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Legislating for Humanity's Next Step: Cultivating a Legal Framework for the Mining of Celestial Bodies

Joseph Crombie

Rapid expansion in the space sector by state and private sector actors highlights the need for a new legal regulatory framework, particularly regarding property rights. The exploitation of space-based resources through the mining of asteroids is currently subject to a cold-war era international agreement that did not include clear consideration about how future off-world commercial exploitation might be regulated or property rights assigned. This article explores two empirical examples, the International Seabed Authority and the International Telecommunication Union, to determine whether they provide useful models of a future international legal framework for off-world property rights.

Exploration and exploitation of resources are central themes for Homo sapiens. The history of mankind is littered with examples of great distances and heroic challenges overcome in the face of adversity. After years of steadfast growth, the space industry now appears on the cusp of a new era of rapid expansion in its capabilities and its users (Space Report 2015; Sommariva 2014). Using the *in situ* resources of outer space, commercial enterprise hopes to replicate the private economic growth experienced when new frontiers were explored and developed on earth. To allow this to happen, an updated legal framework is needed to reflect technical developments and ambitions in the contemporary space industry and, which allows, in particular, for property rights to be assigned on celestial bodies, permitting their mining and utilization.

The central research objective of this article is to examine those ambiguities concerning property rights as they relate to celestial bodies. The analysis is exploratory, highlighting advantages and challenges of the empirical examples studied. The first section, below, explores the current legal framework for space activities. The second section details the United Nations role in international cooperation on space. The third and fourth sections respectively analyze existing models of intergovernmental administration namely, the International Seabed Authority and the International Telecommunications Union, providing an informed understanding of what a future legal property rights framework for celestial bodies might include, and what it might

not. Consideration is also given to how property rights on celestial bodies might be governed.

CURRENT LEGAL FRAMEWORK GOVERNING SPACE ACTIVITY

Four international treaties have come into existence through United Nations (UN) resolutions that condition public and private activity in space. International agreements are vital to global commerce because private companies will be less likely to risk their capital without widely shared legal assurances and a regime of mutually recognizing contractual obligations. The first and most significant agreement is the 1967 Outer Space Treaty (OST) (UNOOSA 1967). The OST is the focal point of space law and considers the exploitation and use of outer space as the “province of all mankind” (UNOOSA 1967: 3). This guarantees the freedom of access to space for all states, outlaws national appropriation and the placement of nuclear weapons, forbids military uses of celestial bodies, and sets out a state’s duties and liabilities relevant to its domestic space activity (Johannsson et al. 2015). In regard to the OST forbidding military uses of outer space, it should be noted that this is specific to outlawing all weapons testing, military maneuvers and the creation of military installations only (UNOOSA 1967).

The Rescue Agreement of 1968 was designed to give astronauts any assistance they required in distress, obliging states that they “shall immediately take all possible steps to rescue them

and render them all necessary assistance” (UNOOSA 1968: 6). The agreement also mandated states to provide assistance to a launch state in recovering space objects that returned to earth outside of their territory.

The Liability Convention of 1972 identified that a space object causing damage or loss to human life would be the responsibility of the launching state: “a launching state shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft flight” (UNOOSA 1972: Article 1).

Finally, the Registration Convention of 1975 was intended to provide a mechanism to assist states in the identification of space objects. The agreement created a registry of all objects sent into space, maintained by the Secretary General and available to all (UNOOSA 1975).

A fifth treaty, the 1979 Moon Agreement, was not ratified by any major spacefaring state (Gangale 2009). Christol (1982) argues the primary flaw of the Moon treaty was its inclusion of the *Common Heritage of Mankind* (CHM) principle. This was an extension to a celestial body of the *Province of Mankind* principle within the OST. Hoffstadt (1994) contends that CHM caused disagreement because it was perceived by states as ambiguous, and Pop (2009) alleges it was connected to the ‘New International Economic Order’ favoring developing countries that was shunned by developed states.

THE OUTER SPACE TREATY AND THE DEBATE ABOUT PROPERTY RIGHTS

A crucial obstacle facing the commercialization of outer space and manifestation of private sector ambition is the issue of property rights; these cannot be assigned currently because to insinuate a state has sovereignty over what is being claimed violates the OST’s non-appropriation principle. As Gleeson (2007) notes, international laws apply to states rather than individual entities, placing the responsibility upon the state to enforce entities operating on its territory or on its behalf to conform to international legal obligations. This places the state accountable for the licensing,

authorization and ongoing supervision of its national space activities.

