RES COMMUNIS OMNIUM v. RES NULLIUS IN U.S. SPACE MINING LAW & POLICY: A MULTILEVEL THEORETICAL ANALYSIS OF U.S. PUBLIC POLICY ON SPACE MINERALS MINING UNDER TITLE IV, §51301- §403, U.S. 2015 COMMERCIAL SPACE LAUNCH COMPETITIVENESS ACT (PUBLIC LAW 114-90) & ITS IMPLICATIONS FOR INTERNATIONAL SPACE LAW UNDER ARTICLES I & II, 1967 OUTER SPACE TREATY

by

Samuel Chuks Japhets

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Doctor of Philosophy in Public/Foreign Policy

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ABSTRACT

The outer space territory and celestial bodies are unfathomably rich in strategic mineral resources worth trillions of dollars such as water ice, helium-3, platinum, iron, cobalt, and ammonia. These space resources, distinct from their space territorial and celestial bodies loci, need to be located, characterized, captured, processed, concentrated, and transported to points of use in-situ or on Earth by capable state and private space investors, stakeholders, or national agencies, for private benefits. Investors in this embryonic space mining industry need legal certainty and predictability under unambiguous legal and policy frameworks that guarantee property interests over extracted minerals. The Problem is that space mining activity is not expressly accounted for in the governing outer space law, therefore dueling legal theories abound on the legality of space mining. These notions include strict "Non-Appropriation," permissible competitive appropriations, and conflict-oriented nationalist exclusive / imperial colonization theories. However, this research study finds that under the better, more coherent, and plausible legal interpretation of the "Non-Appropriation" principle, there is no inherent incompatibility between the *terra*/*res communis omnium* philosophical basis of Article II, 1967 OST, and the *res nullius* policy framework of Title IV, U.S. 2015 Space Act. This qualitative research study examined, catalogued, interpreted, and analyzed an exhaustive compendium of empirical and theoretical extant documentary data of outer space Regimes Theory literature, through the lens of a politico-philosophical and legal-historical perspectives. The study used Glaser and Strauss' (1967) Grounded Theory methodology, in a rigorous comparative inductive analysis of the themes, concepts, and theoretical frameworks inherent in the primary and secondary data of space law and policy. The overarching theory is that Article II, 1967 OST and Title IV, U.S. 2015 Space Act can straightforwardly be harmonized. Thus the U.S. does not need to unilaterally modify the 1967 OST, withdraw from its tenets, or embark on a unilateral imperial colonization of outer space and celestial bodies in order to implement and actualize the policy goals of Title IV, Sec. 51301-03, U.S. 2015 Space Act. On this basis therefore this study adds two novelties to the study of space mining law and policy: first, this research study proposes that contemporary theoretical constructs and the theorists of space mining law and policy are best understood when structured in accordance with their underlying dominant ideological spectrum as done in this study; and second, in addition to theories of implicit presence and legal historical analysis of the travaux preparatoires of international space law, the legitimacy of Title IV is best defended principally on the 1927 "Lotus" principle due to the explicit silence of space mining policy in the body of general international law and its cognate international space law.

Keywords: Space mining, asteroid mining, space policy, Articles I & II, 1967 OST, non-appropriation, exploitation, cooperation, competition, conflict, modify/withdraw, Title IV, Sec. 51301-03, and Sec. 403, U.S. 2015 Commercial Space Launch Competitiveness Act, 1862 Homestead Act, 1927 "Lotus" principle, *terra communis omnium*, *res communis omnium*, *terra nullius*, *res nullius*, pre-1967 UN Gen. Assembly space resolutions, UNOOSA, COPUOS, Legal Subcommittee COPUOS, pre-2015 U.S. space regulations, Luxembourg Space Legislation, UAE space policy, JAXA space policy, Moon Agreement.

Copyright

Dedication

I dedicate this project to Elon Musk, the founder, and CEO of SpaceX and Tesla Automotive Company USA, a pivotal figure in the vision of humanity as an interplanetary specie. To my sons, President Odumije and Baron Jimnatu, their future children, the Gen-Z generation, and to all future human species that will experience interplanetary existence, inter-galactic conferences with the other "sons of God" from distant planets in zero-gravity atmospheres. Unfortunately, as much as I do desire otherwise, I will be dead and far gone by the time human beings become multiplanetary species in the 22nd century and beyond. However, may you, the surviving and succeeding generations reading this manuscript, remember that, together with my dissertation committee, we envisioned the concrete reality of the (currently "fictional") state of future physical colonization and human habitations of other planetary bodies in our solar system and galaxies. It is my hope that your generations will conduct all levels of space minerals mining policies and projects in a lawful and ethical manner for the benefit of all humankind.

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I am also highly indebted to the collegial guidance of the Reader, Dr. Kahlib Fischer, an esteemed Professor of Government at Liberty University, Lynchburg, VA. Dr. Kahlib Fischer has taught at both the undergraduate and graduate levels, as well as in the classroom and online settings, and is currently serving as the Program Director for Politics & Policy Concentrations in the Helms School of Government where I studied. He has developed curriculum for, and taught such courses as foreign policy, American government, leadership, business ethics, humanities, and political science, to both traditional and non-traditional students including myself. In addition to teaching, Dr. Fischer served as a field director for a Congressional race and has provided organizational leadership training and consulting.

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List of Abbreviations

1967 OST – The 1967 Outer Space Treaty
CNSA – China National Space Administration
COPUOS – United Nations Committee on the Peaceful Uses of Outer Space
ESA – European Space Agency
GT – Grounded Theory
ICJ – International Court of Justice
ISRO – Indian Space Research Organization
JAXA – Japan Aerospace Exploration Agency
JPL – Jet Propulsion Laboratory
NASA – National Aeronautics and Space Administration
NOAA – National Oceanic and Atmospheric Administration
QSR NVivo – Qualitative Software Research Tool, NVivo
RT – Regimes Theory
ROSCOSMOS – Russian State Corporation for Space Activities
UN – United Nations
UNCLOS – United Nations Convention on the Law of the Sea
UNGA – United Nations General Assembly
UNOOSA – United Nations Office of Space Affairs
U.S. 2015 Space Act – U.S. Commercial Space Launch Competitiveness Act of 2015
VCLT – Vienna Convention on the Law of Treaties (1969)

Table of Codes

Key/Buzz Words	**Code (Label)**
Asteroid Resource (AR)	ARes.
Space Resource (SR)	SRes.
Commercial Exploration (CE)	CEx.
Commercial Recovery (CR)	CRec.
U.S. Citizen (s)	U.S. Citz.
Exploration	Expl.
Utilization / Use	Utlz/Use
Authorization	Auth.
Supervision	Supvs.
Obtain, possess, own, sell, transport	OPOST
United States	US
International	Int'l
International law	IL
Equality	Eq.
Outer space / space	OS
Moon	CB (celestial body)
Asteroid (s)	Ast.
Celestial bodies	CB
Int'l cooperation	IC
Int'l obligation (s)	IO
Appropriation	Approp.
Sovereignty	Sov.
Exclusive	Excl.
Mankind	Mknd.
States / nations/countries	SNC

INTRODUCTION

This project adds two novelties to the research study of space mining law and policy. First, the study proposes that contemporary theorists of space mining law and policy and their various theoretical constructs are best understood when structured consistently with a spectrum of ideas that are also supported by insights from political science, philosophy, the history of political thought, and related subfields and disciplines. The study demonstrates this claim in the synthesis of prevailing perspectives of space mining law and policy. Second, in addition to theories that claim implicit presence of space mining activities in the 1967 Outer Space Treaty and perspectives of legal-historical analysis of the *travaux preparatoires* of international space law, the legitimacy of Title IV, U.S. 2015 Space Act—as having a solid basis in international law—is best definitively established on grounds of the 1927 "Lotus" principle of international law. This is due to the apparent silence of space mining policy in the body of general international law and its cognate international space law. The study substantiates this claim in the synthesis of views in the last chapter. Prior to these conclusions, why should public policy concern itself with outer space and its mineral resources?

There are colossal economic and financial opportunities, with consequences for the balance of economic and military on planet Earth, in the mining of strategic space minerals that amounts to trillions and trillions of dollars (chapter 1). But who will capitalize on it? Without clear legal guidelines in the body of general (public) international law—of which space law is a part of—or a universally acceptable international space mining legal framework made by spacefaring States and consented to, by them, the risk is an escalating arms race, geopolitical conflict that spills over, and potentially, a global war on planet Earth over outer space mineral resources. What legal perceptions of the international domain of outer space at the international

and domestic levels can best avert this looming danger and provide unambiguous, peaceful policy guidelines for space mining in the 21st century?

In the past, legal debates about non-sovereign international spaces have involved thinkers such as Hugo Grotius, William Welwod, John Locke, and John Selden. Of course, these theorists had their differences on the legal status of international spaces and whether direct sovereign territorial claims versus indirect national jurisdictions should be extended to international spaces such as the high seas. Some, as this project will show, erred more on the side of common ownership that barred all forms of sovereign territorial claims. Others clearly favored the idea of individual appropriation of natural resources from international spaces through personal jurisdiction of states over legal entities engaged in such non-sovereign activities. But wherever they stood – clearly, they theorized about these international spaces against the background of empires in tension, bloodshed, and war.

In Europe, the 1500s and 1600s were bloody ones, as political projects expanded, and emerging nations fought over ownership of non-sovereign territories and matters of faith within sovereign borders. And, as the Atlantic and Indian Oceans became the theater of international trade and imperial quests, intense debates arose on the recurring issue of the scope of national sovereignty – namely, whether a state could claim and assert legal territorial sovereignty over the high seas. Significantly, during the era of Spanish / Portuguese imperialism over the high seas, the legal theories of the Dutch jurist, Hugo Grotius (1583 – 1645) on the scope of sovereignty relative to the high seas, constituted a pivotal intellectual foundation for the new political structure of Europe at the close of the Thirty Years' War (1618-1648) and the consequent 1648 Treaty of Westphalia (Bryce 1904, 436). In his landmark works such as *De Jure Praedae* (1603) and *Mare Liberum* of 1609, Grotius reasoned that his nation, the Dutch, has the right of

unfettered navigation and commerce in the high seas because the high seas is owned in common by all and not subject to sovereign territorial claims.

Grotius (1625) extended these views in *The Law of War and Peace* (1625) in which he crafted the novel law of international relations and legal framework for understanding the scope of sovereign territorial claims and limitations of sovereignty relative to international spaces, especially as states competed for global markets and offshore fishing in the high seas. Similarly, opponents of Grotius' perspective such as English professor of civil law, William Welwod (1578 -1622 – *An Abridgement of All Sea Laws Gathered Forth of All Writings and Monuments,* 1636), and English jurist John Selden (1584 – 1654 – *Mare Clausum,* 1631/1635) respectively affirmed that contiguous territorial waters are under the sovereign territorial jurisdiction and dominion of the states adjoining such water bodies, while the high sea remains free and common to all.

