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LEGAL PROPERTY RIGHTS IN SPACE:

IMPLICATIONS FOR THE U.S. SPACE FORCE AND THE OUTER SPACE TREATY

by

Rhett W. Brown, Lt Col, USAF

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Advisor: Dr. Brent Ziarnick

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Biography

Lt Col Rhett Brown is assigned to the Air War College, Air University, Maxwell AFB, AL. He is a command pilot with more than 3000 hours flight time in C-130E/H, MC-12W and AC-208 aircraft and is a certified Foreign Area Officer specializing in the European region.

Abstract

As access to space proliferates and launch costs reduce, competition in the space domain experiences a corresponding increase. Current U.S. policy, such as the Commercial Space Launch Competitiveness Act , supports the commercialization of space and legal space property rights as described by the National Space Society Milestone Seven. In order to secure the best possible outcome, as described by the 2019 Space Futures Working Group, the U.S. must embrace a whole of government effort to promote domestic investment in the space industry, retain international leadership and set international norms in space. As space industry becomes more profitable, the Space Force mission to protect U.S. space interests will grow to potentially include manned defense missions, kinetic and non-kinetic operations and furthering the scientific understanding of the space domain. Current international agreements, such as the Outer Space Treaty, must be revised to reflect the new geopolitical situation the globe experiences today. Issues such as legal property rights and sovereignty over celestial bodies, extraplanetary self-determination and the 1968 Rescue Agreement should be re-addressed to reflect an increasingly competitive and accessible space environment.

Introduction

While most individuals are excited about space as the final frontier and feel a corresponding fascination and desire to explore that frontier, there is also a great reluctance to expend the necessary capital to realize that dream. Despite this reluctance, there are several compelling reasons that not only make the journey of space exploration, discovery and utilization attractive, but also necessary for humankind to thrive, and in some cases, continue to survive. Over four decades ago, Dr. Gerard O'Neill argued that there are commercial benefits to be gained from exploiting solar energy in space to the benefit of both space colonies and terrestrial inhabitants.[1] More recent studies have reviewed his work and highlighted the importance of proceeding forward with U.S. government leading the way for industry to make space more profitable.[2] While economic prosperity through space commerce is clearly desirable, it is only one of three factors that were examined by the 2019 Space Futures Working Group within Air Force Space Command in exploring eight possible future scenarios tied to the questions of space habitability, U.S. space dominance and economic potential.[3] Of the eight proposed futures, this paper discusses the proposed "Star Trek" future in which the above three questions are answered in the affirmative and this future reflects a deliberate national objective in space. In other words, the "Star Trek" future is the best case scenario where a free market dominates, space commercial ventures are profitable and sustainable and breakthroughs in technology allow for colonization of space in great numbers.

As a means for achieving that objective, this paper will utilize the National Space Society published series of Milestones needed to accomplish the ultimate goal of colonizing Mars.[4] More specifically, it will describe how achieving Milestone Seven, "Legal Protection of Property and Other Rights" propels the U.S. towards a "Star Trek" future. Following this,

potential avenues for a whole of government effort in achieving this milestone and an appropriate lead agency will be discussed. Finally, this paper will describe the U.S. Space Force involvement and both military and international treaty implications of legal property rights in space.

Thesis

The current trend of US policy legislation supports establishing clear guidelines for legal property rights in space. As access becomes readily available to a number of global competitors, the Outer Space Treaty (OST) must re-address the topic of sovereignty outside the terrestrial sphere and the newly created U.S. Space Force must be ready to protect national interests in a highly competitive and unforgiving domain.

Getting to Star Trek

Before going into the bulk of the discussion, it is worth describing in broad terms what the Space Futures working group envisioned with the term "Star Trek"[5] as a positive future along three axes where the U.S continues to lead in a rules-based order, space commerce results in great wealth and many humans live and work in space. Yet despite O'Neill's four decades-old proposal of rotating space habitats, there is still some doubt on whether space colonization can be accomplished on the large scale that this future envisions. Part of this concern is due to the technological challenges of transporting the materials via current space launch capacity. For example, while the International Space Station required the space lift of 232 metric tons (MT) to an orbit of 333 km, "a single Space Solar Power Satellite [SSPS] is expected to be above 3,000 MT, several kilometers across, and most likely be located in GEO, at 42,124 km."[6] Building a space habitat would involve even more material than a SSPS, requiring a herculean effort akin to the Berlin Airlift where launches would occur nearly continuously to achieve measurable progress. One alternative to the massive effort of escaping Earth's gravity well may be found in building infrastructure to harvest lunar materials and utilize much less propellant to transport materials, but this of course would mean a great deal of development in autonomous production, a concept largely untested outside the confines of Earth's atmosphere, especially on the scale that is being proposed. The "Star Trek" future assumes that these technological obstacles will at least have begun to be overcome and that "thousands of humans live or work in space at a variety of habitats across cislunar space, the Moon, and Mars."[7]