The establishment of property rights within a legal framework is essential to creating an optimal environment for the development of private sector led economic activity in outer space (Johannsson et al, 2015; Tronchetti, 2014). Jakhu & Buzdugan (2008) argue that clarifying issues surrounding right of way, spectrum rights, intellectual property, mineral rights, and title deeds are necessary first steps but cannot be undertaken under the current legal apparatus. For private companies to extract lucrative resources from asteroids or the moon, they would expect to establish property rights to protect their ownership of the minerals they mine.

Widely shared legal norms would likely need to be a starting point for many commercial business plans. Article 2 of the OST expressly forbids the national appropriation of celestial bodies via claims of sovereignty, use or occupation or any other means (UNOOSA 1967). But contradicting arguments exist over whether a ban on national appropriation extends to a ban on individual appropriation, as will now be examined.

While the national appropriation of celestial bodies is explicitly forbidden within the OST, the appropriation by individual means is not explicitly outlawed. Gorove (1968) argues as the dominant proponent of a minority of authors that “the [Outer Space] Treaty in its present form appears to contain no prohibition regarding individual appropriation” (1968: 42) although the generally accepted view is that private appropriation and property rights are not allowed under the OST (O’Donnell & Goldman 1997). A principal reason articulated by Sterns et al. (1996) is that states are not able to license for private appropriation that “which cannot be appropriated publicly” (1996: 53).

Pop (2000) argues that even if a property claim is made it would be unenforceable because to recognize the property claim would be implying national sovereignty over the territory in question and would constitute national appropriation. Indeed, even before the creation of the OST, Jenks (1965) argued that “states bear international responsibility for national activities in space; it

follows that what is forbidden to a state is not permitted to a chartered company created by a state or to one of its nationals acting as a private adventurer” (1965: 201). Academic literature overtly favors the argument that private appropriation is outlawed on celestial bodies. Consequently, Lambright (2003) argues that property rights cannot be claimed by prospective private mining firms on celestial bodies under the existing legal framework.

Some legal commentators have questioned whether asteroids should be defined as celestial bodies or “whether they should be seen instead as chattel because they are moveable property” (Feinman 2014: 220). In support of this, Tingkang (2012) argues that while it is not feasible to move a planet or a moon, an asteroid can be captured and its path altered, and this reclassification would allow for property rights to be claimed and the extraction of resources outside the legal umbrella of the OST. However, this change in definition would not address issues such as how different pieces of a chattel would be claimed, underscoring the need for a new legal framework and not simply a reinterpretation of the existing one. The traditional role of international law is to clarify and regularize state behavior (Leib, 2015). Thus, the ambiguity created under the OST highlights that it is lacking in its key purpose and a new framework is required.

CONTEMPORARY DEVELOPMENTS SHAPING THE SPACE SECTOR

Space policy has previously been manifested through international politics and state rivalries in the form of prestige projects and the substantial growth in the number of military and civilian satellites. But the rapid growth of private-sector enterprise has drastically altered the dynamics of space policy. Since the birth of the space age, the principal and predominantly only players in the space arena have been major space powers such as the United States and Russia.

States committed significant investment of public money into space exploration to gain prestige, security, and for strategic competition with fellow states (Leib, 2015). While these rationales are decidedly present among state motivations today,

the revolution in the private sector’s role has been driven by political and economic trends “towards privatization, commercialization, deregulation, and globalization of almost all human activities” (Jakhu & Buzdugan 2008: 205).

The private sector space industry has burgeoned considerably by the prospect of exploiting what are perceived, rightly or wrongly, as the virtually limitless mineral resources located within celestial bodies. This sector exists alongside and as part of other commercial space players investing in communications, imagery, and launch services.

The advancement of analyzing asteroid geology using spectroscopic analysis has allowed for the identification of resources contained within near-earth asteroids (Sommariva 2015), with the recognition of valuable elements such as platinum group metals, gold, and many others in gargantuan quantities (Lladó et al. 2014). The Earth’s moon has been identified as having large quantities of Helium 3, an element relatively scarce on Earth and vital for future nuclear fusion development (D’Souza et al. 2006). The largest companies are all based in the United States (O’Neill 2015) suggesting an advantage to technologically advanced economies that have the ability to conduct speculative research.

When the OST was negotiated there was no consideration of the technologies that would become commonplace in the future or the growth in the private sector. The size of the space industry has seen steady growth, to \$330 billion in 2014, of which 76% was made up of commercial space activities (The Space Report 2015). Between 1996 and 2006, satellite manufacturing within the United States achieved annual growth levels of 11%, while the rest of the world achieved around 13% (Anderson 2015). Garretson (2008) notes that the number of spacefaring nations will increase as costs are driven down and private operators offer cost effective options to developing states.

