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Property Rights in Space

Rand Simberg

Ever since space travel began in the 1950s, space enthusiasts have dreamed that the exploration of space would lead to the colonization of space by human beings. From Arthur C. Clarke's visions of colonies on the Moon to the plans of the Mars Society today, the goal of human settlements on celestial bodies has inspired scientists and science fiction writers, and to a lesser extent politicians and entrepreneurs. But progress toward a permanent human presence in space has stalled. Scientific research conducted by people in orbiting labs like the International Space Station has contributed modestly to our knowledge of living in space. Unmanned satellites for telecommunications, defense, weather monitoring, scientific research, and other applications have proliferated over the last half-century. However, practical, economic development of space—treating it not as a mere borderland of Earth, but a new frontier in its own right—has not materialized. Still, the promise is as great as it ever was, and, contrary to popular opinion, is eminently achievable—but only if the current legal framework and attitude toward space can be shifted toward seeing it as a realm not just of human exploration, but also of human enterprise.

Space contains valuable resources. These provide a compelling reason for entrepreneurs, investors, and governments to pursue space exploration and settlement. Asteroids are known to be rich in valuable elements like neodymium, scandium, yttrium, iridium, platinum, and palladium, most of which are rare on Earth. Because of the high price that these minerals command, harvesting them from space could possibly justify even very costly mining expeditions. This is the hope of Planetary Resources, a company recently formed and funded by Google executives Larry Page and Eric Schmidt with the intent of mining asteroids. Similarly, Microsoft billionaire Naveen Jain has founded the company Moon Express, with plans to use robots to start mining the Moon—as early as next year, it claims. Meanwhile, Texas-based Shackleton Energy Company plans to mine ice in Shackleton Crater at the lunar south pole to provide propellant for planetary missions, and is raising funds for the venture now.

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The basic technology for space travel necessary for off-planet development has of course existed for several decades; the United States did, after all, put a man on the Moon in 1969. And recent advances in spacefaring technology, like the SpaceX Falcon Heavy launcher, promise to reduce the cost of transporting people and goods to and from outer space. This new rocket will deliver about fifty metric tons of payload to low-Earth orbit at a price of $120 million, allowing material to be shipped to space for about a thousand dollars per pound—far less than the tens of thousands of dollars per pound that technologies like NASA's retired space shuttle cost to ferry cargo. And if SpaceX or some other company can achieve the goal of partial or full reusability, the price of launching goods into orbit will likely drop much further, especially if market forces bring more competitors into the field.

Despite the progress in technology, and the appeal of valuable resources, space settlement has been hampered by the lack of a clearly defined legal regime for recognizing property rights in space under current U.S. and international law. There is in fact some slight internationally recognized legal precedent for retaining ownership of resources mined in space, as lunar samples returned to Earth on both U.S. and Soviet missions (the latter robotically) have been exchanged for other tokens of value. But actually owning the portion of the celestial body from which the resources are harvested—as in a traditional mining claim—is more problematic. Without legally recognized rights to buy, own, and sell titled property, it is difficult if not impossible to raise capital to develop land or extract the resources it holds. Property rights have long been considered one of the pillars of prosperity in the modern world, and their absence in space—due to the contingencies of the history of international law during the early space age—partly explains why we have not yet developed that final frontier.

A Brief History of International Space Law

International space law, such as it is, began to take shape during the space race, when outer space was viewed not as a potential frontier for development and settlement by private actors but rather as a competitive battlefield between the two superpowers in the Cold War, as well as a new realm for scientific discovery, led by government space agencies. The United States and the Soviet Union each sought to curtail the other's political and military use of space; they found common ground, or at least claimed to, in the project of exploring space for the advancement of science.

An important precedent for the development of international space law was the 1959 Antarctic Treaty, which was meant to prevent the militarization of the Antarctic and to ensure that peaceful activities, particularly scientific exploration, be allowed to continue there. These were just the sort of aims that world leaders at the time were concerned with achieving through an international agreement governing space activities, and on September 22, 1960, President Eisenhower recommended that the principles of the Antarctic Treaty be used as a model for an international agreement governing space. But tellingly, because the Antarctic Treaty prevented any nations from establishing sovereignty and contained no provisions for granting property rights or regulating economic activity, resources in the Antarctic have gone undeveloped to this day. This stands in contrast to the emerging resource boom in the equally inhospitable regions of the Arctic, where much clearer property rights exist under the jurisdiction of Arctic nations.