Evidently, these theorists laid the foundation upon which the system of international jurisprudence has been anchored during the last four centuries of public international law. Certainly, the interest in international spaces and concerns about sovereign territorial extensions then was underpinned by the desire for global peace. This research study revisit that era, and some of those sovereign territorial expansions debates, to gain a better perspective on contemporary controversies surrounding possible extensions of national sovereign territorial claims over the outer space non-sovereign international space.

Having taken this tour, in turning to the 20th century, the research study found that current international space law clearly indicates a common ownership or commons framework specific to the high seas, Antarctica, and the outer space territory, including the Moon, Mars, and other celestial bodies (Von der Dunk 2017). Strikingly, the names of Hugo Grotius, John Selden, and others were mentioned during the adoption of many of these most important legal instruments

(Lachs 2010). Just like those that instituted the 1945 Charter of the United Nations, these post-WWII international legal frameworks were designed to prevent the kinds of rivalrous nationalism, terrestrial sovereign territorial quests, and imperial logic that characterized the 16th and 17th centuries as well as the brutal violence of World War I and World War II.

But recent pivotal 21st century space law developments at the domestic level of international relations appear to threaten this 20th century progress. Specifically, space mining under current US policy, going back to 2015 in particular, seems to reintroduce the kind of "free for all" rivalrous takings that early theorists of "the state of nature" feared, and which the UN and related post-WWII global legal instruments were set up to circumvent. Remarkably, this law was enacted by a Republican house and Senate and signed by President Barack Obama, a Democrat. What were they thinking? Were the supporters and actors involved not able to appreciate the risks, and dangers, of moving away from the customary understanding of space based on the authoritative principles of international law and international space law, and embracing one that relied predominantly on the acquisitive version of John Locke or the 1862 Homestead Act?

The synthesis, drawing both from the older thinkers, a careful survey of the empirical and theoretical literature, and a 20th century international court precedent on jurisdictional extensions to international spaces, suggests a compromise and a way forward. Although it is, to some extent, indicated by thinkers who wrote at the dawn of modernity in order to mitigate the risks of global war, it is also supported by certain aspects of Title IV, U.S. 2015 Space Act, and important 21st century national space legal frameworks. In particular, this research study demonstrates how one international court's decision holds the key; and how the contemporary dueling theories of space mining could be harmonized to advance the theory and practice of

space mining. That key has to do with the silence of international law on space mining policy. The 1927 “Lotus” decision by the Permanent Court of International Justice, to which I refer, gives nations significant leeway to pursue their interests when international law does not spell out, in unambiguous terms, their duties, rights, and obligations or the steps they need to take in a particular policy domain of international space. Alongside the 1927 “Lotus” decision, I will consider the 1969 Vienna Convention on the Law of Treaties, which underscores the legal force of authentic and definitive international treaties.

The Problem

The outer space territory and celestial bodies are unfathomably rich in strategic mineral resources worth trillions of dollars such as water ice, helium-3, platinum, iron, cobalt, and ammonia (Eric Kulu 2020; Michael B. Duke 2020). These space resources, distinct from their space territorial and celestial bodies loci, need to be located, characterized, captured, processed, concentrated, and transported to points of use in-situ (i.e., in outer space) or on Earth, by capable state and private space investors, stakeholders, or national agencies, for private benefits (Dinkin 2004). Investors and private enterprises in this evolving space mining industry need legal certainty and predictability under unambiguous legal and policy frameworks that guarantee property interests and profitability (Von der Dunk 2017; Blount and Robinson 2016).

The Problem is that the 1967 OST and its *travaux preparatoires* are explicitly silent on a comprehensive space mining framework that would provide clear unambiguous regulatory guidance and legal certainty to practitioners and theorists in the emerging space mining policy domain (IISL 2015). This 1967 OST stipulates that all states can freely explore and use outer space and celestial bodies and may license and supervise their legal entities to do so. However, 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, according to Article II, 1967 OST, which advances a "Non-Appropriation" principle which provides that ""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" (UNOOSA 1967, Art. II). The ambiguity of the "Non-Appropriation" principle deepens the legal uncertainty of the 1967 OST for potential investors in space mining. Thus, leaving a gap in this policy domain. This gap is widened by the lack of universal acceptance of the 1979 Moon Agreement which enacted a space mining policy in its Article 11, under a controversial theory of the outer space Global Commons and its mineral resources as the "Common Heritage of Mankind" (CHM) subject only to a futuristic international exploitation regime that would ensure equitable sharing of the economic benefits from space mining. The 1979 Moon Agreement was rejected by key spacefaring States, including the U.S., and has remained in constant decline among spacefaring States. Thus, at the international level, the policy gap in space mining still remains.

However, at the national level, in 2015 (after an unsuccessful 2014 ASTEROIDS ACT), the U.S. finally enacted the pivotal Title IV, of the U.S. 2015 Commercial Space Launch Competitiveness Act (Congressional Research Services – CRS 2015/2016). Title IV is captioned "Space Resource Commercial Exploration And Utilization" and regulates commercial exploration and commercial recovery of asteroid and space resources (ibid.). Most significantly, in Section 51303, Title IV assigned property rights over extracted asteroid or space resources to U.S. citizens engaged in such asteroid or space resources mining (IISL 2015; Von der Dunk 2015). For the first time in human history, a national space policy has expressly defined the legal status of space and asteroid resources, and the nature of applicable property rights over those

resources – especially when extracted (Blount and Robinson 2016). This was a pivotal legal framework in international space law that was hailed by some experts as a positive development and criticized by others as a frontal attack against the authority of the 1967 OST and international law. Thus, a controversy ensued as to whether the public policy of Title IV has a solid basis in international law.

While it is uncontested under international law that any appropriation of "territory" even in outer space (e.g. orbital slots) or on celestial bodies is prohibited, authorities are divided on whether the "non-appropriation" principle of Article II, also prohibits the taking of resources from outer space (Tronchetti 2019; Von der Dunk 2017/2019; Blount and Robinson 2016). At the international level, some who view international law as the sole legal authority that governs international spaces hold to a strict interpretation of "non-appropriation" as prohibiting all unilateral taking of outer space natural resources based on national jurisdictional laws. The IISL-American Branch (2016/2022, 8-9) refers to these as "monists" because they rationalize that "public international law enjoys primacy as the original legal order from which all national orders derived their validity" (9). Conversely, a growing majority of experts subscribe to a pragmatic approach to the space minerals mining question.

These fall into the "dualist" classification of IISL-American Branch (2016/2022), who "are based on the premise that public international law and domestic law are autonomous legal orders which are based on two very different levels. Either public international law or national law would have their own legal bases" (9). Radical dualists envision domestic and international law as two circles that never cross, while "limited dualists" hold that certain linkages exist between domestic and international law (ibid., 9). These perceptions contribute to the dueling theoretical interpretations of current international space mining issues raised by Title IV. At the

U.S. domestic level most nationalist commentators adopt a reverse "monist" approach that reject the authority of international law in outer space especially controversial principles like the "non-appropriation" principle of Article II, 1967 OST. These prohibitive principles are altogether viewed as imposing unlawful international constraint on the freedom of states under international law (Weichert 2020). I will also consider legal issues related to "exploration and use" in Article I of OST, as well as Article 11 of the 1979 Moon Agreement, in this research that explores possibilities of 1967 OST and Title IV harmonization.

For many U.S. national level theorists, this legal situation raises the specter of U.S. hegemonic colonization of outer space and its mineral resources regardless of Article II, 1967 OST; unilateral modification of the 1967 OST; unilateral withdrawal from U.S. treaty obligations under the 1967 OST; or unqualified allegiance to the 1967 OST precepts in order to effectively implement and realize the policy goals of Title IV, U.S. 2015 Space Act.

To the emerging space minerals mining investors, industry, and practitioners, the legal ambiguities and theoretical disparities create a chaotic state of economic and investment uncertainties. A harmonized, streamlined theoretical and legal clarity would provide space minerals mining practitioners and investors with a coherent and consistent policy framework that assures predictability, profitability, clarifies the applicable law, and eliminates theoretical obfuscations.

Contemporary literature of space law and policy is likewise split along dueling spectra of cooperation, competition, or conflict regimes, each vying for optimal dominance among the emerging theoretical approaches to contemporary U.S. space minerals mining policy under Title IV, U.S. 2015 Space Act. Harmonizing the current theoretical frameworks will contribute to a more coherent academic understanding of the evolving space minerals mining discipline. Thus,

an opening exists in the literature of space mining law and policy for an alternative and more robust theoretical approach that harmonizes the dueling perspectives of dualist / monist cooperation, competition, and conflict in the new policy domain of space mining.

The Research Question

The issue for this research study is whether Title IV, U.S. 2015 Space Act has solid basis in international law under Articles I and II, 1967 OST to constitute a practicable official position of the United States on space minerals mining; and what are the theoretical constructs for either conclusion? Consequently, how can the U.S. realize her foreign policy goal of commercial extraction of asteroid and space resources by U.S. citizens for private benefits under the *res nullius* doctrine of Title IV, Sec. 51301-03, U.S. 2015 Space Act without violating Article II, 1967 OST, invoking Article XVI to withdraw from the 1967 OST, or Article XV to seek amendment or modification to the treaty? In essence, how can the current competing theoretical frameworks of space minerals mining be harmonized to implement and actualize space resources extractions by U.S. citizens under Title IV while sustaining the equal freedom of "exploration and use" of space by other states under Article I, 1967 OST and the "non-appropriation" principle of Article II, 1967 OST? More specifically, does the U.S. space mining policy under Title IV, U.S. 2015 Space Act have a solid basis in int'l law, and is it consistent & compatible with the international policy of Articles I and II, 1967 OST, that governs the outer space global commons, when on face value, both legal instruments appear incompatible and results in an ambiguous, incoherent, inconsistent, and controversial perceptions of U.S. space mining policy?

Why it is Important to Address & Resolve The Problem

Issues related to multilevel legal uncertainties and ambiguous policies of space mineral resources mining generates troubling concerns for a "Wild, Wild, West" dynamic in space as

self-interested *realpolitik* drives space actors, possibilities of 21st century interstellar race, threats to interstate cooperation and coexistence, consequent destabilization of the rules-based global order contrary to the UN 1945 Charter, and potential Cold War or WWIII. In addition, unregulated space mining raises concerns for a "tragedy of the commons" such as overuse, abuses, waste, space environmental degradation, pollutions, and debris littering of outer space and celestial bodies with abandoned space crafts, dangerous chemicals, and deadly junks. And, for the U.S., the actualization of its foreign policy goal of unfettered Free Market enterprise in space and the prosperity of U.S. legal entities engaged in space mining depends on a harmonized multilevel approach to space mining.

