction, which while important is not the most significant use of the Outer Space Treaty in the modern setting.

Organization of content

The Outer Space Treaty was written as many large paragraphs, organized thematically but with only titles demarcating them. When the treaty was written, this fit with the overall goals of the treaty being a set of guiding principles outlining the acceptable activities of a limited number of state actors. There did not need to be minutia or details, only the principles, which fit nicely in paragraph form. However, the space environment has significantly changed. The number of state and non-state actors and complexity of activity suggests that more detail should be added to make the Treaty a more robust and useful document. In comparing the Convention and Protocol, organizing a treaty in this way makes the document easier to read, especially when specific requirements are added. Making use of sections and subsections within each article of the treaty allows more information to be included on each topic while keeping the document legible. For example, Article IV, when detailing the types of military activities forbidden in space, includes several long descriptions within a single sentence. Article 4 of the new treaty separates each of these things in to individual points, which makes for clearer reading and referencing. Because each Article of the OST concerned the same topic, they were split in to an appropriate number of sections to address the different areas of the topic. Generally, this separation occurred at each sentence. Splitting the paragraphs in to sections which each focus on a specific point makes the document easier to read and navigate and allows greater specificity through the addition of more subsections. This change makes the treaty a more functional document and brings it up to par with similar modern documents.

Definitions

The original treaty lacked any section dedicated to definitions. At the time, this did not present a problem because there were no questions as to the practical meaning of specific terms. For example, “astronaut” very clearly meant anyone in space, as the only people to whom the term could possibly apply would be trained personnel from government space agencies. However, these assumed definitions are no longer necessarily the case, due again to the wider variety of actors and activities that are occurring. Continuing with the astronaut example, it might now include private

pilots, tourists, and personnel deployed on private space stations. Providing proper definitions is important in determining which parts of the Treaty apply. This has been emphasized by the current attempts to overhaul U.S. national regulations of space launch vehicles. There has been intense discussion between industry and the FAA on the topic of definitions, because definitions can often be the sole arbiter of what regulations apply in which cases. Article 1 of the new treaty includes definitions so that the terms used throughout the treaty have specific meanings. This clears up any potential misunderstandings to ensure that the treaty is applied in the appropriate scenarios. The most important terms are defined: “Outer Space”, “sovereignty”, “astronaut”, and “non-governmental entity”. These are the terms that are either most frequently used in the text of the treaty or have the widest applicability in the modern space industry.

Outer Space is defined in the proposed treaty as, “means 80 kilometers above the surface of the Earth, including the surface of the Moon and other celestial bodies”. Half of this definition, the portion which encompasses the surface of the Moon and other celestial bodies, is copied directly from the original Outer Space Treaty. Every time the term “outer space” is used in the original Treaty, it is specified that this term includes the surface of the Moon and other celestial bodies. By adding this phrase to the complete definition, it makes it clearer when the term is used throughout the proposed treaty by eliminating the repetitive prepositional phrase. The other portion of this definition adds a starting altitude for the edge of space. This is commonly referred to as the Karman line, after the physicist Karman who calculated the altitude where the atmosphere is too thin to support normal flight, that is the boundary between where aircraft can operate and where spacecraft are needed (Voosen, 2018). This boundary is partially arbitrary and contested between international organizations. The actual altitude is not of critical importance, and it would likely be a subject of intense negotiation should the Outer Space Treaty ever be renegotiated. However, a clear line of demarcation is necessary to codify the rules of operation in space and prevent different nations and international organizations from adopting competing definitions. This will be important for regulating hybrid and unconventional spacecraft. For example, Virgin Galactic’s SpaceShip2 flies to a high altitude as a normal plane before sharply ascending like a rocket. Without a proper definition of where the jurisdiction of the treaty begins, hybrid craft would be regulated based on the interpretation of their sponsoring nation. By including the Karman line in the definition of Outer Space, this eliminates that ambiguity and establishes a uniform interpretation of where the treaty has jurisdiction.

“Sovereignty” is defined in the proposed treaty as, “claim or exercise exclusive possession of territory, including exclusionary claims to in-situ resources, to navigation, or research”. This is the most difficult definition in the new treaty. It is intended to clarify the extent to which property rights exist in space. In the current iteration, it is not specified if who is forbidden from claiming sovereignty, and what qualifies as a claim of sovereignty. This definition answers the second question, by including the classical definition of sovereignty along with other types of exclusionary activities that would allow de facto sovereignty. The first portion of the question regarding sovereignty is addressed in subsequent articles where sovereignty is discussed and not in the definition of the term. These activities are referenced as three broad categories which encompass all activities in space – resource extraction, navigation, and research. The first category has not yet been realized, but it has attracted interest from multiple companies like SpaceX and the now practically defunct Planetary Resources and Deep Space Industries (Abrahamian, 2019). The second is navigation, which includes not only flight paths between celestial objects but orbits around them. This category would cover all satellites and potential space stations orbiting the Earth and would prevent incidents like the Bogota declaration where states attempt to claim orbits without directly utilizing them (Durrani, 2014). The last category is research, which applies primarily to government space agencies, as there is little economic incentive to motivate private actors to pursue costly scientific activities in space. It was included in the original Outer Space Treaty and carried over to the new version for completeness.

“Astronaut” is defined in the new treaty as, “any crew member or other persons flying in or operating a space craft, or inhabiting, visiting, or operating an installation in space or on a celestial body, including the Moon”. This definition broadens the term astronaut from its original use in the Outer Space Treaty. In the 1960s the only astronauts would have been government employees operating a national spacecraft, and as such clearly fell within the boundaries of the treaty that was signed by states. However, there is now a possibility of different classifications of civilians in space. Space tourism is one example of a business model where the term “astronaut” is fuzzy. It could refer solely to the pilots of the spacecraft, since they are under the employment of the company that was authorized to launch, but the passengers might not be part of the authorization process and so are not included. There may also be questions if there are passengers who have a different nationality than the authorizing government; are they the responsibility of the authorizing nation or their country of origin? These same concerns are shared in the case of

civilians being present in orbit for extended periods, for example private scientists on the International Space Station. There are no standards of care for human habitation in space, even if the term astronaut applied to them. This broader definition is designed to include all humans in space for any length of time, whether sent there by a government or a civilian entity, whether they are under an employment contact or a paying customer.