The Need for Legal Property Rights

Once the access to space as described above becomes a technological and financial reality, it is natural to contemplate the importance of the National Space Society Milestone

Seven, “Legal Protection of Property and Other Rights” and its value in achieving a “Star Trek” future. Without a doubt, there is a national desire to ensure that legal protections are afforded American citizens and corporations with respect to property and the ability to conduct business. First of all, the success of industry in any environment provides a solid foundation for national prosperity and serves as a prerequisite for investment to secure national economic interests. A notable example of this phenomena is found in early development of U.S. sea power in support of developing commercial trade. Mahan makes the argument that naval power was developed to secure commercial shipping lanes and reflected the national interest of bolstering economic prosperity.[8] While space activity is commonly thought of as nothing more than satellites and science labs that may not warrant robust protection, it represents so much more in terms of both physical and environmental resources—all available on a first-come, first-serve basis. For example, the microgravity environment itself is a resource unavailable on Earth that allows for emerging technologies such as complex 3D organ printing and the ability to produce fiber optic cables that are more than ten times as conductive as those produced terrestrially.[9] Such advances would require tremendous investment to achieve the initial results and highlight the importance of protecting those investments through not only legal means, but also through physical means as well. It is crucial, therefore, to establish domestic and international standards, and recent U.S. trends show that we are doing just that. In 2015, the Commercial Space Launch Competitiveness Act (CSLCA) was passed in part to bolster “the space mining industry through the creation of private property rights in relation to the extraction of certain space and asteroid resources.”[10] However, the passage of the CSLCA was not without some controversy. Some feared it conflicted with Article II of the OST by serving as justification for a “land grab” and potentially causing conflict in areas with commercially beneficial resources.[11] Not all agree on this

interpretation, and some insist that Article II and the CSLCA can co-exist peacefully by emphasizing there is a distinction between national sovereignty (which Article II prohibits) and national jurisdiction[12] which itself would require states to work together to form a common understanding; in many ways a process that mirrors the limitations and opportunities within the sea domain. While no entity can claim the high seas as their own, they are afforded legal rights when occupying an area...rights which are enforceable through international laws and norms. This highlights a serious shortcoming of international space law, wherein norms have largely remained ambiguous and only recently have technology and industrial will progressed to the point where this becomes an issue. In other words, space is no longer just a grand science adventure, there is real competition in every sense of the word.

Space is not Antarctica

There is a tendency to assume operations in the space domain belong solely to scientific or cooperative entities. Some of this can be attributed to the habit of equating space with Antarctica in which any sovereign claims are prohibited and no permanent military presence is authorized. In fact, much of the formatting of the OST is arguably identical to the Antarctica Treaty.[13] In some ways this is understandable. The geopolitical situation during the Cold War era supported such a strategy due to the importance of maintaining the status quo between two superpowers involved in a nuclear standoff. These two superpowers (the U.S. and U.S.S.R.) were the only states, broadly speaking, with access and ambitions to establish international norms in the space domain. Today we are faced with a completely different political situation. Not only are several additional nations conducting space operations on a regular basis, they are doing so primarily through commercial entities for the purpose of increasing economic power. China, in particular, is contesting "existing norms" and seeking "to promote its leadership role in

international space governance institutions to shape global space norms and practices in ways that benefit its economic and other national interests."[14] Ironically, contesting the status quo may be exactly what the U.S. is doing as well by promoting legal property rights in space, though many would argue that this is still in keeping with Article II of the OST. In either case, there is no doubt that the geopolitical landscape has changed dramatically since the OST was first proposed, and equally dramatic changes to the OST are becoming unavoidable in light of increased access and ambitions in the space domain.

The "first-come, first-serve" type mindset with regard to space resource harvesting and exploitation, in some ways, is an inevitable outcome as the current cost of launch and space-worthy technology is a barrier to entry for most. However, as prices come down, and without further guidance and a clear legal framework, a nightmare scenario unfolds for both national and international authorities in dispute resolution. Whether property rights should belong to those that discover resources or to those that first extract them can be an expected debate. When we begin to speak of finite resources in particular, such as water ice on the Moon's poles that would allow further exploration and resource harvesting within the solar system, this debate and distinction becomes even more heated. This particular issue is likely to be interpreted differently by nation-states and thereby become a matter of national security with an associated military mission, an issue which will be discussed in more detail later.