Therefore, it is important to resolve the legal and policy problem articulated above because a resolution will provide the space mining industry, space mining practitioners, investors, policymakers, theorists, and researchers with a coherent and consistent space mining policy framework that significantly harmonizes the multilevel legal instruments with current dueling theories and provides legal certainty to U.S. legal entities. Further, addressing the present theoretical issues between Title IV and Articles I and II, 1967 OST would clarify the existing rudimentary space minerals mining law under Title IV, eliminate theoretical obfuscations, and contribute to understandings of the evolving Articles I & II, 1967 OST scholarship relative to future comprehensive expansions of Title IV as space resources mining activities becomes widely practiced.

A theoretical resolution would provide more solid legal basis for post-2015 space resources activities policies such as the state of Luxembourg's (2017) space resources extraction legislation and The Hague Working Group's (2019/2022) "Building Blocks" proposal of an "adaptive' international space resources activity regime. In addition, the practical

implementation of what I will show is the res nullius policy of Title IV, U.S. 2015 Space Act, and the actualization of its principal goal of guaranteeing to U.S. legal entities unfettered commercial exploitation of asteroid and space mineral resources for private benefits. This policy outcome will be jeopardized if the present theoretical discord is not adequately streamlined and resolved in a harmonious and coherent manner.

Why the Study is Qualitative

The purpose of this research study is to understand the phenomenon of multilevel space mining law and policy using non-numerical words, texts, and meanings inductively derived from the empirical and theoretical literature of outer space law and policy. It is qualitative because it used a constructivist assumption that relevant realities of the legal status of outer space mineral resources and policy frameworks for their extraction are grounded in the subjective experiences, social contexts, and historical events of the empirical and theoretical space mining law and policy domain (Creswell 2013, 1-19). Those realities are embodied in the implicit or explicit principles, norms, rules, and decision-making procedures around which the expectations of space actors and theorists converge (Krasner 1982, 186). The legal instruments of Articles I and II, 1967 OST and Title IV, Sec. 51301-03, U.S. 2015 Space Act constitute such ground of convergence for qualitative inquiry.

Hence this research study relied on inductive reasoning processes to interpret and structure the meanings derived from the collected empirical and theoretical documentary data of this field (Thorne 2000, 5-11). Inductive reasoning is ‘hypothesis generating’ because it uses the data to generate ideas (Thomas 2006, 13-25). Because this study aimed to examine the legal and policy instruments as empirical data on which theoretical texts were based, an inductive approach was the most appropriate choice to enforce a hypothesis-generating strategy that

derived understanding from the documents and texts (Corbin and Strauss 2008, 4-10). The method that fits best for this inductive process is Glaser and Strauss' (1967) Grounded Theory which was employed in the granulation of the relevant extant documents into research data for inductive analysis.

In the process, empirical data was drawn from primary sources like the original texts of the 1967 OST, preceding UN General Assembly outer space resolutions, the Antarctic Treaty of 1959, the 1958 / 1981 UN Convention on the Law of the Seas, the 1945 UN Charter, and the 1609 / 1625 international law theories of Hugo Grotius. Other empirical literature included the 2015 U.S. Commercial Space Launch Competitiveness Act, preceding U.S. Congress space legislations, White House space policy documents, Executive Orders on space, agency directives, national security strategy documents, and space exploitation rules. Secondary sources used as theoretical literature encompass academic journals, space law and policy texts, space policy think tanks, space policy reports, and publications by space law and policy institutions.

Using the interpretivist inductive model, the study derived meaning from these already published empirical and theoretical texts by generating ideas and theories from them to test the hypothesis. These ideas also helped to answer the research question and propose an alternate all-encompassing theory in which the U.S. can realize its foreign policy goals in Title IV, Sec. 51301-03, without invoking her withdrawal or amendment rights under the 1967 OST (Charmaz and Bryant 2011, 7-9). Thus, the study created understanding by uncovering the original intent meanings of the Res Communis and Res Nullius phenomena in the aggregate of published documents of the law and policy of outer space.

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A Brief Survey of Literature: Regimes Theory of International Law

The research study is about the phenomena of contemporary theoretical conflicts in U.S. public / foreign policy in space mineral resources exploitation. The literature of this policy domain deals with rules, norms, practices, and procedures, that constitute what Krasner (1982, 497-510) defined as Regimes Theory. The "regimes" were defined by Krasner (1982, 2) as "sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actors' expectations converge in a given area of international relations" (2). According to Krasner (1983, 273-314), the "regimes" also governed state behavior in specific issue-areas of international relations. Kenneth W. Abbott (1989, 335-408) extended the Regimes Theory analysis to international law, and it was further applied to the international space law sphere by Stuart (2013). As applied in international law analysis by Abbott (1989, 335-408), Regimes Theory literature analysis involved the examination of fundamental issues such as functions performed for states by international rules and institutions.

Jill Stuart (2013) points to the transnational and norm-governed nature of outer space as factors that necessitate the extension of Regimes Theory analysis to the empirical and theoretical sources of this field of study. In this view, "As a neutral territory in which multiple actors have interests but none has exclusive rights or control, and where normative discourses (and norms) of cooperation sit alongside self-interested state realpolitik, the notion of regimes has proven to provide enduring explanatory purchase." (Stuart 2013, 1). At the international level, a non-exhaustive list of outer space regimes within this context includes the Outer Space Treaty of 1967; the Rescue and Return Agreement of 1968; the 1972 Liability Convention; the 1974 Registration Convention; the various radio and satellite communication regimes and ITU's space-related regulations; the regime to govern the International Space Station; and the 1979 Moon Agreement. At the domestic or national policy level, states enact diverse regulatory

regimes that impact international relations. Examples of such national regimes are Title IV, Sec. 51301-03 and 403, U.S. 2015 Space Act and the state of Luxembourg's 2017 space legislation.

In this study, the use of Regimes Theory involved the exploration of empirical (primary) and theoretical (secondary) literature of international rules and institutions of space law and policy to uncover the interrelationship between the international norms of space minerals mining in Articles I and II, 1967 OST and the domestic level official approach of the U.S. public space policy in Title IV, Sec. 51301-03, U.S. 2015 Space Act. This application of modern Regimes Theory investigation to the analysis of a specific international law and policy issue strengthens an integrative academic understanding of both fields, while widening the scope of analysis using multidisciplinary tools in a theoretical and empirical inquiry (Abbott 1989, 406-408). Some of those "multidisciplinary tools" included a public and foreign policy analysis of Articles I and II, 1967 OST, the Title IV, Sec. 51301-03 and 403, U.S. 2015 Space Act, and key theoretical literature interpreting these regimes. The regimes and theoretical constructs were further subjected to politico-philosophical and legal-historical inquiry pursuant to resolving the space minerals mining policy-centric research question.

A Brief Summary of the Structure of this Manuscript

This research study features five chapters of substantive study of the legal aspects of a theoretical analysis of dueling perspectives of U.S. space minerals mining policy. The "Introduction" comprises of a brief description of the research problem, why it is important to resolve, the emerging research question, and short summaries of the research design and literature review. Chapter One examines the non-legal background of contemporary space mining theoretical issues. In this context, the research study evaluates the evolving space minerals science, space mining technology, space economy, space industry, politics, and policy of the space mining policy domain.

In Chapter Two, the study articulates the historical and general public international law background to the issue. The relevant contributions of theorists such as Hugo Grotius, John Selden, and John Locke are explored. Similarly, notions such as terra communis omnium, res communis omnium, terra nullius, and res nullius are historically surveyed in the context of Roman Law and English Common Law. In addition, the study evaluates some specific instances of how the U.S has viewed these issues, such as contemporary analogies of the 1862 Homestead Act (such as Weichert (2020), Reynolds (1992), Baca (1993), Dinkin (2004), and U.S. politicians like Senator Ted Cruz (2017), and House Speaker, Kevin McCarthy – the co-sponsors of the 2015 U.S. Space Act. Chapter Three focuses on what international space law have to say on space mining under Article II, 1967 OST and its dueling interpretive schools. Brief evaluations of associated articles, including aspects of the 1979 Moon Agreement follow. Comparative analysis of points of agreement and disagreement is highlighted, while open questions are underscored.

Chapter Four discusses Title IV, U.S. 2015 Space Act as the pivotal element of U.S. interpretation and implementation of international space law. The background, contents, interpretations, criticisms, and affirmations are articulated. The 1927 “Lotus” Principle of international law is considered analogous to Title IV authority. Arguments based on Title IV as a deviation from Art. II versus as consistent/in conformity with Art. II, 1967 OST are explored. The chapter ends with a comparative evaluation of three key modern national space mining frameworks: Luxembourg, UAE, JAXA (Japan). Finally, Chapter Five synthesizes the preceding analysis with an overarching argument on why this study concludes that a proper interpretation of Art. II, 1967 OST would not necessarily stand in the way of maintaining Title IV, U.S. 2015 Space Act. The Conclusion sums up the main thrust of the analysis in this research study and

includes implications of the study for various sectors. Recommendations on future research in the evolving field of space minerals mining policymaking cap the project.

CHAPTER ONE

The Economics, Science, Technology, and Geopolitics of Space Minerals Mining

The study determined that the existence of unfathomable deposits of diverse varieties of is uncontested, with concrete evidence based on empirical scientific validations of the existence of such space minerals (Kleinschneider et al 2014, 1-2). The feasibility of extracting outer space minerals resources, a reality during the early days of negotiating the 1979 Moon Agreement, has only become more real in the 21st century due to viability of evolving 21st century technological capabilities of commercial extraction (Kulu 2021, 1-8). Further, the existence of multilevel vivacious corporate interests in actual economic investments in the extractions of space minerals resources from asteroids or space constituted the primary driving force for the emergence of the certain legal regimes to regulate this novel policy domain.

Thus, contrary to skeptical views of space minerals as fictional, concrete evidence do exist in the literature, of scientifically verified space and asteroid mineral resources deposits deemed of high strategic economic value (NASA / JPL 2022, 1-6). Statista's research expert in the role of space minerals in energy transition, M. Garside (2021) revealed that the asteroid "Davida, which has a real diameter of 326.06 kilometers, has been identified as the most valuable asteroid in the asteroid belt, with a resource value estimated to be some 27 quintillion (26,990,000,000,000,000,000) U.S. dollars. It is a carbonaceous chondrite asteroid, and it contains water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen. In terms of cost-effectiveness to mine, however, Ryugu has among the highest estimated profit as a proportion of the value of its materials: it is worth some 5.57 trillion U.S. dollars, and it is estimated that 1.25 trillion U.S. dollars of that would be profit" (In, Statista: Statistics and Facts About Space Mining 2021, 1). And this is just the tip of the iceberg.