Garretson (2008) believes the increase in space actors will lead to a higher probability of accidents, problems, and unnecessary tensions that could be avoided through an up-to-date strategy to manage and further develop space. As

space increasingly becomes a strategic “center of gravity” (Gleeson 2007: 146) for many within the international community, it is important that fresh changes are brought about to address how states and their entities safeguard their interests within space. Sommariva (2014) argues that efforts should be made to enlarge the discussion to create an informed public debate on a matter that affects the lives of everyone on earth.

The United States has historically enjoyed a global leadership position in regard to space activities (Cremins & Spudis 2007), meaning it can exert strong influence on the processes characterizing space activity. In 2014 a bill was introduced to Congress that later went on to become the U.S. Commercial Space Launch Competitiveness Act (Congress 2016). The core of the bill was a provision that recognizes U.S. commercial asteroid resource companies’ property rights over the resources they extract. Tronchetti (2014) argues that while the bill is not intended to extend American ownership over asteroids, this could be its legal effect. Tronchetti (2014) further argues that the Act goes against principles created by the OST and amounts to an attempted amendment of the treaty.

The United States is not the only country to have developed such legislation. Luxembourg announced that it would “seek to jump-start an industrial sector to mine asteroid resources in space by creating regulatory and financial incentives” (Selding 2016:1). The emergence of independent domestic legislation further showcases the failure of the OST in not allowing states to facilitate their own private sector growth within the terms of the treaty.

When the OST was created, Feinmen (2014) argues that it was positively received by the international community. But the creation of independent domestic legislation by states party to the OST shows overt dissatisfaction with it in a modern context. Many authors such as Johannsson et al. (2015), Tronchetti (2014), and Hertzfeld & von der Dunk (2005) argue for the creation of a new international framework. The academic debate on this matter shows an inclination to argue that property rights cannot be claimed under the OST, and multiple efforts to

reinterpret its specifics highlight an aspect of law that is now out of touch with reality.

THE ROLE OF THE UNITED NATIONS

Since its inception in 1945, the United Nations (UN) has been a key player in international affairs. As Urquhart (1993) identifies, following processes of decolonization and the internationally paralyzing nature of the Cold War, the UN became the arena for mediation and conciliation among the world’s states, aiming to maintain and promote international peace and security.

Perez de Cuellar (1989), the UN’s fifth Secretary General, serving 1982-1991, argued that “the United Nations has been a witness, a catalyst and an agent of a massive transition in global affairs” (1989: 1). Its importance to, and central role in, effecting global cooperation cannot be understated. The values and norms that shape international institutions and state sovereignty are constantly subject to change as global society adapts to new developments (Makinda 1998), but this has an impact on how the UN is perceived, its influence, and how effectively it can operate.

White (2008) describes a tension at the core of the UN as angst regarding loss of sovereignty that is assumed by international cooperation. Makinda (1998) argues that there is a perception among states that the UN erodes the authority of its individual member states. So even though the UN and other international organizations such as the World Bank and World Trade Organization have proliferated since the end of World War II, suggesting acceptance by states of their validity as international players, their increase in powers is often associated with alarm among domestic policy makers who feel their sovereignty is being threatened (White 2008). Nevertheless, the UN’s experience in international dialogue means that it plays a crucial role in determining the sovereign expectations a state should have.

The agenda of the UN is set by the intentions and aims of its members and is subject to a wide array of differing motives, with the most powerful member states able to table more coercive ideas successfully. Historically, the attempted passage

of space legislation that contravenes the interests of the space powers such as the United States or Russia has been ignored. For example, the 1976 Bogotá declaration, signed by several states on the Equator, attempted to assert sovereignty over their respective portions of favorable geosynchronous orbit, but it was widely ignored by more powerful states.

The Bogotá declaration, and the aforementioned Moon Treaty, did not serve the interests of the major space powers and were consequently disregarded. It is clear that international space legislation will not become universally recognized or implemented unless it is supported by the hegemonic space powers such as the United States or Russia. Overall, it is reasonable to assume that any future agreement concerning the property rights of celestial bodies must have the support of the key actors if it is to be implemented universally and successfully.

There is precedent for international agreement concerning space to be created outside of the UN. Hertzfeld and von der Dunk (2005) highlight the case of the International Space Station (ISS), which allows participating states to classify each module of the space station associated to them as “quasi territory” (2005: 88). The agreement between the participant states of the ISS allows for seamless travel for its resident astronauts between modules contributed by numerous states and as Leib (2015) notes allowed states to retain jurisdiction including criminal jurisdiction over their citizens who are in the ISS. But this is a confined agreement with little validity as a template for circumstances outside of and beyond the confines of the ISS.