“Non-governmental entities” is defined in the new treaty as, “any non-governmental owner or operator of space launch vehicles, manned or unmanned space craft, installations, or other assets in outer space or on celestial bodies, including the Moon”. Regulation of non-governmental entities is one of the main areas that the Outer Space Treaty is lacking. The treaty dedicates only a single paragraph to this category of actors, yet they now make up the bulk of activity in space (*The Annual Compendium of Commercial Space Transportation: 2018*, 2018). This definition is consistent with the term’s use in the Outer Space Treaty as an umbrella term for any entity operating in space that is not a government space agency, but it is more specific. It includes both the legal standing and the type of operations they must be conducting to fall under this portion of the treaty, as well as the necessary broad language to encompass any outliers. This term is also heavily used in other portions of the proposed treaty, so a proper definition is important for providing clarity to those other added sections.

General Obligations

Article 3 of the modified treaty was previously Article 1 of the Outer Space Treaty. It is the core of the treaty; most of the rest of the document is the specific ways that nations should act to fulfill this objective. The original text has no shortcomings of its own accord and the principles it outlines are consistently maintained in the new version. However, the lack of proper definitions elsewhere in the treaty and the developments in commercial activity undercut its power. In particular, the term “province of all mankind” is broad and not well-defined. It brings up questions in a variety of scenarios about property and mineral rights, should private companies have such advanced operations in space that these issues are relevant. This term is eliminated and replaced with a more precise section that reads:

“In implementing this treaty, states shall make no claims or exercise national appropriation of outer space, including the Moon and other celestial bodies by claims of sovereignty, by means of use or occupations, or by any other means.”

This section addresses the same issues as “province of mankind”, but without relying on ill-defined terminology. Instead, it outlines the circumstances that would violate the province of mankind doctrine, then forbids those circumstances and the actions that could lead to them occurring. It also includes the catch-all term, “other means”, which can broadly be applied to any problematic situation that is not covered in this text. In the new version the text from Article 1 has been combined with other statements that together form a more robust Article 3. The previous Article III, which was a single statement requiring conduct in space to broadly adhere to international laws, is added to Article 3 as a new section, because it is a similar high-level requirement of conduct and fits thematically with the rest of the article.

Importantly, the new version includes the phrase “states shall guarantee”, as opposed to the previous language, “The exploration and use...shall...”. The new language explicitly shifts the responsibility for ensuring the freedom of navigation in space to states, which are signatories to the treaty. In the previous version, where freedom of access was addressed as a statement of fact and not an obligation, it could be argued that non-state actors in space are exempt from guaranteeing freedom of navigation in space, since they are not signatories to the treaty. The new text makes explicit the requirement that states regulate non-governmental entities in such a way as to preserve the freedom of space, where before states only agreed that it needed to stay open. It is a small change, but it eliminates the potential for nations to skirt this part of their responsibility and is consistent with the structure used throughout the London Protocol.

Non-Governmental Entities

As previously discussed, addressing non-governmental entities is the biggest shortcoming of the Outer Space Treaty. The treaty only dedicates one paragraph to this topic, yet many space launches from the United States are completely commercial – by private companies for other companies (*Licensed Launches*, 2019). At the time it was suitable to leave the obligation to “authorize and monitor” orbital activities of non-governmental entities exceptionally vague, as that provided maximum flexibility to deal with the issue in the future should it ever develop. However, now that there is a robust commercial space industry the current paragraph is insufficient. Even the United States, which has the dominant commercial space industry, is technically in violation because it does not actively monitor commercial activities in space. U.S. national regulations include a payload review by the FAA and telecommunications licensing from the FCC, but the

actual operation of any spacecraft is not monitored by any government agency. This is currently tolerable because all commercial space activity is in near-Earth orbit and *can* be monitored, but as companies eye the Moon and beyond they might be able to slip the surly bonds of watchful governments if proper procedures are not put in place.

The proposed modifications to the treaty add specific reporting and monitoring requirements, which obligate the authorizing governments to look at specific aspects of commercial activities and report their findings to the United Nations where they will be made public to all. This is the same system that was implemented in the Convention and strengthened in the Protocol. This keeps flexibility by not prohibiting any activities or technologies but adds specificity in the requirements for information that needs to be collected prior to authorizing any activities in space. Nations should be able to justify the activities that they authorize, which requires collecting the appropriate information. There is still flexibility built in to the new text, as nations can set their own limits, but those limits will be visible to the rest of the international community through the information submitted to the United Nations. This is similar to the approach that the Federal Aviation Administration is trying to take as it overhauls its process for authorizing commercial space launches, and it has been met with support from the industry.

Following the model of the Protocol and Convention, the technical details of the reporting requirements were included in a new Annex to the Treaty. Including the material in this way accomplishes two things. First, it makes the more technical information easier to find and read, as opposed to putting that information in the middle of the rest of the treaty. Second, it allows the specific requirements to be modified without renegotiating the whole treaty. By carving out the technical reporting requirements as a special section, the new Treaty can also include new rules for modifying the annex separately from the rest of the Treaty. The Protocol does this in Article 22, and a similar Article is included in the new Treaty as Article 15, which includes practically the same rules as those in the Protocol. This Article requires a 2/3 affirmative vote to amend an annex or adopt a new one, instead of opening the entire treaty up for renegotiation. This proportion was selected because it was sufficient for the London Protocol, however if the proposed treaty were actually negotiated it is possible a different threshold would be agreed upon. Regardless, so long as it is less than the entire body of signatories, this would allow the treaty to be more easily updated in the future should new information need to be factored in to the authorization process.