NASA's Jet Propulsion Laboratory (JPL 2021/2022), the European Space Agency (2023), the Luxembourg Space Agency (2017, 1-8), and the Congressional Research Service Reports (2015/2016) revealed some irrefutable data of the rich reservoir of outer space mineral resources in asteroids, the Moon, and Mars. According to space resources researcher at the Colorado Scholl of Mines, Alex Gilbert (2021, 1), "….many analysts (even some with their feet on the ground) believe that commercial developments in the space industry may be on the cusp of starting the largest resource rush in history: mining on the Moon, Mars and asteroids" (1). Otherwise, the U.S. Congress would not be wasting taxpayers' dollars holding the numerous ongoing space resources hearings that culminate in new space policies. And even though some early pioneers of the space mining rush are defunct, such as Planetary Resources and Deep Space Industries, Kulu (2021) articulates an array of emerging space mining enterprises at the U.S. domestic level.

In the *Routledge Handbook of Space Law*, editors, Jakhu and Dempsey (2017, 1) further asserted that "The global space economy reached $330 billion in 2015 [about $1,000 per person in the U.S.], with a growth rate of 9 per cent vis-à-vis the previous year. Consequently, Space Law is changing and expanding expeditiously, especially at the national level. More laws and regulations are being adopted by space-faring nations, while more countries are adapting their Space Laws and regulations related to activities in outer space…" (1). Some of these national reactions to the changing landscape of space economy include the Luxembourg 2017 space extraction legislation, and the adapting national space agencies of the UAE and Japan (JAXA). Jakhu and Dempsey (2017) underscored that "More regulatory bodies are being created, while more regulatory diversity (from public law to private law) is being instituted as increasing and innovative activities are undertaken by private entities which employ new technologies and

business initiatives…." (1). Inevitably, this technology-enabled, profits-driven evolving quests for space minerals extractions for private benefits would result in more States extending their sovereignty in space through national jurisdictions over national legal entities engaged in asteroid and/or space minerals exploitations. The result will be an ever-increasing controversy over the legitimacy, in international law, of the emerging national jurisdictional frameworks. And while these controversies rage, the ever-accelerating hi-tech possibilities of earth-based robotic long-arm reaches to the space realm would complicate the legal landscape of international space law, unless the current theoretical issues are harmoniously resolved.

Space Mineral Resources: "Most Valuable" Asteroids

Asteroid Name	Mineral Compositions	Estimated Value ($)	Est. Profit ($)
Davida	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Chicago	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Alauda	Iron, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Diotima	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Palma	Iron, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Winchester	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Kreusa	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Stereoskopia	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Chiron	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Siegena	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Zelinda	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Lucina	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Gyptis	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Lachesis	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Berbericia	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Aurelia	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Arethusa	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Pulcova	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Liguria	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Comacina	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Nemausa	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Hispania	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Hippo	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Klymene	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion

Erminia	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Elfriede	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Ophelia	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Carlova	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Ornamenta	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Myrrha	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Tanete	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Charybdis	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Aemilia	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Asterope	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Desiderata	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Ursula	Platinum, nickel, iron, cobalt	>100 trillion	>100 trillion
Emita	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Veritas	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Princetonia	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Ani	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Freda	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Chloris	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Faina	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Hersilia	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Messalina	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Marianna	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Semele	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Helio	Iron, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion
Thia	Water, nickel, iron, cobalt, nitrogen, ammonia, and hydrogen	>100 trillion	>100 trillion

Table.1. Partial List of Most Valuable Asteroids (Asterank 2023 – open data source)

The Minor Planet Center (MPC) and NASA's Jet Propulsion Laboratory (2023) have the most current substantiated accounts of outer space mineral deposits in asteroids (NASA / JPL 2023, 1-4). The Asterank (2023) scientific database sources its equally valid scientific data from NASA's Jet Propulsion Laboratory – a research and development laboratory federally funded by NASA and managed by the California Institute of Technology. According to the MPC (2023, 1) database, the Minor Planet Center (MPC) is the single worldwide location for receipt and distribution of positional measurements of minor planets, comets, and outer irregular natural

satellites of the major planets. The MPC is responsible for the identification, designation, and orbit computation for all of these objects.

MPC's task involves maintaining the master files of observations and orbits, keeping track of the discoverer of each object, and announcing discoveries to the rest of the world via electronic circulars and an extensive website (MPC 2023, 1). The MPC operates at the Smithsonian Astrophysical Observatory, under the auspices of Division F of the International Astronomical Union (IAU) (ibid.). Asterank (2023, 1) on the other hand is a scientific online database that integrates data from NASA's JPL and the MPC database to compute and make inferences of the mineral contents and estimated values of over 600, 000 asteroids. The nature of those minerals, the physical characteristics, orbits, and projected economic values are tabulated by Asterank in its interactive online database known simply as "Asterank" and available to the public.

The study examined the data of about 989 of the named asteroids considered by NASA's Jet Propulsion Laboratory (JPL 2023, 1) as "most valuable" due to high compositions of natural mineral resources that are considered of high economic value on planet Earth. The process for this evaluation included simple organization and coding of the 989 named asteroids in Microsoft Excel. The automatic data graphing features in Excel were used to structure and rank the asteroids as shown in the table. The result is a determination that each of those named asteroids are uniquely enriched with high concentrations of natural resources.

The "high value" mineral compositions of asteroids include water, nickel, iron, cobalt, platinum, cobalt, nitrogen, hydrogen, ammonia, magnesium silicate, aluminum, and others in high demand in planet Earth's economies. According to Makichuk (2021, 1), "…Outer space holds virtually limitless amounts of energy and raw materials, from Helium-3 fuel on the Moon

for clean fusion reactors to heavy metals and volatile gases from asteroids, which can be harvested for use on Earth and in space…" (1). With regards to Near Earth Asteroids (NEAs) and comets, influential planetary scientist, John S. Lewis (1997), observed that comets are rich resources for the water and carbon-based molecules necessary to sustain life while asteroids are rich in the mineral raw materials required to build structures in space and generate rocket fuel for in-situ refueling of space crafts. Further, Lewis (1997) asserts that "an abundant supply of cometary water ice could provide copious quantities of liquid hydrogen and oxygen" (5) for rocket fuel – a kind of gas stations for interplanetary space crafts.

These strategic minerals are the targets of most state and private space mining enterprises and could result to what some influential commentators refer to as the next self-interested "space minerals race" between the major spacefaring powers such as the U.S., China, Russia, Japan, and the European Space Agency. The Center for Near Earth Object Studies (2023) shows in the following chart the cumulative number of known Near-Earth Asteroids (NEAs) of all sizes (between 1 to 40 kilometers in size) versus time (based on the most recent discovery as of July 29, 2023). The chart also demonstrates the data for Near-Earth Comets (NECs) and Potentially Hazardous Asteroids (PHAs – based on potential for making threatening close approaches to planet Earth). Notice the escalating discoveries of minerals-rich asteroids and comets in the 2020s as an important factor in the shifting global economic interests in the outer space realm. The chart and table below demonstrates that the 21st century would continue with a heightened trajectory of discoveries of minerals-rich celestial bodies as innovate science and technology continue to raise potentials for commercial mining of the geospatial space realm and celestial bodies.

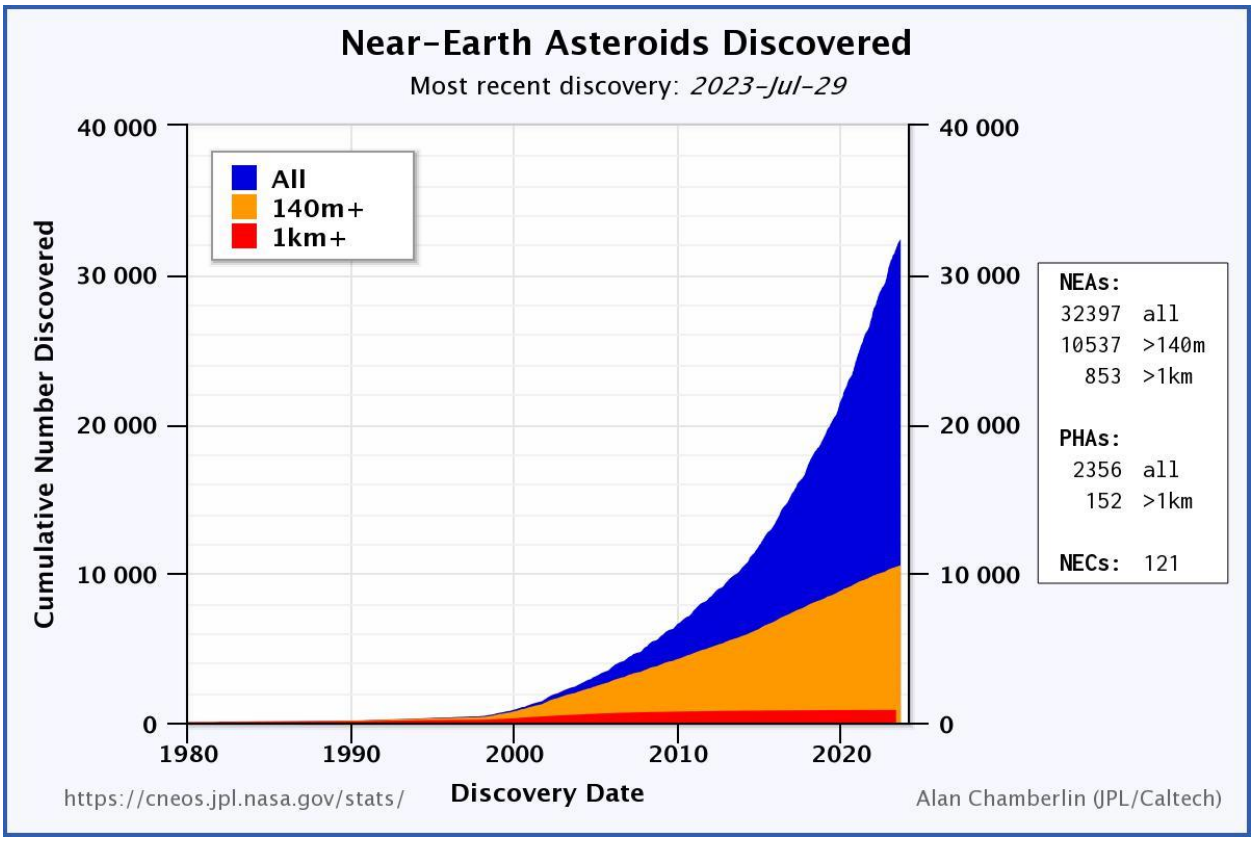


Fig.1. Most recent discoveries: Asteroids, Comets, & potentially hazardous Asteroids (open source: Center for Near Earth Objects Studies 2023).