The UN is the principal international body for cooperation and the maintenance of peace, but the reality is arguably more complex because the role of the hegemonic powers is key to how future dialogue will be shaped. Sommariva (2015) maintains that it is vital the United States remain open to cooperation with other states in creating an international legal and institutional framework for the advancement of the space economy. The role of the United States within the United Nations will be critical, but this opportunity comes at a time when the UN has been relegated

to one of the country’s “fair weather friends” (Mingst 2003: 82). The desire to maintain the full range of sovereign options along with the dominant role of hegemonic influence within the UN and its space agreements are factors for consideration when forecasting the nature of future governance, including property rights on celestial bodies.

THE INTERNATIONAL SEABED AUTHORITY (ISA): AN IDEOLOGICALLY CONTENTIOUS AGENCY IN ITS INFANCY

The International Seabed Authority (ISA) was created in 1994 following international recognition of the need for a supranational form of governance of areas outside traditional zones of state sovereignty, after entry into force of the United Nations Convention on the Law of the Sea (UNCLOS). While it is closely aligned with the United Nations (UN) hierarchy, it is an autonomous international organization (Wood 2008). Nandan (2006) states that the ISA was established to provide vital protection to investors by giving them exclusive rights over seabed areas through ISA contracts or licenses.

This section analyses the ISA model for its applicability and relevance to any future model concerning or regulating the property rights of celestial bodies. The ISA’s principle role is that of supranational administration over mining activities beyond sovereign jurisdiction, so immediate parallels can be drawn with a potential future body to protect the interests of businesses planning to mine celestial bodies. Indeed, Johannsson et al. (2015) argues that the operational structure of the ISA could provide “a viable model for overseeing asteroid mining activities” (2015: 181). But the ideological foundation of the ISA, namely the principle of “Common Heritage,” will be discussed and reviewed for the likely impediment that it might cause in future inter-state dialogues or agreements given contemporary political contexts.

The establishment of the ISA provided a new legal framework in which the seabed is owned as property for all mankind; its ownership and utilization existed outside of the Westphalian state legal system (Brearley 2006). Part XI of

UNCLOS, adopted by UNCLOS III in 1982, was the largest part of the convention, the most contentiously negotiated, and the most relevant to the deep seabed-mining regime, laying the foundation for the ISA (Lodge 2002).

The ISA was established on 16 November 1994 to implement the UNCLOS agreement for the “Area,” meaning the “seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction” (UNCLOS Article 1: 1; Lodge 2002). The ISA remit also included the power to regulate and protect marine ecosystems, coastlines, and the marine environment from hazards and pollution (Chircop 2011). The activities in the Area were described as “all activities of exploration for, and exploitation of, the resources of the Area” (UNCLOS Article 1: 3). This means the role of the ISA was the “organization through which States Parties shall organize and control activities in the Area, particularly with a view to administering the resources of the Area” (UNCLOS Article 157: 1).

The ISA comprises three bodies: the assembly, which is the supreme body, and the one to which the other two bodies—the council, and the legal and technical commission—are accountable (Lodge 2002). The three ISA bodies operate through consensus with decisions taken on a practical and technical basis; this is in contrast to the ideological concerns that marked the initial negotiation of UNCLOS during the cold war (Wood 2008).

Ultimately, the ISA’s primary function is to regulate deep-sea mining, which is mining taking place outside of the 200 nautical mile exclusive economic zone of states (Glasby 2002). The activities that it can regulate include “drilling; dredging; excavation; waste disposal; and construction and operation or maintenance of installations, pipelines, and other devices related to such activities” (UNCLOS Article 157: 1). It should be noted that the ISA does not have jurisdiction over the seabed as a whole. For example, as Brearley (2006) notes, under UNCLOS III, states can lay cables and pipelines on the seabed without the consent of the ISA.

The need for the ISA as a governing body was driven by projections of abundant resources on the sea bed, similar to the profuse projected resources from off-world mining. J. L. Mero in *Mineral Resources of the Sea* (1965) set prospectors’ pulses racing by describing a virtually inexhaustible supply of nickel, copper, cobalt, and manganese on the floor of the Pacific Ocean. Many of these undersea prospectors saw the ocean floor in much the same way as those who claim the existence of huge reserves and profitable opportunities for economic exploitation of scarce and valuable minerals on celestial bodies.