Negotiations in the late 1950s and early 1960s between the United States and the Soviet Union on governing space activities culminated in the signing in 1967 of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (better known as the Outer Space Treaty, or OST), an international agreement that remains the most important piece of international space law today. Just as the Antarctic Treaty was meant to preserve Antarctica as a place for international scientific cooperation, space-law historian Vladimír Kopal writes that agreement on the OST was guided by the principles that "outer space and celestial bodies are free for exploration," and that they remain free from "national appropriation."

Some parties to the treaty, particularly the Soviet Union, wanted space activities to be the sole preserve of governments. But negotiators from the United States managed to achieve a compromise in Article VI of the treaty that, as Kopal writes, "paved the way for the private sector to conduct space activities side by side with States and international intergovernmental organizations." Under Article VI, signatory governments

> 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.

By permitting non-governmental activities in space, albeit under government supervision, this section of the treaty allowed for the creation of the

commercial telecommunications, remote-sensing, and spacecraft launching industries, which were then in their infancy and today are thriving. However, as Kopal notes, the treaty "does not contain any principles that would regulate economic activities for the purpose of exploring and exploiting the natural resources of outer space, the Moon and other celestial bodies." At the time the treaty was negotiated, the issues of economic development in space seemed remote, and so diplomats set them aside as potential obstacles to finding agreement on what they saw as more pressing issues.

A dozen years after the signing of the Outer Space Treaty, a handful of countries proposed a new treaty aimed at governing economic activities in space: the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies. (Its informal name, the Moon Treaty, is somewhat misleading, since the treaty applies to all celestial bodies in the solar system, not just the Moon.) The principle behind this treaty is that resources falling outside the territories of nation-states—in this case, off-Earth resources—are "the common heritage of mankind." This principle is modeled on the 1982 Law of the Sea Treaty, one of the aims of which is to regulate seabed mining. But as a 2009 *Economist* article argued, the Law of the Sea Treaty would deny most of the rewards of prospecting to those who actually undertake it, making it a barrier to seabed mining happening at all: "Commercial miners want both a clear title to their holding and exclusive rights to exploit it. They also have to answer to shareholders." This is one of the principal reasons that the U.S. Senate has never approved the Law of the Sea Treaty despite repeated efforts to muster the necessary two-thirds vote, most recently in summer 2012.

Fortunately, the Moon Treaty is essentially a failed piece of international law. Only fourteen states are signatories to the agreement, and none of these is a spacefaring nation. Nonetheless, the provisions of the Moon Treaty remain a potential disincentive to the economic development of space, and underscore the case for the United States to repudiate it by providing an alternative, more market-friendly legal approach to space settlement.

Unlike the Moon Treaty, all spacefaring nations are signatories of the Outer Space Treaty. But there remains a question of how property rights stand under the OST—whether they are permitted, outlawed, or neither. This issue has not been put to the test in any significant legal proceedings, but some analysts have argued that recognizing property claims would be explicitly prohibited under Article II of the treaty, which reads in part, "Outer space, including the moon and other celestial bodies, is not

subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means." It is certainly clear that this part of the treaty prohibits *nations* from making claims of sovereignty off-planet; but whether private property claims are national appropriations depends on whether the recognition of these claims can be considered one of the "any other means" of national appropriation.

A later section of the OST can be interpreted to suggest that private property might count as national appropriation. As noted earlier, under Article VI, signatory states bear "responsibility for national activities in outer space" no matter whether those activities are conducted by government personnel or private citizens. But it is still not clear that the "national activities" referred to here would include private activities and property claims not made on behalf of a national government. As early as 1969, the distinguished space-law scholar Stephen Gorove argued in the Fordham Law Review that

> the Treaty in its present form appears to contain no prohibition regarding individual appropriation or acquisition by a private association or an international organization, even if other than the United Nations. Thus, at present, an individual acting on his own behalf or on behalf of another individual or a private association or an international organization could lawfully appropriate any part of outer space, including the moon and other celestial bodies.

In a way, the very existence of the Moon Treaty (notwithstanding its paucity of ratifying states) undermines the notion that the Outer Space Treaty outlaws private property in space—for if it did, there would then have been no need for the Moon Treaty to outlaw it explicitly. At best, as Gorove argued, this is one among several issues that the OST leaves unclear.