Table. 2. Most recent (2020 – 2023) Near-Earth Comets, Potentially Hazardous Asteroids, & Near-Earth Asteroids

Date	NEC	Atira	Aten	Apollo	Amor	PHA-km	PHA	NEA-km	NEA-140m	NEA	NEO
2023-07-29	121	32	2,544	18,274	11,547	152	2,356	853	10,537	32,397	32,518
2023-07-01	121	32	2,532	18,223	11,499	152	2,348	853	10,510	32,286	32,407
2023-06-01	121	32	2,518	18,131	11,446	152	2,341	853	10,482	32,127	32,248
2023-05-01	121	31	2,499	18,003	11,373	152	2,335	853	10,457	31,906	32,027
2023-04-01	121	31	2,477	17,839	11,310	152	2,327	851	10,422	31,657	31,778
2023-03-01	121	29	2,459	17,697	11,227	152	2,318	851	10,385	31,412	31,533
2023-02-01	121	29	2,446	17,592	11,196	152	2,314	851	10,369	31,263	31,384
2023-01-01	121	29	2,429	17,455	11,134	152	2,309	851	10,335	31,047	31,168
2022-12-01	120	29	2,409	17,304	11,087	152	2,302	851	10,303	30,829	30,949
2022-11-01	120	29	2,384	17,100	10,999	152	2,298	851	10,268	30,512	30,632
2022-10-01	120	29	2,340	16,803	10,864	152	2,284	851	10,208	30,036	30,156
2022-09-01	120	29	2,318	16,584	10,694	151	2,274	850	10,148	29,625	29,745
2022-08-01	120	29	2,299	16,483	10,579	151	2,271	849	10,105	29,390	29,510
2022-07-01	120	29	2,283	16,408	10,512	151	2,264	849	10,073	29,232	29,352
2022-06-01	120	29	2,269	16,347	10,451	151	2,259	849	10,046	29,096	29,216

2022-05-01	120	29	2,255	16,227	10,399	151	2,254	848	10,019	28,910	29,030
2022-04-01	120	29	2,239	16,070	10,346	151	2,247	848	9,982	28,684	28,804
2022-03-01	120	29	2,215	15,901	10,277	151	2,242	848	9,959	28,422	28,542
2022-02-01	120	29	2,188	15,727	10,204	151	2,235	848	9,930	28,148	28,268
2022-01-01	120	28	2,159	15,541	10,120	150	2,221	847	9,881	27,848	27,968
2021-12-01	120	28	2,143	15,435	10,090	150	2,216	847	9,865	27,696	27,816
2021-11-01	120	27	2,109	15,202	9,992	150	2,206	847	9,813	27,330	27,450
2021-10-01	120	27	2,076	14,964	9,863	150	2,194	846	9,775	26,930	27,050
2021-09-01	120	27	2,052	14,763	9,728	150	2,187	846	9,727	26,570	26,690
2021-08-01	118	25	2,034	14,658	9,605	150	2,176	845	9,666	26,322	26,440
2021-07-01	118	25	2,024	14,595	9,551	150	2,169	845	9,633	26,195	26,313
2021-06-01	117	24	2,006	14,515	9,478	150	2,162	844	9,589	26,023	26,140
2021-05-01	117	24	1,980	14,375	9,395	150	2,156	844	9,556	25,774	25,891
2021-04-01	116	24	1,955	14,191	9,298	149	2,147	843	9,515	25,468	25,584
2021-03-01	116	24	1,932	14,065	9,248	149	2,143	843	9,496	25,269	25,385
2021-02-01	116	24	1,906	13,894	9,177	149	2,135	843	9,462	25,001	25,117
2021-01-01	116	23	1,876	13,721	9,130	149	2,128	843	9,426	24,750	24,866
2020-12-01	116	23	1,846	13,565	9,049	149	2,117	843	9,372	24,483	24,599
2020-11-01	116	23	1,824	13,397	8,975	149	2,107	843	9,325	24,219	24,335
2020-10-01	116	23	1,802	13,195	8,860	149	2,098	842	9,275	23,880	23,996
2020-09-01	116	23	1,782	13,020	8,722	148	2,090	841	9,236	23,547	23,663
2020-08-01	116	23	1,762	12,895	8,612	148	2,075	841	9,171	23,292	23,408
2020-07-01	116	22	1,752	12,830	8,536	148	2,069	841	9,128	23,140	23,256
2020-06-01	115	22	1,740	12,780	8,479	148	2,064	841	9,094	23,021	23,136
2020-05-01	115	22	1,719	12,653	8,397	148	2,055	841	9,056	22,791	22,906
2020-04-01	114	21	1,695	12,484	8,306	148	2,052	841	9,014	22,506	22,620
2020-03-01	114	21	1,688	12,368	8,267	148	2,041	841	8,985	22,344	22,458
2020-02-01	114	21	1,670	12,225	8,236	148	2,032	841	8,964	22,152	22,266
2020-01-01	114	20	1,631	12,012	8,124	148	2,017	840	8,888	21,787	21,901

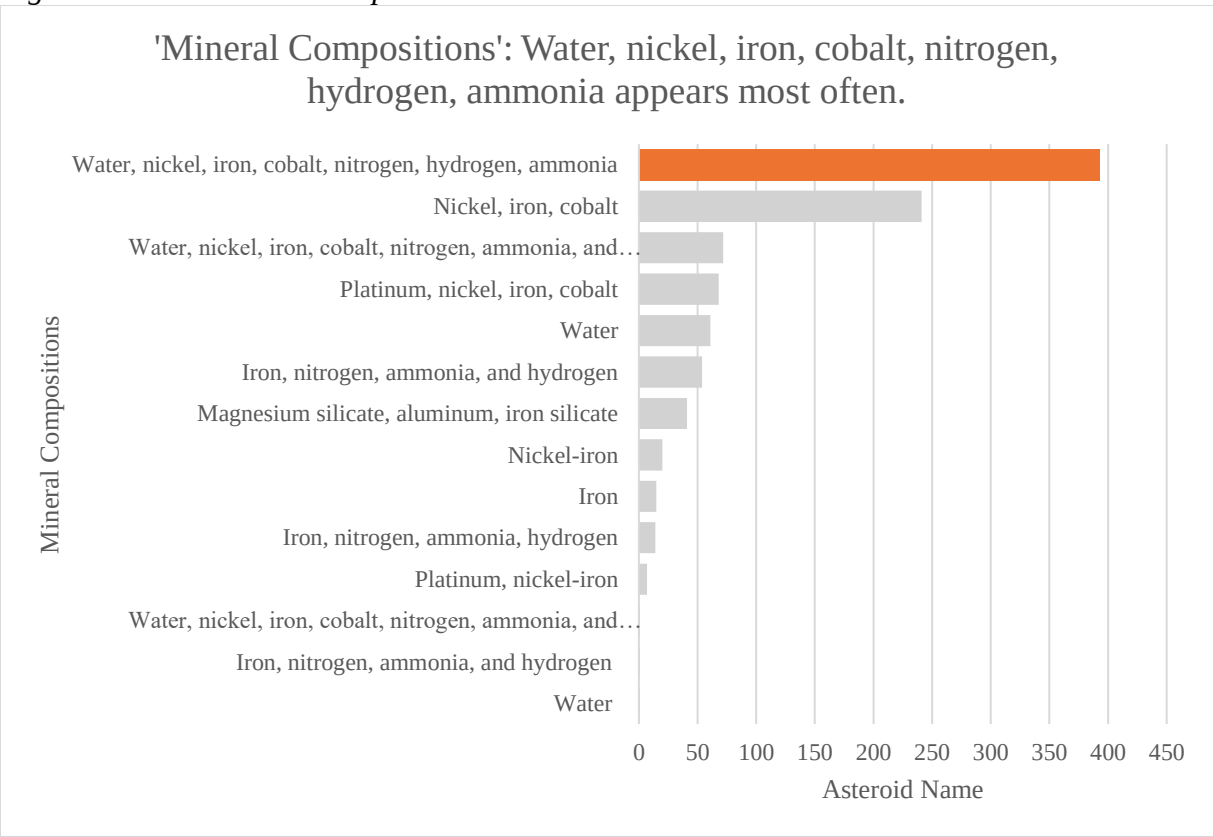
Considering the foregoing irrefutable evidence of massive quantities of minerals-rich celestial bodies, space policy expert, Goswami (2019/2020) warns that states like China, Russia, and India, are awakening to the reality of space mining in the 21st century and responding with aggressive long-term national space minerals appropriation goals. Some critical strategic space minerals have been identified. For instance, though helium-3 is not specifically featured on the graph above, Sherriff (2020, 1-2) notes that this rare moon crystal has the potential to power the

Earth limitlessly, and with minimal environmental risks to planet Earth and humans. According to Sherriff (2020), 'Helium-3 is particularly promising as it produces significantly less radiation and nuclear waste than other elements, according to the European Space Agency. The current nuclear fission process, which is used in nuclear power plants, releases not only energy but radioactivity, and spent nuclear fuel must be reprocessed into uranium, plutonium, and other waste. It's a process that has raised serious safety concerns, and as a result, scientists have been searching for a way to create nuclear power from nuclear fusion, rather than fission…." (1). Unlike nuclear fission, in the nuclear fusion process radioactive waste is not produced. Thus, nuclear fusion is potentially safer and a more efficient fuel source.

Sherriff (2020) further highlighted that "Around 25 tonnes of helium-3, equivalent to a fully loaded Space Shuttle cargo bay, could power the US for a year. According to estimates, this means that helium-3 has a potential economic value of $3bn a ton…." (ibid., 1). Arguably, this makes helium-3 a strategic mineral resource and a strong candidate for the inevitable "space minerals race" among major spacefaring states. The Beijing Research Institute of Uranium Geology (BRIUG) continues to study the topography and composition of Moon soil samples returned by China's Chang'e (2018) and Chang'e 5 (2020) in quest of the quantity of helium-3 present (Makichuk 2021). In essence, access to helium-3 would mean that humanity increases its capability to access the same type of solar-generated power from novel fission-generated energy to power the planet from within—limitlessly (Whittington 2022, 1-4). Hence, the interminable geopolitical rivalries on Earth, depleting terrestrial natural resources, and the increasing awareness of the existence of alternative strategic resources in space, could inspire rivalrous space mining policies in the sustained absence of a harmonized states-driven international space mining regulatory framework. The bar chart below demonstrates the current estimations of

mineral compositions in about 700 named asteroids evaluated by this study in the NASA / JPL 2021 and Asterank Scientific Database 2022, 1

Fig.2. Asteroid Mineral Compositions



(Original analysis of estimated mineral compositions of 989 randomly selected asteroids, using raw asteroid data obtained from NASA / JPL 2021 and Asterank Scientific Database 2022, 1).