Cooperation is Necessary within the State

In order to establish legal property rights in space, and continue towards the positive "Star Trek" outcome that the AFSPC report outlines, it will be necessary to employ a whole of government effort. This is chiefly for two major reasons, the first of which is reducing the risk to commercial partners for investing in space resource harvest and utilization. The fact remains

that access to space comes only at extreme expense and our capability to put terrestrial resources in space is limited. Companies such as SpaceX and Blue Origin are engaged heavily in reducing those costs and increasing lift capabilities, but with extreme risk in terms of both cost and schedule while only Boeing enjoys the benefit of direct government support for its development of the heavy launch platform SLS.[15] It is imperative to implement wider government support and risk reduction for a broader group of companies to invest in space launch technology; only then can we expect to validate the need for property rights to be taken seriously.

The second reason for a whole of government effort is to ensure that a common understanding is promulgated to avoid unintentional conflict within the government, both in terms of policy and resources. An earlier case highlights this very issue, in which a private individual attempted to sue the federal government for utilization of an asteroid body he had identified and laid claim upon.[16] This claim was dismissed as there didn't appear to be legal precedent for his property ownership of this asteroid by merely filing property rights. While not taken very seriously at the time, this incident could have contributed to some of the momentum that resulted in the CSLCA passing ten years later. In fact, the asteroid in question was named Eros, recently of fame in the Sci-Fi television series "The Expanse" which is rife with the issue of property rights in the solar system. At the end of the day, however, it will be difficult for any individual or organization to substantiate a claim to extraterrestrial property without demonstrating the ability to somehow access or utilize said resource.

This is where the government can lay the framework for success by aiding space industry to accept the risk of attempting to utilize space for commercial purposes and incentivize performance beyond relying upon government payments. Clear guidance on legal property acquisition in the space domain will resolve corporate doubts and encourage investment in this

new industry. While many could arguably vie for position as lead agency in establishing clear policy, in this case, the Department of Commerce (DoC) appears to be the most logical choice and is already taking on more space responsibility through its leadership role in Space Traffic Management.[17] Utilizing the "Unity of Effort Framework Solution Guide," it will be necessary for the DoC to review guidance (policy, law, etc) and identify stakeholder and mission partners. Stakeholders in this case would likely consist of the Department of Defense (DoD), NASA, and the Department of State (DoS) at a minimum. Each of these organizations would have a defined interest in reaching the Milestone. For the DoD it would be to understand where U.S. industry may need to be protected in the future, what technologies need to be developed to secure that national interest and how to partner with commercial and international entities appropriately. For NASA, this will introduce an opportunity to further exploration, both manned and unmanned and to leverage opportunities to partner with industry to share the cost burden of doing so. For the DoS, it will be critical to establish relationships with international agencies and foster communication and cooperation towards the common goal of setting norms with respect to property and other rights in the space domain beyond what is currently outlined in Article II of the Outer Space Treaty. All stakeholders will require a common understanding of the goal and work under the leadership of the DoC to achieve said objectives.

Fiscal constraints may represent a major challenge in this effort. With increasing austerity measures across the whole of government, priority will need to be given to funding this effort at the appropriate level to have actual effect. This could be accomplished in several ways. For example, lobby interest groups are likely to approach congressional bodies such as the House Committee on Space, Science and Technology. Much of the research and proposed legislation is likely to be funded by industry entities with a vested interest in seeing these norms established

not just in the U.S., but internationally as well. Additionally, as technology narrows the gap between the concept of space resource utilization and its execution, "legal protection of property and other rights" will naturally rise in priority for government funding and other resources. In all cases, once the possibility of profit enters the picture, investors, whether private or government, will inevitably move to support this effort. As the leading space nation, the U.S. will then have a responsibility in protecting and promoting its domestic and international space agenda.

Implications for the U.S. Space Force

The creation of a separate military branch is a natural consequence of American expansion into the vacuum of space and its commercialization. Before space property and other rights are firmly in place, both domestically and internationally, the necessity of the Space Force will become evident. There are, however, a few unanswered questions regarding how it might be employed. For example, determinations must be made concerning the ratio of manned vs. unmanned assets, kinetic vs. non-kinetic capabilities, and to what extent it will conduct a scientific role in the further exploration of this new frontier and a myriad of other topics. For the purposes of this discussion, only the aforementioned will be examined to demonstrate some of the key issues at hand for the newly created Space Force.