Yet, despite UNCLOS and what Brewer (1985) argues was the openness of financiers to the extraordinary conditions surrounding deep sea mining, the reality of seabed mining seems less likely than ever. Lodge (2002) argues that commercial interest in seabed mining has dwindled to the point where it has now become a remote possibility, and Broadus (1987) contends that the reserves of nickel, copper, cobalt, and manganese, the principal metals that would be mined on the seabed, are more than adequately served by land-based supplies for the foreseeable long term. Deep sea mining has thus not begun in any viable sense. In the absence of commercial interest in deep seabed mineral resources, the role of the ISA has been modest (Keyuan 2010). This also limits the opportunity to analyze examples that could be applied to any possible model for exploiting celestial bodies.

While commercial prospects for future deep sea mining appear slim in the immediate term, the ISA has approved plans for exploration and has entered into 15-year agreements with twenty-six contractors (International Seabed Authority 2017). The authority itself is also authorized to conduct its own mining operations and has full legal personality along with legal immunity (Chircop 2011). The ISA can also contract with private and national companies as long as it is awarded a site of equal size or value (Nagender Nath & Sharma 2000).

THE COMMON HERITAGE PRINCIPLE

What makes the ISA exceptional in regard to international bodies is that its work is guided by the principle of the “Common Heritage of Mankind” (CHM). CHM means that the rights and resources in the area belong to mankind as a whole and are exercised by the ISA on behalf of mankind (Yu & Ji-Lu 2011). CHM is a fundamental principle in the new customary law of the sea arising from UNCLOS (Lihai 1993).

However, a lack of clarity still exists concerning the CHM principle; there are though, commonly agreed features that include “the area is not subject to national sovereignty; all states are to share in the management of the area; benefits from the area are to be distributed evenly; the area is to be used exclusively for peaceful purposes” (Brearley 2006: 51).

Authors such as Glasby (1986) argue that the CHM principle was contentious and caused disagreement among many states. The United States, in particular, found fault with the CHM principle, and the Reagan administration criticized UNCLOS for accepting CHM as a conventional principle of international law. The administration also saw the ISA as complex and unnecessary bureaucracy, while Joyner (1996) argues that American concern over CHM was motivated by the potential for what it perceived as international socialism to be applied to celestial bodies at a later date. Consequently, the United States did not, and so far has not, ratified UNCLOS and is not a member of the ISA.

It is clear that the CHM principle has created division and hindered consensus in regard to international agreements. This was plainly illustrated with the Moon Agreement of 1984 where the inclusion of CHM is blamed by Leib (2015) for creating contention and ultimately playing a key part in the low acceptance rate by states. Although UNCLOS and the Moon Agreement are not directly comparable, both regimes do share similarities because each was designed to implement the concept of CHM.

In examining the ISA much insight is provided to inform a potential model of a celestial body

resource authority. But if the ISA’s key ideological foundation, CHM, has been rejected in treaties covering space, including the Moon agreement, this inevitably raises questions over whether it can be applied beyond the ISA. States party to the Moon Agreement haven’t even begun discussions to create the contemplated international regime it would involve, illustrating its signatories lack of will to fully enact the treaty. While there is much in the ISA model which might be relevant to mining on celestial bodies, incorporating the CHM principle seems certain to cause unease if it is included in future agreements. CHM assigns key preconditions to any possible ownership solutions which could detrimentally influence the success of any agreement on celestial body property rights.

A particularly unique aspect of the ISA’s model, but a potential problem if applied to off-world mining, is the way in which it distributes the revenue it derives from its range of activities. The ISA is required to use the revenues gained to cover (in order of priority), “administrative expenses; equitable distribution between states... with special attention... to the needs of developing countries; funds for the Enterprise; and compensating states affected by market changes due to activities in the Area” (Brearley 2006: 53).

These arrangements illustrate the ISA’s inclination towards practicing social justice. The commitment of the ISA to addressing the needs of developing states applies positive discrimination within the international system. However, this would arguably be unpopular if applied to the space context, considering the vast costs to states and private actors associated with accessing and retrieving mineral resources. The ISA is undoubtedly ambitious in its redistributive remit, but this ambition hinders its applicability, in the modern political context, to acting as a template for an organization administering the property rights of celestial bodies.

The ISA is an organization in its relatively early stages and the practical application of its role has been limited so far, but it undoubtedly has great potential as an organization administering the huge quantities of mineral wealth that are claimed

to lie beneath our oceans. Nandan (2006) argues that since its inception the ISA has established itself as a reliable global institution despite being a modest-sized operation. The powers of commercialization have not challenged the ideological status quo of the deep sea bed regime because it has not been commercially viable to mine these areas. But the ISA's moral principles, if applied to space, may become challenged when subjected to the pressures and expectations of enterprise. Any legal regime developed for property rights on celestial bodies will no doubt be conditioned by the dispute surrounding the CHM principle, which is likely to be a significant conditioning factor.