Current valuations of some outer space bodies were premised on the predicted quantity of the mineral varieties in the graph above. For instance, more than 700 or 85% of the named “Most Valuable” asteroids were valued in excess of one hundred trillion dollars (>$100 trillion) each, while about 15% were estimated to be worth billions of dollars (NASA/JPL 2021, 1-3). In terms of potential profits accruable from a successful exploitation, an average of over 989 trillion dollars (about $3,000,000 per person in the U.S.) accounts for the majority of the estimates (NASA/JPL 2021, 1; Asterank 2020, 1). The Luxembourg Space Agency’s (2020, 1-5) report on space mineral resources, the Moon, other planets, and asteroids contain a rich record of the

diversity of minerals, gases and water that could be used to provide raw materials, energy, and to sustain human life and enable exploration deeper into space. According to this Luxembourg Space Agency (2020) report, the most current analysis of the Moon, and the 400 kilograms of lunar rock and regolith surface material already brought back to Earth, indicated that the lunar resources are rich in important and useful strategic mineral elements.

In addition, the thousands of asteroids floating in the Near-Earth Orbit (NEO) can be rich in carbon (C-type or chondrite/carbonaceous), metals (M-type) or silica (S-type) (NASA-JPL 2022, 1-3). Abundant energy is believed to abound in C-type asteroids (Richard J. Bartlett 2020, 1-3, Astronomy Source 20111-2023). The number of Near-Earth asteroids already identified by NASA's Jet Propulsion Laboratory (JPL 2020, 1-2) currently exceeds 20,000 and counting; more than 1,800 were discovered in 2018 (Asterank 2023, 1-2). NASA had been conducting unmanned efforts to land crafts on asteroids, with a successful launching in 1996 and landing of NEAR Shoemaker on Eros in 2001, and again, Osiris-Rex launched in 2016 landed on asteroid *Bennu* in 2020 (NASA 2001, 1-2; NASA 2020, 1). The latest celebrated attempt was NASA's successful Double Asteroid Redirection Test (DART) mission of Monday, September 26, 2022.

The DART mission conducted a head-on collision between a multi-million-dollar spacecraft and asteroid Dimorphous (an asteroid the size of a football stadium) at a distance of 6.8 million miles (about 10943539.2 km) from planet Earth, and at a speed of 15,000mph (Luscombe / The Guardian Online 2022, 1-4). Previously in 2014, the European Space Agency had soft-landed its Rosetta mission of Philae probe on a comet—an extraordinary feat and the first in space history (ESA 2014, 1). The Chinese, Russian, Japanese, Indian, Israeli, and United Arab Emirates space agencies each have recorded successes in the heightening ambitions to reach space or asteroids for mining purposes (Tronchetti 2019, 809-813, in Von der Dunk and

Tronchetti 2019). These foundational steps bring us closer to the benefits of future asteroid minerals appropriation missions—manned, robotic, or AI-enabled, further increasing the importance of this research.

21st Century Space Mineral Resources Prospecting Corporations

Due to some recent failures of a few leading pioneers in the space mining industry, such as Planetary Resources (acquired in 2018 by blockchain corporation ConsenSys), cynical theorists reject the reality of space mining and the seriousness of corporations committed to space mining (Cobb 2021, 1-3). Similarly, Deep Space Industries was acquired on January 01, 2019, by Bradford Space and reconfigured into a digital services provider (Space News January 2, 2019). However, an examination of the inception timelines of the more than 600 current private enterprises engaged in the outer space economy and listed by NASA, Jet Propulsion Laboratory (JPL), Asterank (2023, 1-3) database, and 'Factories in Space' (Kulu 2021, 1-15) database, indicated a trend of exponential growth of outer space natural resources exploitation companies in the 21st century. Some of these space resources mining corporations and In-Situ Resources Utilization (ISRU) enterprises include the following:

Name	Products & Services	Category	Service Type	Field	Status
Airbus	ROXY	ISRU, Raw Materials & Asteroid Mining	ISRU (In Situ Resource Utilization)	-	Development
AMi Exploration (ARCA Space, Asteroid Mining Program)	Asteroid Mining Spacecraft	Raw Resources & Utilities, ISRU, Raw Materials & Asteroid Mining, Cargo Transport Service, In-Space Transportation	Resources - Asteroid Mining, Space Mining, Transport Service (Re-Entry)	**Mining**	Development
Asteroid Initiatives		ISRU, Raw Materials & Asteroid Mining	Resources - Asteroid Mining,	**Prospecting**	Concept

			Space Mining		
Asteroid Mining Corporation	Asteroid Prospecting Satellite	ISRU, Raw Materials & Asteroid Mining	Resources - Asteroid Mining, Space Mining	**Prospecting, Mining, Database**	Early stage
AstroForge		Raw Resources & Utilities, ISRU, Raw Materials & Asteroid Mining	Space Mining, Resources - Asteroid Mining	**Asteroids, Mining, Beneficiation, Materials to Earth**	Development
Astronika	GALAGO	ISRU, Raw Materials & Asteroid Mining	ISRU (In Situ Resource Utilization), Space Mining, Commercial Rover	**Hopper**	Concept
Astrum		ISRU, Raw Materials & Asteroid Mining	Resources - Asteroid Mining	**Mining**	Dormant
Aten Engineering		ISRU, Raw Materials & Asteroid Mining	Resources - Asteroid Mining	**Prospecting**	Dormant
Austere Engineering	GROWLER	Raw Resources & Utilities, ISRU, Raw Materials & Asteroid Mining	Space Mining, Resources - Asteroid Mining, Commercial Rover	**Mining, Water ice, Prospecting, Lunar Rover**	Concept
Beyond Atlas		ISRU, Raw Materials & Asteroid Mining	Resources - Asteroid Mining	**Prospecting**	Early stage
BigDipper Exploration Technologies		ISRU, Raw Materials & Asteroid Mining	Resources - Asteroid Mining	**Prospecting**	Early stage
Blue Asteroids	Blue Wonder Spacecraft	ISRU, Raw Materials & Asteroid Mining	Resources - Asteroid Mining	**Prospecting, Mining, Materials to Earth**	Concept
Canadian Space Mining Corporation		ISRU, Raw Materials & Asteroid Mining	Resources - Asteroid Mining, Space Mining	**Moon, Mining, Prospecting**	Early stage
Caterpillar		ISRU, Raw Materials & Asteroid Mining	Resources - Asteroid Mining	**Moon**	Concept
CisLunar Industries	Space Foundry	ISRU, Raw Materials &	Resources - Space	**Material Recycling**	Development

		Asteroid Mining	Debris Utilization		
Crow Industries		ISRU, Raw Materials & Asteroid Mining, Space Tug	Transport Service (LEO-Moon), ISRU (In Situ Resource Utilization), Space Tug, In-Space Logistics	**In-Space Transportation, Transport Service (In-Space), Transport Service (LEO-GEO)**	Concept

Table 3. Partial list of contemporary legal entities focused on space mining (Source: Factories In Space 2023).

Geopolitics of Space Mining Policy

Gilbert (2021, 1-12) highlights that spacefaring states such as the U.S., Luxembourg, the U.A.E., China, Russia, Japan, and the intergovernmental European Space Agency, are frontliners in the emerging space mining race by state and non-state space actors. In this view, "…Potential economic, scientific, and even security benefits underlie an emerging geopolitical competition to pursue space mining. The United States is rapidly emerging as a front-runner, in part due to its ambitious Artemis Program to lead a multinational consortium back to the Moon. But it is also a leader in creating a legal infrastructure for mineral exploitation…. the world's first space resources law, recognizing the property rights of private companies and individuals to materials gathered in space…" (ibid., 2). This move constitutes an incentive to the emerging space minerals extraction economy.

Space analyst, Karasik (2021, 1-4) supports Gilbert's (2021) analysis, and asserts that "…There is an argument that mining asteroids is a necessary component of geopolitical and economic competitiveness in the coming two decades. The estimates are that, by 2040, the global space economy could be worth $1 trillion [about $3,100 per person in the U.S.]. With the prospects of space mining being driven by technological advances across the space industry, the use and perfection of reusable rocket components and advances in producing off-the-shelf parts

are making costs lower for new space activities, including commercial use, such as space tourism…." (Karasik 2021, 2). Geopolitical analyst, Kadam (2022, 1-6) warns that "resource-hungry" China is rapidly advancing Chinese space technology for the purpose of out-pacing the rest of the world in the exploitation of the strategic space minerals deposits.

According to Kadam (2022), "…The US and China are contesting for dominance over the exploitation of natural resources in space, such as mining for valuable metals in the asteroids, which could potentially result in further militarization of the space…." (1). "Potential" is the key word—as this project will show, some influential space law scholars assume that an escalating "land grab" and arms race in outer space is inevitable, thereby rationalizing hegemonic colonization frameworks. This study will also demonstrate that the so-called hegemonic colonization approach is, *per se*, inconsistent with the current U.S. domestic space policy and the governing international law. But the indubitable point is that it is the incredible riches of outer space that have some observers thinking along these lines, and that impress upon us the urgency of a stable and reliable legal framework for space mining policy.

As shown in the pie chart below, approximately, more than 70% of outer space natural resources exploitation factories emerged between 1997 and 2022. Only about 1% of space factories emerged following the 1967 OST, while the 1970s, 1980s, and much of the 1990s witnessed more factories primarily focused on Low Earth Orbit (LEO) resources such as radio waves, spectrum, and satellite orbiting (Blount and Robinson 2016, 181-184). In the pie chart below, outer space prospecting companies had grown progressively from 1% in the 1967-1977 era; 5% in 1977-1987 period; 7% in 1987-1997 post-Cold War era to an exponential growth of 10% between 1997-2007 and 27% in the 2007-2017 period (NASA/JPL 2023, 1-8; Asterank 2023, 1-25). Since then, outer space factories are projected to increase by a whopping 50%

between 2017 and 2027 (ibid.). Using raw data from the Factories in Space database and Asterank asteroid database, this researcher conducted a simple percentage pie chart below using Microsoft Excel graph creation tool to measure and predict the percentage of growth of space mining private sector from the inception of the 1967 OST to 2027 in a 10-year interval.

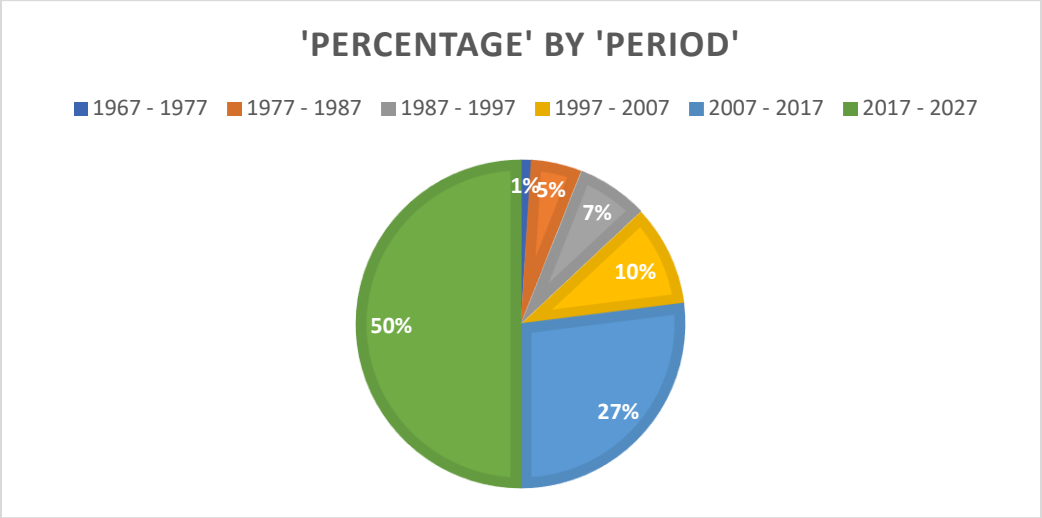


Fig. 3. Pie chart – Percentage of Growth of Outer Space Mining Companies by Period (Using raw data from Kulu's (2021, 1-16) Space Economy and Space Industries data to Create original pie-chart in Microsoft Excel graphical tools).