When considering manned Space Force missions, one factor that will certainly play into the calculus is the extent to which human population, and especially Americans, move into space. It would be hard to argue that manned defense missions are necessary to protect space assets if nearly all activity in the future is accomplished via automated processes. In the short term, at least, this appears to be very likely as the challenges of harvesting in situ resources on the moon or asteroids present a long-term challenge for human health both in terms of life support (oxygen, warmth, nutrition, etc.) and microgravity's deteriorating effect on muscle mass

and bone density. While the muscle atrophy can be mitigated somewhat by steroid or hormonal measures, "data suggests that bone loss experienced in microgravity may be permanent."[18] These profound physiological impacts suggest that any long-term human presence in space will need to induce some sort of artificial gravity in order to avoid undesirable, and in the case of bone density, permanent effects. One model that might support this endeavor could consist of a large rotating space station, within which approximate earth gravity can be maintained. As occasion calls for it, smaller craft might venture out for missions of shorter duration without appreciable long-term health risks.

However, assuming these engineering and physiological challenges are overcome, there still remains the question of to what extent there will be a pressing need for humans to be a part of the space environment if automated processes can accomplish resource extraction and transportation more efficiently. If automation is unable to sustainably secure those resources for mankind, it becomes more likely that a human presence will proliferate in order to harvest them. Additionally, the harsh space environment makes it likely that repair operations will be needed for those automated equipment items, necessitating direct human involvement. Assuming space commerce grows in profitability, and a corresponding increase in competition for those resources manifests, the need to secure those resources via human physical presence will grow. Physical presence for security reasons would alleviate any ethical concerns posed by using either automated defense systems or artificial intelligence to inflict potentially lethal damage to an adversary force. To this point, there is some evidence that identification algorithms used by deep learning recognition software can be spoofed, in one case causing the software to misidentify a panda for a gibbon, a mistake no human would ever make.[19] In light of the above factors and

despite all the challenges associated with surviving in the space environment, there remains a scenario in which manned Space Force missions are a necessity.

An additional aspect to consider with the implementation of manned space force missions is the current OST and 1968 Rescue Agreement stance regarding astronauts and vehicles in distress and rendering timely aid irrespective of nationality.[20] As mentioned earlier, past space ventures, while largely state-driven, were arguably more exploratory in nature compared to the proposed defense mission of the Space Force. It is worth recalling the 2001 incident, in which a US Navy EP-3 reconnaissance aircraft collided with an intercepting Chinese fighter aircraft resulting in a forced landing on Hainan Island creating a political and military crisis for which no one had especially prepared. As global space forces begin to proliferate, additional consideration must be given to how highly classified and sensitive equipment must be treated in case of a catastrophic emergency that would require aid from an adversary power. Failure to do so could easily lead to international incidents and at a minimum, yielding either technology or secrets to competitors in the space domain.

A natural question for a military organization to ponder is the dilemma posed by the use of kinetic weapons in space, especially in orbit around planetary bodies. As demonstrated by the Chinese anti-satellite missile test in 2007, the employment of kinetic force in space can create a massive debris field with consequences for the global community that can last more than a century.[21] In the case of planetary defense, however, kinetic capability may be the only option to divert an asteroid from colliding with Earth and creating a cataclysmic event. A major challenge in planetary defense, however, is our limited ability to drive enough mass in kinetic form to have effect on large asteroid bodies due to current propulsion technology limitations.

While there is the potential to utilize the nuclear pulse propulsion method theorized by Project Orion for planetary defense,[22] the associated nuclear waste and fallout inevitably created by development and testing poses a huge limitation. Beyond this, the 1963 Partial Test Ban Treaty that in many ways contributed to the end of that project imposes the same constraints today.[23] In contrast, there are many non-kinetic options that range from electromagnetic pulse (EMP) weapons, to directed energy and cyber warfare assets that are already in effect in the space domain against adversarial actors. Indeed, part of the challenge of developing the Space Force is not wholly in developing capability, but rather mastering those capabilities and innovating effective tactics, techniques and procedure for appropriate employment. As is so often the case, there is not a simple binary answer of kinetic means for planetary defense and non-kinetic for all other military applications, but rather a necessity to consider developing domain and territory specific rules of engagement in tandem with evolving international norms and alliance conditions.

Much of what we currently know about space effects on human and other terrestrial life forms is based on very limited data due to the extremely high cost of space launch. Because of this, it can be expected that any early manned Space Force missions will certainly have a scientific component, at a minimum to take advantage of the data collection opportunity. Here is an obvious parallel to the sea domain, and historical examples demonstrate U.S. naval officers furthering scientific understanding...Jason Smith proposes that "ultimately, for the navy, sea power rested fundamentally in knowledge of the sea itself."[24] Despite more than seven decades since the first man entered the space domain, our knowledge of even the next closest planetary body is still extremely limited. It is inconceivable, and would be a costly mistake, to find ourselves in a scenario in which some component of the Space Force mission does not contribute

to further scientific understanding of the environment beyond our own atmosphere. Indeed, it is only a natural conclusion that the "Star Trek" future envisioned earlier consists of an appropriate blend of military, commercial and scientific efforts to further and protect national interests in space.