Annex

The 1962 Outer Space Treaty was a list of principles and general guidelines for state actors. It did include some language indicating that States were responsible for authorizing and supervising private space actors, but it gave no additional guidance indicating what form this supervision should take. At the time it was written, it seemed very unlikely that private actors would be able to operate in space. Only two space programs existed in the world, and they both required billions of dollars of support from the two most powerful and scientifically advanced nations to operate, so it seemed unlikely that any private actors would need to be regulated because there probably weren't going to be any. However, this is no longer the case, and the Treaty that gives states the authority and obligation to regulate private space actors also needs to clarify what those regulations should look like. Annex 1 to the Treaty adds the technical information that national regulations should examine when regulating private actors in space. This information falls in to two categories: pre-launch review and post-launch monitoring. The pre-launch review includes a comprehensive review of the mission plans from beginning to end, launch details, and flight information. It is important to have some uniformity of regulations between nations to prevent the adoption of “flags-of-convenience”, where private actors move operations to nations with more lenient rules that allow them to get away with behaviors they otherwise wouldn't be able to. For space this is especially important because actions in space can have large collateral impacts – orbital debris being the most significant example. This annex set requirements for what must be examined but leaves the technical methodologies and limits up to the individual nation to decide. However, by requiring it be examined and reported, the relevant information would be made available to all nations to examine, allowing them to align their regulations and assist each other in reaching commonly acceptable levels of safety.

International Geo-Political Implications

All international agreements are difficult, complex arrangements that balance a host of factors and from the various participants, including those of other issues that are not directly related. The proposed treaty would need to account for these factors if it were ever actually negotiated. Though they will be discussed here, generating satisfying resolutions is beyond the scope of this work.

The last attempt at an international treaty regarding space was the 1984 Moon Agreement. This treaty has entered force and is binding on the nations that signed it, but as of 2019 that is only 18 ratifications and a further 4 signatories (*Status of International Agreements relating to activities in outer space as at 1 January 2019*, 2019). Of the 18 nations that have ratified the treaty, none have their own space programs, though France and India both have space programs and have signed the treaty. The main point of contention with this treaty is Article 4, which says that activities on the Moon and other celestial bodies in the solar system shall, “be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development” (*United Nations Treaties and Principles on Outer Space*, 2002). Developed nations with space agencies and developing nations without the same technical capacity had very different opinions on this Article. The United States and the Soviet Union did not want to have their space programs saddled by the needs of other nations, while developing nations wanted to ensure that they would receive a portion of the benefits from space activities and not be left even further behind the developed world. Though the Moon Agreement has not seen any significant activity since the 80s, the concerns have persisted. As recently as the drafting of the U.N. Sustainable Development Goals in 2015, space and its benefits for developing nations have been a focus of the international community (“Space Supporting the Sustainable Development Goals,” 2019). Reconciling the desires of developed nations with space programs and the needs of developing is a difficult task that involves the larger structuring of the international community, as not all of these nations wield the same influence.

The United States has the most-developed commercial space industry in the world, with over 50% of commercial launches being handled by companies based in the United States (*The Annual Compendium of Commercial Space Transportation: 2018*, 2018). This gives the United States a sizeable influence over the agenda and norms of commercial space regulation, influence that the U.S. does not want to relinquish; the official stance of the U.S. delegation to the United Nations Committee on the Peaceful Use of Outer Space (UNCOPUOS) is that the Outer Space Treaty should not be renegotiated. Under the current system, flawed though it is, the United States has the flexibility to regulate its commercial space industry however it sees fit. The United States does not see a benefit to ceding this flexibility and leadership to the rest of the international community.

The United States also has deep concerns about the military dimension of space, and should the Outer Space Treaty be renegotiated this issue would be critically important. Modern military equipment relies heavily on satellites for communication and intelligence. This has made space a war-fighting domain, as evidenced by the U.S.'s intention to create a military branch focused solely on space (Feldscher, 2019b). As a nation with many space-based military assets, the United States would like to see the militarization of space slowed or stopped. Specifically, the U.S. wants to see proper regulation of anti-satellite missiles, a strong system of verification of compliance, and more broader bans on weapons in space and the use of force against objects in space. However, the proposal put forward in 2008 by Russia and China that might have moved the issue of militarization in space forward was rejected by the United States because it did not address those issues of concern (Xu & Su, 2018). If these three nations cannot find common ground on the issue of militarization in space, it is unlikely that any agreement touching on that issue will move forward, which includes the Outer Space Treaty.

Conclusion

As more actors deploy advanced technologies in space and move farther beyond Earth, they also move beyond the ability of governments to easily monitor their activities. Collisions and debris rendering Earth orbit unusable, industrial accidents on facilities in space harming workers, and nations claiming celestial bodies through the companies they authorize are all realistically possible, however unlikely they are to occur. When everything is moving at thousands of meters per second, and the only breathable atmosphere is inside a pressurized metal can, even a small tolerance for risk can be too great. There are a few possible alternatives to prevent such incidents from occurring, for example creating a new international body with the authority to actively regulate entities operating in space. But there has not been political will to even attempt to negotiate a new international treaty on space since the 1980s, and such an agreement would still require the issues with the Outer Space Treaty be addressed. A new Outer Space Treaty such as the one proposed would help ensure the continued use of outer space in a responsible manner without further complicating the governance of space through new entities. Such an update can draw on experience gained in the regulation of the oceans, another resource shared by the world. Elements of the London Protocol were incorporated in the proposed treaty because of that treaty system's success in regulating non-governmental actors. By adapting elements of this similar

treaty framework, the Outer Space Treaty can be updated in a way that makes it relevant to the modern space economy while keeping its original intent of promoting the peaceful use of space intact.