It has been proven scientifically that fuel and oxygen abound in Mars regolith brine (Gayen et al 2020, 31685-31689), that helium-3 could be mined from the surface of the Moon (ESA 2022, 1-3; Whittington 2022, 1-4), and that most asteroids contain rare strategic minerals resources (Asterank 2023, 1-117). Space mining technologies are still evolving in the 21st century. Currently, not all active companies with outer space mining aspirations have acquired the necessary technological capabilities to actually embark on space mining (Karasik 2021, 2-4). Some corporations like Space Mining Technologies are committed to "…develop critical technologies enabling sustainable space exploration and future settlements of the Moon and

beyond" (Space Mining Technologies 2020/2023, 1). In the graph below, the study demonstrates the increasing technological capabilities of the existing outer space prospecting companies.

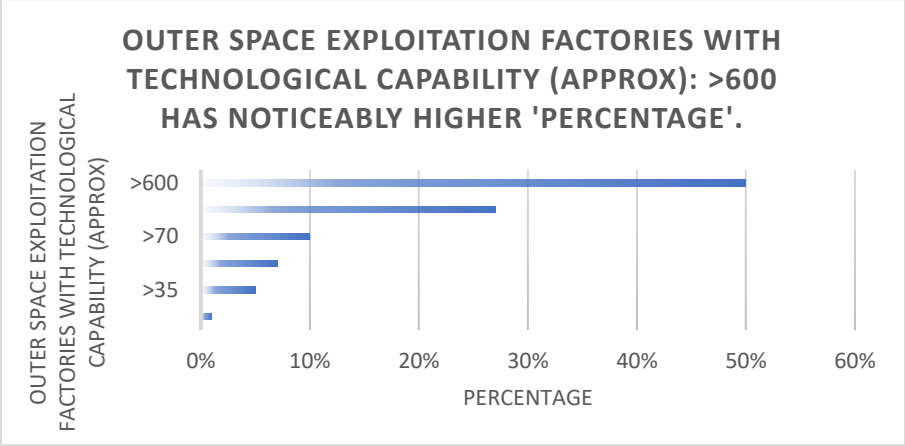


Fig. 4. Exponential Growth of Outer Space Exploitation Companies in the 21st Century.

As demonstrated here, most of the 21st century higher volume of more than 600 technologically capable firms in the economy and industry of outer space natural resources exploitation (whether active or dormant) originated in the United States (Dodge 2016, 1-2). This volume of interest is reasonably reflective of the growing domestic private sector and individual investors' profit-driven interest in the commercial appropriation of outer space natural resources (Donohue 2021, 2-8). In addition, apart from the commercial-tourism interests of a few spacefaring firms like Amazon's Blue Origins, Virgin Galactic, Axiom, and Space-X, the 1960s and 1970s interests in "exploration" of space by States for primarily national prestige purposes has mostly succumbed to competitive space mineral resources mining visions of a majority of the 21st century outer space private sector (Hobe and Chen 2017, 25-41; Fidler 2020, 1-4).

Likewise, the core concerns of some experts for "security" and national prestige-driven explorations of outer space no longer constitute the leading motivation for outer space actors (Von der Dunk 2017, 83-84). Most governmental and private sector interests in outer space increasingly targets the commercial appropriations of outer space mineral resources (De Man

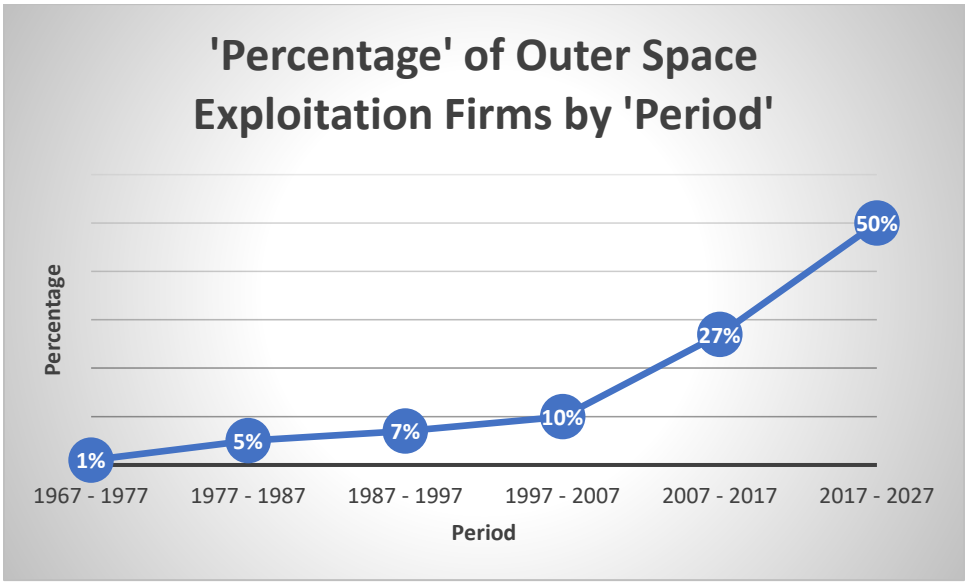
2017, 1-7). Demonstrably, regulatory regimes such as the emerging national space mining legislations set out to align space law with current 21st century trends in exclusive commercial appropriations interests in outer space mineral resources (Blount and Robinson 2016, 182-187). Thus, in the examined documentary data of the Regimes Theory literature of multilevel space minerals exploitation law and policy, the "fictional" theories of bygone eras are fast becoming the mainstream realities of the 21st century and beyond (Kulu 2021, 1-23). The private space sector is fast outpacing state actors in the booming quest for exclusive appropriations of strategic space minerals resources for private benefits.

Growth of Space Mineral Resources Prospecting Companies

There has also been an upward surge of outer space economy and firms between 1967 and the current 21st century. The findings depicted below indicate the exponential growth of innovative industries committed to outer space natural resources exploitation. Thus, Kulu (2021, 1-23) demonstrates a statistical comparison of current space economy and industries, explaining that "…New in-space economy fields are emerging. The nascent space industries include human spaceflight, satellite servicing, orbital transfer vehicles, commercial space stations, in-space manufacturing, commercial landers, and many others. In-space economy includes cislunar economy and Moon and Mars economies…." (1). The "Factories in Space' database lists over 400 active space minerals prospecting companies committed to actual extractions of space minerals resources (Kulu 2023/Factories in Space 2023, 1-65). Based on the 'Factories in Space' database, the graph below was originally created using Microsoft Excel, and it shows the response of technological innovations to the increasing scientific knowledge of the outer space expanse, celestial bodies, and the outer space natural resources.

Strikingly, in the 1960s era of limited scientific knowledge and crude space technologies, only a paltry 1% interest existed in private sector industrial investment and interest in outer space economy for exploitation purposes (ibid.). However, from the late 20th and early 21st centuries, there was a jump of 10% to 50% increases in private sector factories heavily vested in outer space economy for natural resources exploitation purposes. Garside's (2021, 1) space minerals exploitation statistical model predicts an increase of the space economy to a minimum of $3.9 billion by the year 2025 (i.e., about $12 per person in the U.S.). This is a conservative estimate in the view of Matthews (2021, 1-2), who projects that the declining costs of commercial space launches and the increasing space vehicles reuse capabilities of most space actors would hasten the profitability of the novel space minerals exploitation industry and economy in the short and long terms.

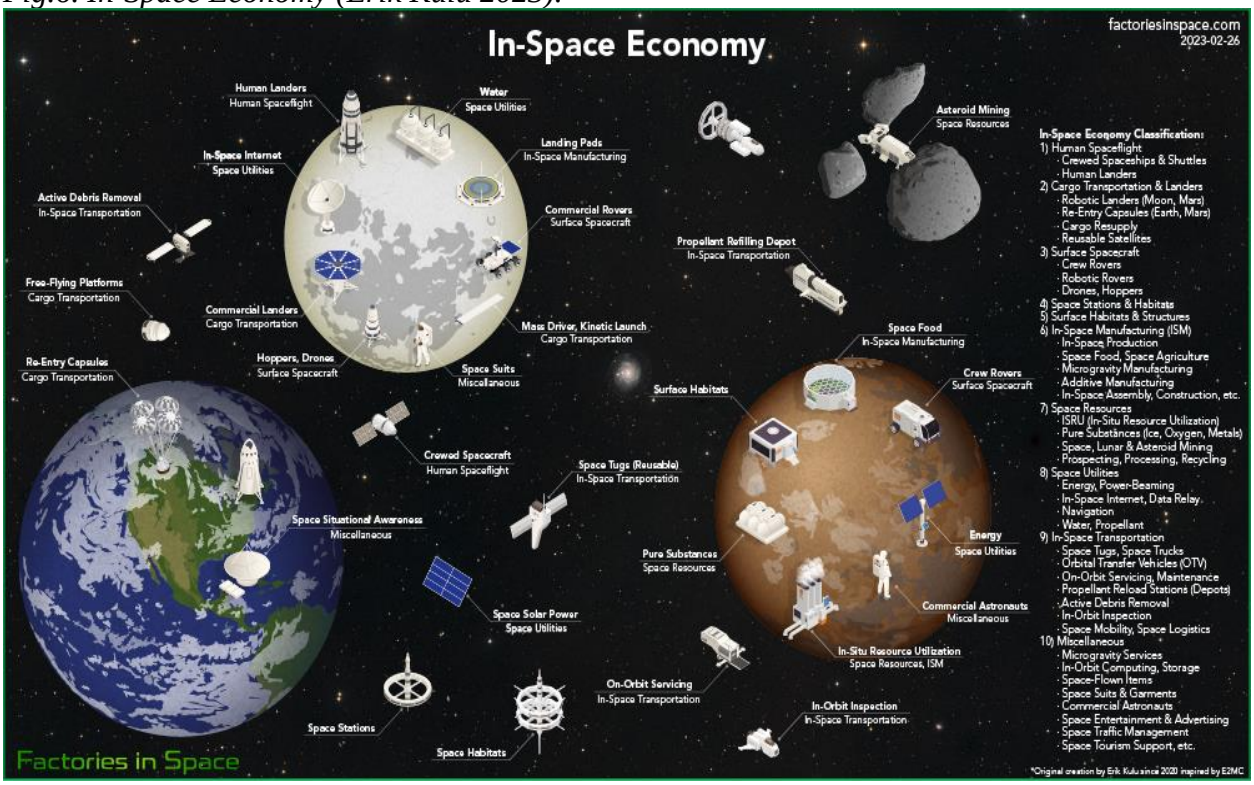
Fig. 5. Trajectory of Outer Space Mineral Resources Commercial Exploitation Interests



Trends of In-Situ Economy

Adding to the considerations above, in the depictions below, space systems analyst and engineer, Erik Kulu (2023, 1-23), articulated the most current outer space factories and industries particularly vested in the use of outer space resources. Kulu (2023, 7) classified those "In-Space Economy" (Fig.13) factories into areas of expertise such as cargo transport, in-space, or in-situ manufacturing, space resources exploitation, space transportation, space tourism, and space utilities. Key factors common to the "In-Space Economy" are the widening scientific and technological innovations. Particularly, Kulu (2023, 7-23) displayed upward trends in innovative technologies including nanotechnologies, robotics, and Artificial Intelligence (AI) enabling the varieties of private actors in the space economy.