Despite these ambiguities, an alternative property-rights regime would be most successful if it aimed to conform with the OST. After all, the OST is the basis of most current international space law, including subsequent treaties, such as the Rescue Agreement (1968), relating to astronaut rescue and return, and the Liability Convention (1972), which establishes how to adjudicate claims for incidents that result in harm to third parties. Hence the first step in any space settlement strategy is to find a means of establishing property rights in space that adheres to at least the letter of the Outer Space Treaty, and perhaps can be considered an attempt to clarify and expand upon it—rather than to engage in the much more difficult process of amending the treaty or negotiating a replacement.

Staking Claims

Those opposed to the recognition by national governments of property rights in space generally tend to make two assumptions: first, that a national government would only recognize the claims of its own legal persons (that is, citizens of, residents of, and corporations chartered in that nation); and second, that it would defend those claims by force. The former argument has been made by, among others, space-law analyst Leslie I. Tennen, who argued in the Nebraska Law Review in 2010 that the decision by a state to recognize property claims "would constitute a *de facto* exclusion of other states and their nationals, and thereby constitute a form of national appropriation." Under these assumptions, the recognition of property rights in space could lead to international conflict, which would certainly violate the spirit of the Outer Space Treaty.

But what if governments recognized the property claims of *any* individual or corporation which met specified conditions, regardless of citizenship or nationality? And what if governments did not promise to provide physical defense for these property claims? Under these circumstances, the argument that recognizing property rights counts as *de facto* national appropriation would be on much shakier legal ground. How, after all, could recognition of the property rights of the citizens or corporations of *other* nations count as acts of national appropriation?

The Space Settlement Institute, a New York-based advocacy group, has taken just such an approach in proposed legislation it calls the Space Settlement Prize Act, which, if passed by Congress, would require the U.S. government to recognize and legally support land ownership claims "for any private entity which has, in fact, established a permanently inhabited settlement on the Moon, Mars, or an asteroid, with regular transportation between the settlement and the Earth open to any paying passenger." The act explicitly defines a "private entity" as "a company, a consortium of companies, and/or one or more individuals that are not controlled by any sovereign state or government."

This regime would seem to resolve the sticky issue of the Outer Space Treaty's prohibition of "national appropriation." For example, a corporation based in Canada could start and inhabit a settlement on the Moon without either the Canadian government or the corporation making an explicit property claim—but the U.S. government could say that *it* recognizes the corporation as having valid property rights in the lunar land that it settled. Under this you-scratch-my-back-and-I'll-scratch-yours arrangement, neither the Canadian government nor the

U.S. government could be said to be violating the prohibition of national appropriation.

The privately held space settlements envisioned by the proposed Space Settlement Prize Act would not be under the sovereign jurisdiction of any terrestrial nation (although the individual citizens would still be subject to the laws of their own nations). The corporations who own these settlements would be able to pass local laws, and could, in theory, apply for U.N. recognition and become an extraterrestrial nation-state capable of granting citizenship to its residents.

More importantly, this legal regime would offer needed assurance that private property rights could be secured by those who undertake the high costs of space exploration and settlement—but it would set the bar high enough to permit only serious property claims. While the proposed act, if adopted by the United States and other governments, would not permit any country to discriminate against the property claims of individuals or corporations from other countries, it also would impose certain obligations on property holders to ensure that they did not act in an "anti-competitive manner" or selectively withhold access to their property to members of any other nations.

The act as currently drafted would permit the first claim on the Moon to be no larger than 600,000 square miles—roughly 4 percent of the total lunar area, or about the area of the state of Alaska. The first claim on Mars could be up to 3.6 million square miles—roughly 6 percent of its area, or about the area of the United States. Each subsequent claim is reduced by 15 percent of the previous, and no entity is allowed multiple concurrent claims on the same body, so as to prevent monopolies. For asteroids or other bodies, claims of up to 600,000 square miles would be allowed, unless the body had total area of less than a million square miles, in which case the entire body could be claimed. Claims staked on the Moon, Mars, or asteroids would have to have a "contiguous, reasonably compact shape."

Where do the numbers come from? The U.S. General Mining Act of 1872 generally only permits land claims of around twenty acres. And while traditional land claims in the United States were forty acres (or one-sixteenth of a square mile), this was based on what was once considered sufficient size for a farm. So why should such large claims—hundreds of thousands of square miles—be permitted on the Moon, Mars, and asteroids? Because large claims would enable land sales to others in exchange for cash or other items of value. The goal of the proposed legislation is to allow for claims large enough to serve as collateral to raise necessary funds for development.