However, this proposed treaty is not a panacea for the legal and ethical challenges of the continued economic development of space. First, there is no strong enforcement mechanism for the requirements of the treaty. This has been the case since 1967, but the original treaty only had large requirements, such as the prohibition on deploying weapons of mass destruction in space, that would likely be adjudicated at the highest levels of international diplomacy. The proposed treaty includes less-pressing requirements, such as the information to be considered when authorizing activities in space. If that information were not collected, or the conclusions drawn from them were unsatisfactory, nations would have to address this through other channels and international organizations. Government space programs directly communicating, forums like UNCOPUOUS, and international organizations with the capacity to settle disputes such as the World Trade Organization are all possible ways for states to interact with each other and resolve conflicts over space, but these mechanisms were not specifically created to address disagreements over the interpretation or application of the Outer Space Treaty. The proposed treaty framework was also created based on the assumption that private, western companies should be able to operate in space, and more economic development of space is a desirable outcome. It does not address questions of equity, especially for developing nations that do not have space programs and could miss out on economic opportunities to developed western nations. Environmental concerns, e.g. preserving the condition of the Moon and other celestial bodies, were also not considered. It is possible that if the international community were ever to seriously revisit the issue of governance of space that these or values other than those considered in creating this new treaty would be the overriding principles of the discussion.

The proposed changes transform the Outer Space Treaty, the fundamental legal document of space law, from a treaty that raises questions to one that provides guidance. By including definitions for terminology and clarifying concepts such as the “province of mankind”, the proposed treaty reduces problematic vagueness and instead offers guidance for nations that are establishing their own regulatory regimes. By establishing a minimum set of information for nations to examine when authorizing non-governmental actors, the treaty ensures a degree of

uniformity across nations to reduce the likelihood of commercial space companies adopting flags of convenience to avoid scrutiny. At the same time, in only requiring certain inputs to the authorization process, the treaty maintains the flexibility for nations to develop their own system of authorizing non-governmental entities. The proposed treaty would allow current activities in space to continue and set the legal groundwork for new ventures to push farther, to the Moon and beyond. Space has already enabled many modern technologies, from GPS in consumer cell phones to navigating airliners and starting the next agricultural revolution. Companies are now looking to provide global wireless internet, take astronauts to the Moon and Mars, and test their products and technology on the International Space Station, and the limits of what is possible continue to be tested. The benefits space provides have economic impacts in the billions, and as these new technologies are successful that number will grow to trillions. With such large economic and real impacts, proper governance will only be more important.

The economic development of space is poised to deliver tremendous benefits in the coming century. It has great potential to improve the lives of people on Earth, but there are also dangers of inequality and corporate malfeasance. The proposed treaty would create a system that will help ensure that space is utilized responsibly by all parties. More importantly, this treaty is one part of the conversation about the shared future the human race wants to create beyond our pale blue dot, a conversation that needs to should be started now.

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Cover image: Space Exploration Technologies Corporation. Hawthorne, CA. Retrieved from: <https://www.spacex.com/starship>

Appendix 1: Proposed Updates to the Outer Space Treaty

The States Parties to this Treaty,

Inspired by the great technological advances made in access and use of outer space,

Recognizing the common interest of all mankind in the continued progress of the exploration and use of outer space for peaceful purposes,

Noting the growing activity by non-governmental entities in the use of outer space, particularly for economic benefit,

Believing that the exploration and use of outer space has produced great benefits to many aspects of modern life, and should continue to be safely carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development,

Desiring to contribute to broad international co-operation in the scientific as well as the legal aspects of the exploration and use of outer space for peaceful purposes,

Believing that such co-operation will contribute to the development of mutual understanding and to the strengthening of friendly relations between States and peoples,

Taking account relevant international agreements and actions, especially the 1962 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies

Convinced that a new Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, will further the purposes and principles of the Charter of the United Nations,

Have agreed on the following:

Article 1

For the purposes of this treaty:

1. “Outer Space” means 80 kilometers above the surface of the Earth, including the surface of the Moon and other celestial bodies
2. “Sovereignty” means to claim or exercise exclusive possession of territory, including exclusionary claims to in-situ resources, to navigation, or research
3. “Astronaut” means any crew member or other persons flying in or operating a space craft, or inhabiting, visiting, or operating an installation in space or on a celestial body, including the Moon
4. “Non-governmental entities” means any non-governmental owner or operator of space launch vehicles, manned or unmanned space craft, installations, or other assets in outer space or on celestial bodies, including the Moon

Article 2

Contracting parties shall ensure activities in outer space, whether conducted by nations or non-governmental entities, are conducted to ensure the safe, continued access to the resources of outer space for peaceful purposes by all peoples, such that the commercial and scientific benefits

of outer space will be available for posterity, and shall not pose undue risk to the safety of human lives.

Article 3

1. In implementing this treaty, no nation shall limit the exploration and use of Outer space, by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies for exploration and use.
2. States shall guarantee the freedom of scientific investigation in outer space, and States shall facilitate and encourage international co-operation in such investigation.
3. In implementing this treaty, states shall make no claims or exercise national appropriation of outer space, including the Moon and other celestial bodies by claims of sovereignty, by means of use or occupations, or by any other means.
4. In implementing this treaty, States Parties to the Treaty and non-governmental entities under their jurisdiction, shall carry on activities in the exploration and use of outer space, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding.

Article 4

1. State parties to this treaty shall use outer space, the Moon, and other celestial bodies exclusively for peaceful purposes.
 - a. No state shall:
 - i. Establish military bases, installations, or fortifications in outer space or on the surface of the Moon or other celestial bodies
 - ii. Test weapons of any kind in space or on the Moon or celestial bodies
 - iii. Conduct military maneuvers on celestial bodies
 - b. States may:
 - i. Use military personnel for scientific research or any other peaceful purpose
 - ii. Use any equipment or facility necessary for peaceful exploration of outer space

Article 5

1. States Parties to the Treaty shall regard astronauts as envoys of mankind in outer space and shall render to them all possible assistance in the event of accident, distress, or emergency landing on the territory of another State Party or on the high seas.
 - a. When astronauts make such an emergency landing, they shall be safely and promptly returned to the State of registry of their space vehicle.
2. In conducting activities in outer space and on celestial bodies, the astronauts of one State Party shall render all possible assistance to the astronauts of other States Parties. States Parties to the Treaty shall immediately inform the other States Parties to the Treaty or the Secretary-General of the United Nations of any phenomena they discover in outer space, which could constitute a danger to the life or health of astronauts.