**THE INTERNATIONAL
TELECOMMUNICATION UNION:
AN EFFECTIVE, IF LACKLUSTER,
INSTITUTION**

This section analyses how successfully the International Telecommunications Union (ITU) engages with and accomplishes its role of administering the most important activity in the contemporary space sector: the allocation of radio frequencies and slots in the geostationary orbit (GEO). The ITU's merits and flaws are critiqued to give an informed perspective on whether it can be a template for creating an international agreement governing the legal framework of property rights on celestial bodies.

The International Telecommunications Union (ITU) was created in 1932 following the merger of the International Telegraph Union, established in 1885, with the signatories to the International Radio Telegraph Convention of 1906 (Cowhey, 1999). The International Telegraph Union was established as part of an agreement between twenty European states that allowed for interoperability between international telegraph networks (Zacher 2002). The primary motive behind the establishment of the International Telegraph Union, and later the ITU, was the need to guarantee the continuous function of communication across borders. While initially only operating in Western Europe, overarching standards covering costs and payment mechanisms allowed for international standards to be set (Shahin 2011).

The ITU is one of the oldest functional purpose international organizations in the world. It is guided by voluntary agreements and became a specialized United Nations (UN) agency in 1947 (Wallenstein 1977). The administrative and diplomatic aspects of the ITU's work are discussed by its member states at plenipotentiary conferences held once every four years. This gives direction to the administrative and policy support work for the institution and its eight hundred Geneva-based staff (Shahin 2011).

The ITU serves to facilitate the seamless communication of information within and across borders. The period preceding the establishment of common standards and a guiding international body was rife with restricted communication networks that would stop at borders due to incompatibility (Shahin 2011). This scenario extrapolates to one where states offer differing methods of recognizing celestial body property rights that are not mutually honored, creating difficult market conditions for all actors.

It has been discussed how domestic legislation, such as by the United States in its Space Act of 2015, set domestic standards that may not correlate with the domestic legislation of other states, creating potentially competing standards. While it is uncommon for the sovereign priorities of states and the internal legal processes of two states to be identical, a certain degree of harmonization is crucial. If left alone, this would inevitably have the effect of restricting the development of off-world resource mining, as differing standards would be likely to inhibit market growth. Many authors argue that the globalization of telecommunications networks and introduction of common standards has enhanced international cooperation and enabled international telecommunications to flourish (Cowhey 1999; Krasner 1991; Ruggie 1975). It is, therefore, reasonable to argue that international cooperation would flourish in a similar manner following the introduction of common standards for off-world property rights.

Parallels can be drawn between motivations for creating seamless function and the setting of universal standards that created the ITU on the one hand, and factors now providing momentum

to create an international agreement on the property rights of celestial bodies allowing for their exploitation. International agreement can create overarching standards. These govern how international and domestic companies offer their goods on a global market and the environment within which private and public actors in states would operate. Just like the establishment of the ITU, these are national issues that require international agreement.

The role the ITU currently plays directly in the space arena is the allocation of radio frequencies and satellite orbital slot positions in geostationary orbit. This is within the ITU's mandate because satellites allow for the optimal expansion of telecommunications services, both nationally and globally (Jakhu 2007). The largest sector of the space industry is currently telecommunication services, characterized by continual expansion and innovation, and worth over \$195 billion (Satellite Industry Association 2014). The ITU thus oversees the largest area of the contemporary space sector.

Radio frequencies and orbital positions are a scarce resource. Indeed, since 1973 the ITU has described them as a "limited natural resource and that they must be used rationally, efficiently and economically" (ITU 2011: 42). Only a finite number of frequency bands and orbital slots can be allocated without potential harmful interference between them. Of course, while radio frequencies or satellite orbital slots cannot be depleted in the same way as fish reserves or minerals, their stock is finite, and this engenders competition for the best slots and frequencies. The importance of the ITU is highlighted by the fact that there are over 1,419 satellites currently orbiting Earth (Union of Concerned Scientists 2017), with each satellite registered with the ITU given a unique orbital position and radio frequency.

Using the ITU as a model or template for establishing property rights in space is therefore limited by the fact that it currently administers activity for a relatively narrow aspect of space utilization. The ITU does serve as a functional example of what can be achieved through international cooperation, but it must be

acknowledged that the area within which it operates is constrained. A future agreement concerning property rights on celestial bodies would need to be more than a direct copy of the ITU's framework because it will apply to a far different and wider arena.

The flexibility that the ITU provides through its operational mandate given directly by member states has, however, led to criticism that it has no enforcement mechanisms. The ITU is made up of member states and has no power to enforce its own regulations over its members. The organization also has no mandate to settle disputes between members and expects that all states should cooperate to find solutions (Jakhu 2007).