There is precedent in the U.S. federal government's history of land grants to railroad corporations—once the corporation owned the land, it had a strong incentive to increase the land's value by laying track. The situations are not quite parallel: in that case, the land rights only covered surface uses, not mineral rights; and of course, in the case of the Moon, the federal government has no land to grant. But while the general recognition of secured property rights would here take the place of grants from a previous governmental owner, the central premise still applies.

In the scenario envisioned here, the government would recognize claims and register titles, and claimants could then begin to grant, sell, and trade property deeds. The first claim would be the hardest to raise money for, which is why it would be the largest, and would also have the advantage of being able to select the most apparently promising land. For example, were this law in place today, a company like Shackleton Energy would be able to raise funds by selling its stock, the value of which would be based on the promise of the future value of the claimed lunar land itself. Once it had sent the initial settlers to the Shackleton Crater, it would apply for the title, after which it could actually start selling plots. Many, perhaps even most of the purchasers would do so with no intention of ever going to the Moon, but rather would hold their deeds as speculative investments like any other high-risk, high-reward venture. The act of selling the land would be similar to an initial public offering for the company. Once the company had raised sufficient funds with the land sales, it could afford to invest in the facilities to start to harvest ice and other resources for the manufacture of propellants, air, and other valuable materials. Similarly, asteroids or comets with favorable orbital and compositional characteristics would be the first targets of other space-resource companies, leaving less desirable real estate for the stragglers.

Even if companies were unable to sell much of the land initially, they might need to raise only a few billion dollars for a private venture—which they could do by selling just a fraction of the land available from the claim. A recent analysis conducted by Boeing's Dallas Bienhoff, using Shackleton Energy as an example, suggests that supporting a lunar base would require launching just a few thousand tons of material (including the mass of propellant) into low-Earth orbit. The SpaceX Falcon Heavy could launch this much material with less than twenty flights, which would cost about $2 billion, with development and manufacturing costs for the moon base's equipment adding just a few billion more to the cost of the enterprise.

Critics and Costs

The proposed Space Settlement Prize Act embodies an approach that is sure to raise complaints from some quarters. Many environmentalists can be counted upon to criticize what they will view as the pillaging or contaminating of the solar system; their opposition to the settlement and development of space will likely lead to discussions about the price we're willing to pay for economic growth and development. Diplomats might also object to such a proposal as unnecessarily risking an upset of the international status quo. Signatories to the Moon Treaty would likely be dissatisfied with an American plan to reject their principle of sharing "mankind's common heritage" in favor of using the market to exploit raw materials available in space. And while the Moon Treaty has only fourteen signatories, some U.S. allies—Austria, Australia, the Netherlands, and Belgium—are among them.

Setting aside the potential environmental and diplomatic concerns about the Space Settlement Prize Act, what would be the fiscal impact on the United States of passing such legislation? If we were pledging not only to recognize, but also to defend such claims, then it could require an increase in the Pentagon's space budget (or perhaps that of the U.S. Space Guard that James C. Bennett has proposed in these pages [Winter 2011]) that would be difficult to estimate. But the Space Settlement Prize Act as currently drafted explicitly states that it "makes no pledge of military defense of recognized extraterrestrial properties." Recognizing and defending property claims might result in costs to our international relations, in terms of diplomatic fallout or trade sanctions. But none of this need *necessarily* result in dollar costs to the U.S. government.

Another cost would come from the need to survey the land. But this could be done by claimant, and verified by an independent entity, at the cost of the claimant, to prevent fraud. Such a survey is well within the capability of current technology and the means of private players. NASA has just released the first high-resolution topographical map of the entire lunar surface, with a resolution to 100 meters, generated by the Lunar Reconnaissance Orbiter launched in 2009. Technology is advancing rapidly in this area, and the necessary survey would be quite affordable in the context of the overall project.

Of course, in order to maximize the probability of achieving the goals of the proposed legislation, it would be useful to invest in the development of fundamental space technologies—something that NASA has traditionally done very poorly for political reasons. This could mean a refocusing

of NASA's mission, and a concomitant increase in its budget. These technologies might include things like life-support systems, techniques for processing lunar resources, nuclear reactors capable of running in space, advanced propulsion systems, and cryogenic storage. It might also be useful to put into place GPS-like navigation systems around the Moon and Mars, and beacons out in the solar system. But the proposed legislation does not require any of this, nor any other necessary significant costs to the taxpayer.