Article 6

1. States Parties to the Treaty shall bear international responsibility for national activities in outer space, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.
2. The activities of non-governmental entities in outer space, shall require authorization and continuing supervision by the appropriate State Party to the Treaty, in accordance with the provisions of Annex 1.
3. Each state party to the Treaty shall report to the Secretary-General of the United Nations, and where appropriate and practicable other state parties, the public and the international scientific community:
 - a. The information in Annex 1, Section 2
 - b. The nature, conduct, locations, and results of peaceful exploration and use of outer space
 - c. The administrative and legislative measures taken to implement this treaty, especially as related to paragraph 2
 - d. The effectiveness of the measures referred to in paragraphs 4.c and any problems encountered in their application

The information in paragraph 4.a and 4.b shall be submitted on a regular basis as soon as practicable prior to the relevant activity in space

The information in paragraphs 4.c and 4.d shall be submitted on a regular basis

Article 7

Each State Party to the Treaty that launches, procures, or exercises jurisdiction over the launching of an object into outer space or the operation of an object in outer space, and each State Party which permits the launch of an object from its territory or facility, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air or in outer space.

Article 8

1. A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body.
2. Resources produced in outer space or on a celestial body shall be owned by the entity that exercises possession via extracting, processing, or otherwise changing the resource from its in-situ state, and shall be subject to the jurisdiction of the responsible party to this treaty
3. Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts or objects harvested from a celestial body, is not affected by their presence in outer space or on a celestial body or by their return to the Earth.
4. Such objects or component parts found beyond the limits of the State Party to the Treaty on whose registry they are carried shall be returned to that State Party, which shall, upon request, furnish identifying data prior to their return.

Article 9

1. In the exploration and use of outer space, including the moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space with, and ensure the activities they authorize in space maintain, due regard to the corresponding interests of all other States Parties to the Treaty.
2. States Parties to the Treaty shall pursue studies of outer space, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose.
 - a. If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, it shall undertake appropriate international consultations before proceeding with any such activity or experiment.
 - b. A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, may request consultation concerning the activity or experiment.

Article 10

1. In order to promote international co-operation in the exploration and use of outer space, in conformity with the purposes of this Treaty, the States Parties to the Treaty shall consider on a basis of equality any requests by other States Parties to the Treaty to observe the flight of space objects launched by those States. The nature of such an opportunity for observation and the conditions under which it could be afforded shall be determined by agreement between the States concerned.
2. All stations, installations, equipment and space vehicles on the Moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity. Such representatives shall give reasonable advance notice of a projected visit, in order that appropriate consultations may be held and that maximum precautions may be taken to assure safety and to avoid interference with normal operations in the facility to be visited.
3. State parties shall, through collaboration and in coordination with competent international organizations, promote bilateral and multilateral support for the development of capabilities for the peaceful use and exploration of space as provided for in this Treaty to those state parties that request it for:
 - a. Training of scientific and technical personnel for safe operation and monitoring, including launch and landing, of space craft
 - b. Advice on implementation of this Treaty
 - c. Information and technical co-operation relating to prevention of space debris

Article 11

1. The provisions of this Treaty shall apply to the activities of States Parties to the Treaty in the exploration and use of outer space, whether such activities are carried on by a single

State Party to the Treaty or jointly with other States, including cases where they are carried on within the framework of international intergovernmental organizations.

2. When activities are carried on in outer space, including the Moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the States Parties to the Treaty participating in such organization.
3. Any practical questions arising in connection with activities carried on by international intergovernmental organizations in the exploration and use of outer space, including the Moon and other celestial bodies, shall be resolved by the States Parties to the Treaty either with the appropriate international organization or with one or more States members of that international organization, which are Parties to this Treaty.

Article 12

The annexes to this treaty form an integral part of this treaty.

Article 13

This Treaty will supersede the 1962 *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies* as between parties to this Treaty which are also parties to the 1962 *Treaty*

Article 14

1. This Treaty shall be open to all States for signature. Any State which does not sign this Treaty before its entry into force in accordance with paragraph 3 of this article may accede to it at any time.
2. This Treaty shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of the United Kingdom of Great Britain and Northern Ireland, the Union of Soviet Socialist Republics and the United States of America, which are hereby designated the Depositary Governments.
3. This Treaty shall enter into force upon the deposit of instruments of ratification by five Governments including the Governments designated as Depositary Governments under this Treaty.
4. For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Treaty, it shall enter into force on the date of the deposit of their instruments of ratification or accession.
5. The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification of and accession to this Treaty, the date of its entry into force and other notices.
6. This Treaty shall be registered by the Depositary Governments pursuant to Article 102 of the Charter of the United Nations.

Article 15

Any State Party to the Treaty may propose amendments to this Treaty. Amendments shall enter into force for each State Party to the Treaty accepting the amendments upon their acceptance by

a majority of the States Parties to the Treaty and thereafter for each remaining State Party to the Treaty on the date of acceptance by it.

Article 16

1. Any State Party to the Treaty may propose amendments to the Annexes to this Treaty. The Depositary Governments shall communicate to State Parties the text of a proposed at least six months prior to its consideration by a meeting of State Parties.
2. Amendments to the Annexes will be based on scientific or technical considerations and may take into account legal, social, and economic factors as appropriate. Such amendments may be adopted by a two-thirds majority vote of the State Parties present and voting at a meeting of State Parties designated for this purpose.
3. Amendments to the Annexes that have been adopted at a meeting of State Parties shall be communicated to all State Parties without delay
4. Amendments to the Annexes shall enter into force for each State Party immediately on notification of its acceptance or 100 days after the date of their adoption at a meeting of State Parties, if that is later, that they are not able to accept the amendment at that time. A State Party may at any time substitute an acceptance for a previous declaration of objection and the amendment previously objected to shall thereupon enter into force for that State Party.
5. The Depositary Governments shall without delay notify State Parties of instruments of acceptance or objection deposited by State Parties.