This has led to criticism that the ITU is incapable of carrying out its own responsibilities. Cowhey (1999) argues that the ITU has traditionally been characterized as simply a set of technical rules eliciting minimal commitment by its members. Rendleman (2010) concurs that the ITU has been dismissed as a "gentlemen's club" because it is too reliant on the goodwill of its members while Harrison (2013) contends that historically the ITU has acted as an expensive and exclusive club, leading to the maintenance of high standards only because the members had an interest in maintaining decorum. This interest is critical to international agreements, but whether a similar concern would exist in regulating space resources outside of telecommunication interests can only be speculation.

The lowering of entry costs to the space arena has allowed for new actors, and this has put pressure on the ITU. Indeed, the ITU complains that universities and others are launching satellites into orbit without registering them with their relevant national body, and it has no means to sanction the state within which the offending organization is based (Harrison 2013). This is evidence of the problem facing organizations like the ITU that many states will not readily agree to activities that involve the transfer of their jurisdictional control to an international body. Ceding jurisdiction to an international body will only be accomplished if there is a significant benefit to the state. The ITU's practice of allocating radio spectrum and orbital slots on a first come, first served basis

has also led to criticism. A state notifies the ITU of its intention to start a service using certain radio frequencies from a particular orbital position and is then protected against damaging interference from late comers (Lyall & Larson 2016). States seek to gain radio frequencies and orbital positions as they deem appropriate for enhancing their national interest, disregarding the scarcity the ITU bemoans (Jakhu 2007).

ASCENDENCY OF NEOLIBERALISM

The adoption of neoliberal principles denotes a marked shift from state-centric to market-oriented views of communications among the major spacefaring countries. While there are competing definitions of neoliberalism, for the purpose of this article it is assumed to mean political principles and economic activities grounded in the belief that markets should be privatized to serve the public good. The ITU is an influential and leading actor in the governance of contemporary space-based activity; its policies directly affect the ways in which space activity is conducted.

Escobar (1995) argued that its decisions were based disproportionately on the opinions of those in power and that “our knowledge is ideological in the sense that international organisations’ conceptions and means of description represent the world as it is for those who rule it, rather than for those who are ruled” (1995: 108). In the context of globalization, such a view does not appear out of date today, and as Cowhey (1999) also noted, presciently, it was also necessary to acknowledge increasing precedent for free trade rules and the liberalization of the world economy (Cowhey, 1999).

McCormick (2008) argues that the precedent has manifested itself through the space telecommunications sector, with the privatization and restructuring of two of the world’s biggest intergovernmental satellite organizations, Intelsat and Inmarsat. The privatization of Intelsat and Inmarsat represents creeping marketization of the global commons in line with dominant elite ideas concerning the supremacy of neoliberal principles. Creation of a legal regime for the property rights of celestial bodies will most likely put emphasis

on the role of private interests, on the basis that governments tend to see them as essential for driving economic development. The supremacy of neoliberal principles and the dominance of ideas favoring privatization suggest that a model for celestial body property rights based on the ITU would need to favor private interests.

The evolving nature of telecommunications and the emergence of the ITU as a key actor in the contemporary space arena has resulted in what Shahin (2011) argues is the flexible nature of its mandate. The ITU does have clear merit in that it is a functional body, but it also has weaknesses. Its lack of an enforcement mechanism means it can be held hostage to the goodwill of its members. Crucial for any future institution governing the property rights of celestial bodies would be whether it had the enforcement mechanisms to ensure the implementation of its mandate.

CONCLUSION

This article has used empirical examples to examine what a future legal framework governing the property rights of celestial bodies might include. Private enterprises are setting their sights on exploiting what they foresee as limitless space-based resources. In order for this to happen an internationally recognized and agreed legal framework for allocating property rights has to be determined for mining on celestial bodies such as asteroids. The ambitions of private enterprise have put increasing pressure on policy makers to create international treaties that facilitate the appropriation of celestial bodies’ resources through the establishment of property rights.

The most significant existing treaty, the 1967 Outer Space Treaty (OST), guarantees the freedom of space to all states and is widely held not to allow appropriation by private or public actors. Hence, those seeking to mine celestial bodies cannot claim property rights under the current legal framework. State or private enterprises are unlikely to risk investment when there is no regime of mutually respecting contractual obligations and no legal basis giving them property title to anything they mine.

There is disagreement on whether the OST explicitly prohibits individual or private appropriation because the treaty does not provide clarity on the status of the resources contained in celestial bodies, in particular their exploitation and commercial utilization (Leib 2015; McCormick 2015; Hertzfeld & von der Dunk 2005).