Recommendations on the Outer Space Treaty

As legal property rights become normalized in the space domain, and access becomes more practical, the topic of sovereignty in space must be readdressed. Article II of the Outer Space Treaty currently prohibits any sovereignty claims on celestial bodies, however, this article was drafted and ratified during a time of geopolitical fear, where any advantage yielded to the Soviet Union could have spelled disaster for the U.S. While competition is still fierce between the U.S. and other states, the geopolitical landscape has changed, and the trend of globalization has increased interdependence. In many ways, the space domain will largely remain a commons with access for all, however, resources and especially habitable territory will likely be contested for sole use. As new legislation such as the CSLCA is introduced, Article II must be revised to reflect this new reality and establish provisions for whether or not a corporation, state or individual can stake territorial claims and the conditions necessary to do so. Failure to do so will continue the debate on the international ambiguity of legal property rights in space.[25] The United Nations should continue to preside over extra-planetary cooperation and disputes, but should also look more pointedly to how the vast distances of space affect its ability to do so.

Additionally, as technology develops that allows for planetary body colonization, and or large permanent space habitats, Article II must be revised to allow for the principle of self-determination to be accommodated. One major challenge in this area is the lack of a central authority in space (the UN being a collective body without much in the way of enforcement). Furthermore, past treaties such as the Antarctic Treaty System and the United Nations Common Law of the Sea have succeeded in large part because a central authority was not included as a provision.[26] Thus, special attention must be given to allowing for the principle of self-determination to exist either within the current limitations of Article II or a revision to address

what will inevitably become an issue once habitations becomes permanent. The necessity of doing so becomes more apparent as one examines the birth of the United States, a colony separated by vast distances whose population no longer wished to view themselves as belonging to another nation. While it may be difficult to imagine today, Daniel and Rogers describe a potential future wherein settlers on Mars begin to resent colonial ownership by Earth and resolve to gain independence.[27] To avoid an extremely costly process, both in legal terms and potentially in military interdiction, it is necessary to address this potential issue of extraplanetary self-determination far in advance.

Finally, the space community must consider whether international agreements, including the Outer Space Treaty, address astronauts and space vehicles in distress to a sufficient degree to account for military forces. As the employment of the U.S. Space Force becomes a reality over the coming decade, it is sure to be followed by other national actors, and more importantly, competitors. It is not unreasonable to think that as access to space becomes more commonplace, the chances for vehicles in distress will correspondingly increase...many of which may be military in nature. Military space technology remains highly classified, leading to a complex situation in which rescue attempts may be easily confused with espionage. To avoid such it becomes imperative to engage in both multilateral and bilateral agreements to establish clear rules of engagement for what might otherwise become a volatile international incident as the forced landing of the EP-3 aircraft on Hainan Island in 2001 demonstrated.

Conclusion

This discussion began by proposing that despite the high cost of entry and development in the space domain, the benefits of doing so are well worth the expenditure. To achieve a "Star Trek" future in which space is profitable, inhabited and the U.S. retains a leading role, it is paramount to establish clear legal property and other rights, in accordance with the National Space Society Milestone Seven. This will not only serve to encourage commercial investment in space, but will advance technological solutions, boost the U.S. competitive advantage and help to establish international norms for space resource utilization and property rights. This will require a whole of government effort, led by the DoC in order to reduce risk for commercial investment and coordinate across agencies. Establishment of the U.S. Space Force will play a crucial role in securing national interests as U.S. industry reaches further across the space frontier, but faces challenges in terms of determining the necessity of manned missions, kinetic force and the inclusion of scientific personnel and efforts. Further research is certainly warranted in each of these areas as the long-term organization, training and equipping of this force will take several budget cycles to fund and even longer to bring to full operational capability (FOC). Finally, recommendations were made to readdress shortcomings in the current OST with respect to legal property rights, the principle of self-determination and vehicles in distress. In a period of increasing financial austerity across the Department of Defense, we cannot afford to spend money on capabilities we don't need, or fail to fund those we do. While this certainly requires ample time to plan, paradoxically, we must act now to maintain our dominant posture in space as near-peer adversary capability progresses. Failure to reach FOC quickly enough will result in yielding the ultimate high ground.

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