Article 17

Any State Party to the Treaty may give notice of its withdrawal from the Treaty one year after its entry into force by written notification to the Depositary Governments. Such withdrawal shall take effect one year from the date of receipt of this notification.

Article 18

This Treaty, of which the English, Russian, French, Spanish and Chinese texts are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of this Treaty shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

IN WITNESS WHEREOF the undersigned, duly authorized, have signed this Treaty.

DONE in triplicate, at the cities of London, Moscow, Durham and Washington, the sixth of December, two thousand and nineteen.

Annex 1

General

1. The authorization of non-governmental actors to conduct activities in space does not remove the obligations under this treaty to promote peaceful, sustainable activities in outer space.

Pre-Launch Review

2. Prior to conducting activities in outer space, including launch activities or deployment of payloads, a review of proposed activities by non-governmental entities should, as appropriate, include an evaluation of:
 - a. Mission objectives
 - b. The number, type, and description of all space craft involved
 - c. Measures taken to ensure the safety and return of astronauts
 - d. The risks to other spacecraft and humans, including astronauts not involved in the operations, both in outer space and on Earth, due to accidents or debris-generating events
 - e. The mission profile, including:
 - i. Flight paths in outer space, including descriptive information of any orbits around the Earth
 - ii. Celestial bodies visited
 - iii. Timeline
3. In general terms, if the pre-operation review reveals hazards to other space craft, the long-term sustainable use of outer space, or to humans, an applicant is expected to formulate and implement strategies for risk mitigation, in collaboration with relevant local and national agencies, to reduce risks to tolerable levels. Approval issuance or renewal decisions shall assure compliance with any risk mitigation and safety measure requirements.

Monitoring

4. State parties to this Treaty shall monitor the activities of non-governmental entities conducting activities in outer space to verify:
 - a. Compliance with the intent and obligations of this Treaty
 - b. Adherence to the scope of the approved activities
 - c. Utilization of appropriate risk mitigation strategies

Permit and Permit Conditions

5. A decision to authorize activities by a non-governmental entity in outer space should only be made if all pre-launch reviews are completed and monitoring requirements are determined. The authorization shall ensure, as far as practicable, that risks to other space craft, the sustainable access to outer space, and human life are minimized and benefits, including scientific and economic, are maximized.

Appendix 2: Complete Treaty Mapping

In order to determine how the Outer Space Treaty can be updated in a consistent manner to the London Convention it is necessary to determine which sections of the two documents are similar.

Both treaties start out with an introductory section that states the broad goals of the treaty. These are general principles that motivate the state parties to negotiate the treaty in the first place; the sections even begin with, “The States Parties to this Treaty” and, “The Contracting Parties to this Convention”. These sections also include any necessary references to previous international agreements or resolutions, outlining the precedent that the new agreement will operate in conjunction with. In both treaties, each point is given its own demarcation and begins with an active verb, giving the sections different tones compared to the rest of the documents. The verbs include “recognizing”, “believing”, and “desiring”.

Article I of the Outer Space Treaty includes broad agreements, including the purpose of space activities, the freedom of access to space, and the desire for international cooperation. While these are broad statements, they are different from those found in the introduction section because they are new agreements of fact instead of statements of sentiment; states agree these things will now be the case, not just that there is a shared desire for them. Article II of the OST is a single sentence forbidding nations from claiming the Moon or other celestial bodies, addressing perhaps the core issue of the treaty. These are most similar to Article I and parts of Article II In the Convention. Article I of the Convention lists the goals and requirements of the Convention in the broadest terms, “promote the effective control of all sources of pollution of the marine environment”. It is where the core issue of the treaty is first addressed and addressed in the most general, comprehensive way, just as in Articles I and II of the OST. Article II of the Convention includes some identical language found in Article I of the OST concerning exceptions for signatories based on technical and scientific capability.

Article III of the OST reinforces some of the opening declarations of the treaty by outlining the international agreements that are relevant and supplemental to the goals of the treaty, including the Charter of the United Nations. In the Convention, Article XIII addresses how the Convention interacts with the Conference on the Law of the Sea. Both Articles address how the treaties interact with other relevant international agreements.

Article IV of the OST prohibits states from deploying weapons of mass destruction in orbit. This is a strict ban on this activity with little room for interpretation. There is no direct correlation in the Convention because militarization was not a topic that the treaty was attempting to address, but Article IV of the Convention, does set limits on what states can authorize and so is similar in that it prohibits certain activities of states.

Article V of the OST includes obligations for nations with regards to astronauts. This includes how astronauts should be treated upon their return to Earth in the event of an emergency landing and that aid should be rendered if an accident occurs in space. The concern of this section is not the actions of states, but rather human life. Its analogue in the London Convention is Article V, which contains exceptions to permit dumping under certain circumstances when human lives are in danger. Both sections address how the treaty operates in abnormal circumstances when human lives are in danger, and both put human life before all else.

Article VI of the OST obligates the signatories to authorize and supervise non-governmental entities acting in space. It also puts the responsibility for the actions of non-governmental entities on the authorizing state. Article VI of the London Convention instructs signatories to “designate and appropriate authority” for monitoring and authorizing private actors’ activities regarding dumping in the oceans. For both treaties these articles establish the framework for dealing with private actors.

Article VII of the OST addresses liability for damages, both in space and on Earth as a result of space-based objects. States that launch or authorize the launch of objects in to space are responsible for any damage that those objects cause. In Article X of the London Convention, states are made liable for any damage that occurs in the waters of other states if the pollution that caused the damage was dumped in their waters. Both treaties establish a liability scheme where the nations are responsible for not only their own actions but also the actions of non-governmental actors under their jurisdiction.