Space Property Rights and International Law

It is important to distinguish the Space Settlement Prize Act, which seeks to protect and advance legitimate property rights in space, from the numerous spurious claims that have been made to tracts of land on the Moon and other celestial bodies, such as those made by the "Lunar Embassy" and other novelty lunar deed mills. Such unserious claims—as well as the attempt by the private company Orbital Development to claim the asteroid Eros—were the target of a 2004 statement issued by the board of directors of the International Institute of Space Law (IISL), an organization that studies space law. The IISL board's statement correctly notes that the purveyors of purported lunar deeds have not acquired "legal title to their claims" and so "the deeds they sell have no legal value or significance, and convey no recognized rights whatsoever." However, the statement also interprets the Outer Space Treaty more broadly than it should. The OST, recall, forbids the "national appropriation" of outer space and celestial bodies. But the IISL board's statement argues that "the activities of non-governmental entities (private parties) are national activities" and therefore any property claim in space is tantamount to a "national appropriation" and prohibited by the OST. This is not quite correct, for as we have seen, the backers of the proposed Space Settlement Prize Act argue that the government of one country could recognize a property right *on behalf of a private entity from another country* without engaging in a prohibited act of national appropriation.

Whether or not this interpretation of the OST holds water remains to be seen, since the precise meaning of the OST's restrictions remains an open legal issue for American legislatures and courts. In fact, when U.S. government lawyers countered Orbital Development's claim to Eros, they did not even bother to invoke the OST, nor did the court address it. As a 2004 article in the *Journal of Space Law* noted, "since there is a complete absence of any showing of a property interest in Eros, the

District Court did not have to construe the OST nor answer the question of whether or not the treaty prohibited private ownership of lunar or celestial property."

As with the Orbital Development case, it would be the place of U.S. courts to determine whether the Space Settlement Prize Act is in compliance with international treaty obligations. And if the Supreme Court did find that laws recognizing private property in space violate the Outer Space Treaty, then we would be in a stronger position to reconsider the elements of the treaty that stand in the way of securing property rights in space.

If we were to withdraw from the treaty to implement this legislation, would other countries counter with their own legislation recognizing different property claims? In an April 2012 post at Wired.com, space-law analysts Berin Szoka and James Dunstan asked what might happen if the United States began to recognize property rights in outer space: "What would stop the Chinese from adopting domestic legislation that went further? What if the first time a Chinese probe lands on the moon, the moon could be claimed by the 'Great Wall Company,' owned by the People's Liberation Army?" Unless we assume that China is plotting lunar domination, it seems reasonable that spacefaring countries like China, Russia, India, and Japan may be willing either to initiate a new treaty or to amend the OST, given the advantages that opening space settlement to private investment and settlement could have for the global (and extra-global) economy.

Some critics, including Dunstan, have also objected that the proposed legislation goes too far, arguing for a more gradual, less politically disruptive approach, such as the process that has, over the decades, established property rights over lunar samples and artificial satellites. Dunstan points to a proposal suggested by space-law analyst Wayne White, who argued that property rights be extended beyond private extraterrestrial residential or research facilities to a "safety zone" some small distance (probably several hundred meters) around it, which he maintains would comply with the OST. However, this modest approach would not provide either the necessary certainty or the financial incentives to raise capital for launching large-scale space enterprises in the first place.

Finally, it is worth noting that, while the OST arguably does not prevent the recognition of property claims *per se*, it may prove to be a hindrance to any kind at all of large-scale space activity, not just settlement. In that regard, this is the most troublesome sentence in the entire treaty: "The activities of non-governmental entities in outer space, including the

moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty."

Consider the implications of the words "continuing supervision," if taken literally. It could be argued that satisfaction of this requirement would demand that any person operating off the planet would be required to have a government minder with him at all times. Prior approval—for example, a launch license—might not be sufficient, because supervision could be argued to imply not just observation, but physical control. This wording in the treaty could imply that even the remote monitoring of private activity in space, which itself would be a significant hindrance for space settlement, would be insufficient.

With new affordable spaceflight technologies on the horizon, extensive private activity in space will be a serious possibility in the near future. If we wish to see humanity flourish in space, we have to recognize that the Outer Space Treaty is a relic of a different era. Fresh interpretations may not suffice: we may soon have to renegotiate and amend the treaty—or even completely scrap it and start from scratch—if we want not just to protect space as a mere scientific preserve but to open it for settlement as a grand new frontier.