However, much scholarly literature, legal commentators, and policy makers favor the argument that the OST does outlaw individual appropriation. Some have suggested circumventing this lack of clarity by classifying asteroids as chattel (Feinman 2014) or applying the accepted definition of “commercial use” within the OST from “use,” which could allow mining (Hobe & Schrogl 2009).

To eliminate such ambiguity, it can be argued that only the establishment of a new legal framework creating a clear and unambiguous property rights regime can create the right conditions for private sector led economic activity in outer space (Johannsson 2015; Tronchetti 2014; Sommariva 2015). As space becomes an increasingly busy arena through growing private involvement, it is vital that international law adapts to contemporary realities without simply seeking to reinterpret the OST, whose principle purpose originally was demilitarization (Hickman 2010).

Since its establishment, the United Nations has been a vital actor in mediating and facilitating peace around the world. While the organization has strong historical precedent for mediation, it suffers from tension among its members regarding a loss of sovereignty that UN involvement is felt to create (White 2008). However, the UN is the body which, through the OST, has provided guardianship over celestial bodies, acting as custodian for mankind as a whole. It would thus seem credible to assume the UN will play a role in their future governance.

Without the support of key actors and spacefaring powers, a universal agreement will not be reached. The impacts of hegemonic influence and fragile perceptions of sovereignty are key conditioning factors in any role the UN may play in facilitating

future negotiations and the likelihood of a practical deal being achieved.

An interesting legal precedent establishing sovereignty in space exists outside of the UN through the legal arrangement created for the International Space Station, but this represents a narrow agreement that is of limited relevance as a template for establishing property rights on celestial bodies. It does highlight that international agreement for space can be cultivated outside of the UN.

The International Telecommunications Union (ITU) and the International Seabed Authority (ISA) are each organizations that offer useful parallels and potential models for any future organization administering the property rights of celestial bodies, but each has notable flaws.

The ISA created a new distinct legal framework because it was based on the principle of the Common Heritage of Mankind (CHM). This manifests operationally through the ISA being authorized to conduct its own mining operations, but private and state companies have to give a site of equal value or size to any of their operations in order to qualify for a license (Nagender Nath & Sharma 2000). The ISA is also required to distribute its revenues to states with a particular focus on developing countries; this aspect of social justice was not welcomed by the United States, concerned that this was a form of international socialism. CHM was included in the ill-fated Moon agreement, and Leib (2015) argues that it was central to its failure. This will undoubtedly lead to tension in future agreements governing celestial bodies and could be a sticking point in negotiations. Ultimately, the CHM principle and the lack of market interest in seabed mining restrict the usefulness of the ISA as a template for any future body governing celestial body property rights.

The ITU administers the largest activity in the space sector, allocating orbital slots and radio frequencies for satellites, each of which is a limited commodity. It involves a voluntary arrangement between states which could be attractive to policy makers keen to maintain flexibility. However, the lack of an enforcement

mechanism does not make treaty obligations any less binding from a legal perspective. The ITU's longevity is evidence of the successful role that states believe it plays, but as a template it has a weakness, which is its lack of an enforcement mechanism. Any future body governing or regulating the property rights of celestial bodies would have to include enforcement mechanisms to allow for the implementation of what it is meant to achieve, otherwise the characterizations of infirmity leveled at the ITU (Jakhu 2007; Cowhey 1999) will be just as valid.

which promises high risk for substantial rewards, is wholly dependent on the development of a comprehensive legal regime that facilitates and encourages it.

The creation of overarching international legislation to establish property rights on celestial bodies arises because while these are national issues, they ultimately require international agreements. Domestic laws such as the US Space Act of 2015 do not create overarching standards for all states to abide by, nor do they create a business friendly trade environment.

International agreements do carry the baggage of domestic concerns and are influenced by dominant ideologies. The dominance of neoliberal ideas within global institutions is likely to affect the outcome of any future agreement regarding off-world property rights. Privatization of two of the largest satellite organizations (Inmarsat and Intelsat) also shows, from the application of neoliberal ideas, the preference favoring private interests in global affairs. This likely presages what can be expected in a regime governing the property rights of celestial bodies, where the interests of the private sector may well take precedence.

The current status quo under which space belongs to everybody and nobody has become unsustainable. The present legal regime offers little support to public and private actors seeking to grow the space industry. A new regime or set of governing principles is desirable to allow the potentially vast resources of the cosmos to be utilized, creating a new space economy which is of direct benefit to mankind. While the ITU and ISA may not provide perfect templates, they do offer beneficial and insightful information on what future legislation may and may not include. Ultimately, the realization of any private sector ambition to mine celestial bodies, a prospect

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