Article VIII of the OST establishes ownership for objects launched in to space and for when those objects return to the Earth. This is an important distinction to make because space itself was defined as unowned, or internationally shared, in Article I of the OST. By establishing objects in space as under the jurisdiction of the launching nation, this ensures that there are some laws in space that apply to launched objects. Likewise, Article VII of the London Convention establishes

that states are responsible for applying the treaty to vessels and aircraft under their jurisdiction. Both articles make clear which nations are responsible for enforcement with regards to which objects, either in space or at sea.

Article IX of the OST includes additional general principles and guarantees states the right to request consultation if they believe the future actions of another nation will jeopardize human activity in space in any way. Similar language regarding the broad principles is in part of Article IV of the London Convention, and Annex 3.B and 3.C include similar conditions for consideration when planning to authorize dumping of waste in the ocean.

Article X of the OST encourages international cooperation by urging states to consider requests from other states to observe launches. Article VIII of the London Convention also encourages international cooperation by outlining the mechanisms by which regional agreements should operate under the treaty. Additionally, Article IX details the collaboration and support that states should offer each other so all might meet the goals of the treaty.

Article XI outlines reporting requirements and the information that nations need to submit to the United Nations regarding their own activities in space and the activities that they authorized. The requirements are limited to the, “nature, conduct, locations and results” of activities in space. This topic is covered in the London Convention in Article VI Section 4, which points to other sections of the Convention that detail the type of information that states should report to the United Nations regarding the dumping they permitted.

Article XII does not have a direct parallel within the London Convention. It discusses the responsibility of states to allow their installations in outer space to be visited by other signatories of the treaty. This is most similar text in the Convention is Article VII, which describes the scope of the treaty and directs states to “prevent and punish conduct in contravention of the provisions of this Convention”. Though the two sections of the treaties include different requirements, they both address the same concern, giving states a requirement and mechanism to ensure that all signatories are acting in compliance with the treaty.

Article XIII is the last substantive section of the Outer Space Treaty. Unlike most other sections it contains two paragraphs, each addressing a different topic. The first paragraph clarifies some additional circumstances where the treaty applies, most notably for cases of activities

executed by intergovernmental organizations, for example the International Space Station. The similar topic is addressed in Articles VII and VIII of the Convention. Article VII describes the circumstances under which the Convention apply, and Article VIII encourages the development of regional agreements to carry out the mandates of the treaty. The second paragraph of Article XIII of the OST briefly describes the arbitration procedures should a dispute arise between signatories of the treaty. This is covered in Article XI of the Convention. However, the arbitration and dispute settlement procedures in the Convention are less fully developed than those in the OST. Article XI of the Convention directs the contracting parties to determine the procedures at their first meeting instead of outlining them directly.

Appendix 3: Discussion of Changes from the Convention to the Protocol

While there were many changes made between the London Convention and the Protocol, the overarching objectives and format of the treaties remained consistent.

The introductory section of the Convention is reduced in the Protocol. Some of the statements are merely trimmed down to their straight-forward, core elements, but others are eliminated entirely. Those that are removed are replaced by statements that reflect the updates in the circumstances surrounding the dumping of waste in the oceans. For example, the London Convention is referenced alongside “the evolution towards approaches based on precaution and prevention”. The precautionary principle is explicitly referenced here for the first time in this treaty system, indicating that these opening statements reflect changes in approach, not just material fact.

Article 1 of the Protocol is focused on definitions. This Article is very similar to how it appeared in the Convention, both in content and form though it is moved forward in the document from where it previously appeared as Article III. No definitions were deleted between the two treaties. However, several received more detailed points that expanded the definitions to an increased number of circumstances. “Dumping” was broadened to include storing waste in the seabed and disposing of structures by having them fall in to the sea as part of the definition. Additionally, there were two new definitions, “incineration at sea” and “pollution”. Incineration at sea adds a new category of activity to the jurisdiction of the treaty and reflects this version’s increased scope. Defining pollution gives the treaty greater specificity, as such a detailed and inclusive definition leaves little gray area when it is used in subsequent sections.

Article 2 of the Protocol is a combination of Articles I and II of the Convention. The text is slightly shortened, as part of Article I of the Convention was turned in to the definition of pollution seen in Article 1 of the Protocol. As it has mostly the same text, this Article has the same purpose as it did in the Convention. Combining and shortening the text reflects a modern approach to creating a practical document.

Article 3 of the Protocol is entirely new; It copies no text from the Convention and addresses different subject matter. It goes a step further than Article 2 to discuss the general principles that states should act on, not just the desired end goal. This article articulates the precautionary and polluter pays principles, which appear later in the Protocol when specific regulatory regimes are discussed. Adding this Article reflects a progressive attitude among states on this subject, which is one of the primary reasons for renegotiating the treaty in the first place. Articles 5 and 6 are also new and forbid certain activities, effectively broadening the scope of the treaty. Article 5 prohibits incinerating material at sea and Article 6 forbids the export of waste to then be dumped or incinerated. Similarly progressive changes were made in Article 4 of the Protocol, where an entire category of waste, what is impermissible for dumping in the oceans, was eliminated. Instead of providing an exhaustive list of the types of waste that is impermissible for dumping in the ocean under the treaty, all waste is forbidden unless cleared under the list of exceptions. This change also necessitated the elimination of Annex 1 of the Convention, which previously contained the information about what types of waste cannot be dumped in the oceans. All of these articles are examples of how the Protocol was updated in a progressive matter to expand the scope of the Convention to address new issues.

Article 7 of the Protocol is also entirely new, but its nature is different than the previous articles that were also added in this update to the Convention. Article 7 describes how the treaty relates to internal waters of nations and gives states the option of either applying the terms of the treaty or of creating their own regulatory mechanism and providing sufficient information and verification to the international community. This new flexibility allows nations to develop their own regulatory schemes if they believe it would be beneficial, while still maintaining the same standards on pollution that are the purpose of this treaty.

The text of Article 8 was copied directly from the Convention, where it was Article V. There were also no changes to the structure of the text. While the rest of the treaty makes liberal use of

subsections and individual points, Article 8 is three sections, two of which are lengthier paragraphs. It addresses exceptions to the treaty in emergencies when human lives are in danger. Leaving this section completely unchanged, as well as how much leniency it gives, signifies the overriding value of human life compared to the other goals of the treaty.

Article 9 in the Protocol regarding the issuance of permits is mostly unchanged from where the text appears in Article VI of the Convention. Article 9, Section 1.1 was cleaned up with language that is less convoluted and more concise than Article VI, 1 (a). Article 9, Section 2 has a reference to another part of the treaty that was updated to reflect changes to the organization of the document. Article 9, Sections 3, 4, and 5 are updated with more specific instructions, replacing the part of Article VI that left the details up to “later consultation by the state parties”. Though some specifics have changed as a result of other changes elsewhere in the Protocol, the main framework for issuing permits has not changed. This suggests that the system for permitting is effective, or at least acceptable, in the eyes of the international community, for otherwise it would have been significantly changed in the Protocol.

Article 10 of the Protocol is very similar to Article VII of the Convention and focuses on the application and enforcement of the other provisions of the treaty. Some language was added to clarify a few subsections, for example adding, “in accordance with international law” to Article 10, Section 2 and adding additional cases to Article 10, Section 1.3 such as incineration at sea and broadening the scope to all areas that states have jurisdiction, not just their own territorial waters. Article 10 also has a new Section 5 includes an option for states to voluntarily apply provisions to their sovereign vessels. While this was likely possible before the Protocol, this text makes the option explicit.

Article 11 of the Protocol is new, both in text and in subject matter. It details the procedures that states must go through to assess their compliance with the Protocol, or rather it lays out the determination for states to craft the specifics of such procedures. It explains the purpose of such procedures as “allowing for the full and open exchange of information, in a constructive manner”. This Article was added to promote transparency and evidence-based assistance in meeting the goals of the Protocol and tackles the issue of compliance, which is a major concern in international relations.

Article 12 of the Protocol contains the same text as Article VIII of the Convention, with the exception that the last sentence regarding technical co-operation and assistance is pulled out and expanded in its own article. That sentence is combined with text from Article IX of the Convention to form Article 13. Article 13 focuses the obligations to provide advice, information, and technical knowledge specifically toward nations with less developed capabilities to meet the standards of the treaty. It is an obligation for more advanced states to assist those that are still developing should they request it. This Article also includes new text detailing how “The Organization” plays a role in this process by facilitating requests and transfers of information. The Organization did not exist in the text of the Convention, only the resolve to create it, so Article 13 Section 2 enshrines what was previously determined during the period between treaties, and the overall changes reflect an increased focus on supporting developing nations.

Article 15 of the Protocol is the same as Article X of the Convention, which is unusual relative to the other Articles because both leave the topic to be decided in the future. According to both articles, “Contracting Parties undertake to develop procedures regarding liability arising from the dumping...of wastes or other matter”. That this issue was not sufficiently resolved to allow the section to be modified speaks to the difficulty and complexity of liability. However, the procedures for the settlement of disputes, which was part of the same text in Article X of the Convention, became Article 16 of the Protocol. The system of settlements that was developed is not original; it relies heavily on the United Nations Convention on the Law of the Sea. There is a commitment to resolving disputes peacefully and some stipulations regarding the timeline of resolutions, but the substance of the resolution process is in the referenced treaty.

Articles 17, 18, and 19 describe how the treaty should be applied by international organizations, how Parties to the Treaty should conduct meetings, and the duties of the organization created to implement the treaty. In this regard, the closest parallel to the Outer Space Treaty is the United Nations Committee on the Peaceful Use of Outer Space (UNCOPUOS), however it is an organ of the United Nations and not a treaty organization; it helped to create the Outer Space Treaty, not the other way around. This is one of the few ways that the two sets of treaties are fundamentally different – the Convention and Protocol focus on specific behaviors within a broader international framework, but the Outer Space Treaty is the international framework for space. Creating a treaty organization through a new version of the Outer Space Treaty to

facilitate its execution is beyond the scope of this work, though there have been proposals for some such institution.

Articles 20 and 22 are the last Articles of the Protocol that contain relevant changes to the Convention. Article 20 is a single sentence that gives the annexes the same power as the treaty, and Article 22 describes the process for amending the annexes. The amendment procedure for the annexes to the Protocol requires a two-thirds majority vote, and amendments, “will be based on scientific or technical considerations, and may take in to account legal, social, and economic factors as appropriate.” This shows the thinking on which the annexes are based and how they are considered differently compared to the rest of the treaty.

The Convention and the Protocol have two and three annexes, respectively. Annex 1 of the Convention includes what materials are forbidden to be dumped, Annex 2 contains information about what materials can be dumped if the appropriate permits are issued, and Annex 3 describes the information that should be evaluated in the permitting process. Annex 1 of the Protocol covers the same topic as Annex 2 of the Convention, however it is much stricter in what can be dumped. While the Convention allowed various types of metals to be dumped, the Protocol allows mostly organic wastes and dedicates an entire section to permissible forms of carbon sequestration. Annex 2 of the Protocol includes most of the information included in Annex 3 of the Convention, as well as additional requirements, such as the action list, monitoring requirements, and an assessment of potential effects of the waste. The result is a more comprehensive regulatory scheme that can be adopted by nations instead of a list of “provisions to be considered in establishing criteria”. Annex 1 of the Convention, and Article XII which contains the same information, are eliminated and do not appear in the Convention in any form. Instead, the Protocol bans the dumping of all waste except in circumstances where permits are issued. This change in approach makes it unnecessary to have a specific list of types of matter than can never be dumped, as this is now all waste by default. These changes to the annexes reinforced the existing system instead of modifying it or eliminating it altogether.