Fig.6. In-Space Economy (Erik Kulu 2023).

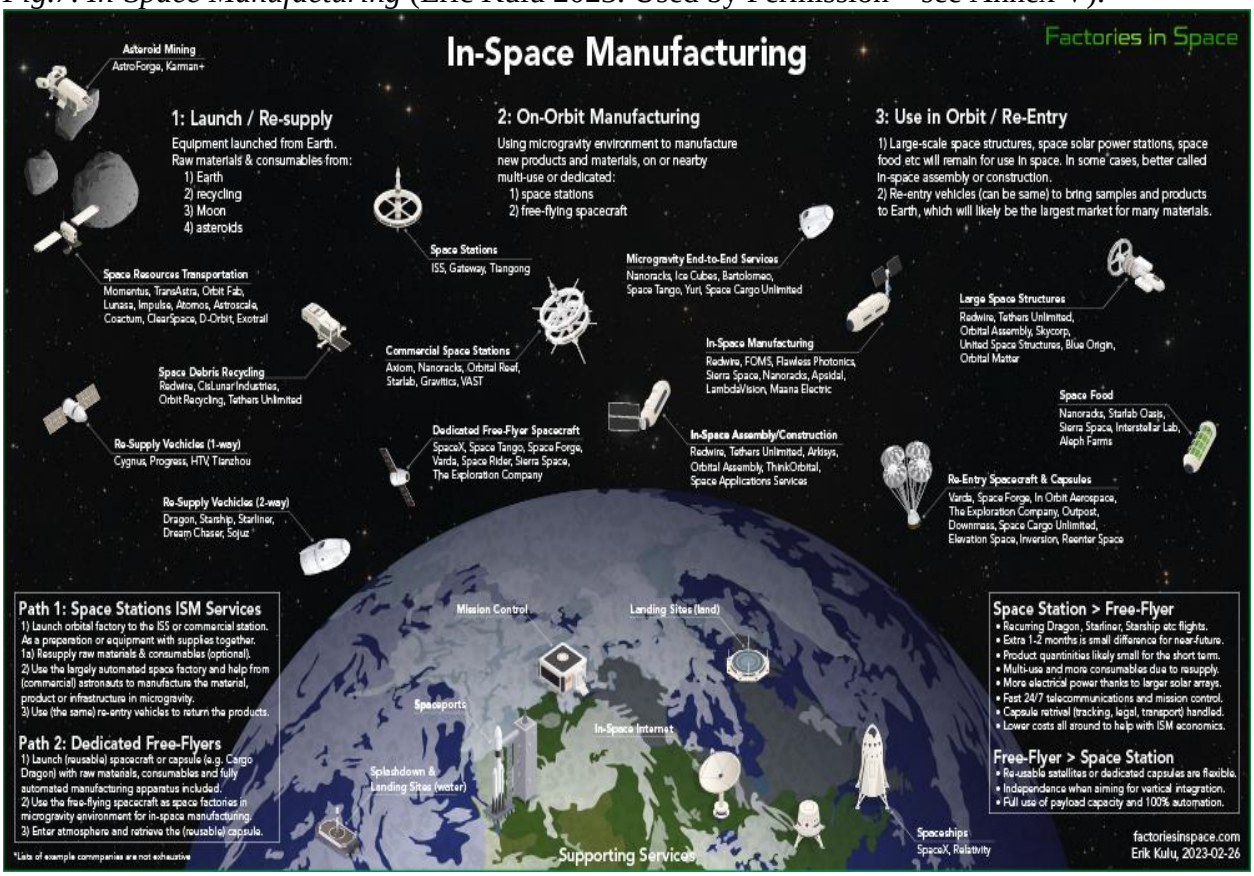


(Source: Erik Kulu. 2023. "In-Space economy in 2023," p. 7. Used by Permission—see Appendix)

Current Trends in In-Situ Manufacturing

In the Fig. below, Kulu (2021/2023, 1-23) highlighted three categories of technology-enabled "in-space manufacturing" as follows: earth/re-supply, on-orbit manufacturing, and those for use in orbit/re-entry. The in-space manufacturing activities include, In-Situ Resource Utilizations (ISRU), space minerals prospecting, space mining, processing, recycling, inter-space and inter-stellar transportations, beneficiation (treatment of raw materials to improve their physical or chemical properties) (Kulu 2021/2023, 1-23). According to NASA (2019, 1), "The ability to perform In-Space Manufacturing (ISM) provides a solution towards sustainable, flexible missions (both in-transit and on-surface) through on-demand fabrication, repair, and recycling capabilities for critical systems, habitats, and mission logistics and maintenance. These capabilities provide tangible cost savings due to reducing launch mass, as well as significant risk reduction due to decreasing dependence on spares and/or over-designing systems for reliability…." (NASA / Susanna Litkenhous and Brian Dunbar, May 22, 2019, In-Space Manufacturing, 1. https://www.nasa.gov/oem/inspacemanufacturing). Scores of space manufacturing corporations operate in one or more of these activities which raises specific legal issues peculiar to each operational policy (The issues are beyond the limited scope of this research study).

Fig.7. In-Space Manufacturing (Eric Kulu 2023. Used by Permission – see Annex V).



(Source: Erik Kulu, 2023. "In-Space Manufacturing (ISM)" - https://www.factoriesinspace.com/ used by written permission from Eric Kulu).

Again, these innovative technologies and the underlying inventive scientific knowledge of space mineral resources were unavailable in the early eras of the outer space treaty debates (Von der Dunk 2017, 83-87). As demonstrated, the outer space economy, and industry, championed by the private sector in the 21st century is primarily profit-driven emphasis on the exploitation or appropriation of strategic outer space natural resources for private benefits (Jakhu and Dempsey 2017, 1). The certainty of actually exercising property rights over extracted space minerals resources has increased the incentive for more private sector entrants into the booming interests in space mining investments (Gangale 2016, 209-212).

Considering these intensified shifts to space minerals, and in the light of the inevitability of space mining, most experts are of the view that global states, international organizations, and space law experts should revisit the "existing but vague international legal principle" of "non-appropriation" (Blount and Robinson 2016). This would "make it feasible to arrive at a widely agreed approach amongst spacefaring nations to allow national licensing of mining operations as long as the relevant overriding public interests in the safety, security, and general international legality of space activities would be guaranteed to be protected thereby…" (Von der Dunk 2017, 101). Ultimately, the prevailing technology-enabled indirect extensions of national jurisdictions to space minerals through states' exercise of both personal jurisdiction over legal entities and "quasi-territorial jurisdiction over space equipment used in space mining, would result in a multilateral international legal regime. But to consider what kind of legal regime, it would benefit us to weigh the different perspectives from which shared spaces have been theorized throughout history. We take up this inquiry in the next chapter.

CHAPTER TWO

Historical & General Public International Law Background

Conceptual Roots: Terra/Res Nullius v. Terra/Res Communis Omnium

Roman law recognized two classes of things: "*Res corporales*" (things which can be touched, or that are perceptible to the senses), and "*Res incorporales*" (imperceptible things that cannot be touched, but could be perceived in the mind alone, such as ideas of "right") (Buckland 1963, i-ix, 1-55). Further, according to Hugo Grotius (1609, 114-118), Roman law divided "*Res corporales*" into three categories. First is "*Res publica,*" used to denote the common property of the Roman people that were subject to government regulation, such as public roads and parks (ibid.). Next, "*Res divini Iuris*" which designated things under the protection of the Gods, such as "*Res sacrae*" (temples and religious objects), and "*Res religiosae*" (sacred burial sites that were not subject to commercial transactions) (ibid., 116-117). The third division of "*res corporales*' is "*Res communis Omnium*" which described things commonly available to everyone and which cannot be owned by anyone, including the State, such as the air and the seas (ibid.).

Further, Roman law recognized some legal acts as satisfying the legal requirements to acquire ownership for effective possession (*iusta causa possessionis*) such as purchase (*pro-emptore*), donation (*pro-donato*), or occupation (*occupatio*), which is acquisition by taking through conquest or long duration of occupancy (Buckland 1963, 2017-209). In the post-state West, to ensure peace, security, harmony, and equity in international relations after the protracted Thirty-Years War, following the 1648 Westphalian Treaty, international law devised novel ways of representing the natural world by the spatial ordering of the universe subject to key principles of international law (Mickelson 2014, 621-622). The State, as sovereign territorial entity, emerged as the central subject of contemporary international order (Distefano 2010, 26).

The Latin terms *res nullius* means a thing (res) without an owner (or a *terra nullius*, when pertaining to land), and it is used in international law to describe a thing outside the jurisdiction of a subject of international law, and hence susceptible in law to being acquired by a subject of international law (such as a State) (Bing Cheng 1997, 227-229). The doctrines of *res nullius* and *terra nullius* were understood under Roman law as things (*res*) or land territories (*terra*) beyond sovereign boundaries of a state and "…unclaimed by any state and therefore subject to lawful appropriation, through occupation, by any state with the inclination, and the military, political, and economic power, to establish and enforce its claim" (Mickelson 2014, 624). But this ancient rivalrous way of thinking about non-sovereign international spaces was challenged, in the case of the high seas, by the legal philosophy of the Dutch lawyer, Hugo Grotius (1609/1625) who argued in his works De Jure Praedae (1604), and *Mare Liberum* or *Free Seas* (1609) that as Global Commons, the high seas cannot be subject to sovereign territorial claims but are free for interstate navigations and trade.

Classical Notions of Sovereign Territorial Jurisdictions in "Global Commons"

The emergence of states in the political developments of the West raised the stakes for political and legal philosophies on the appropriate nature of spheres or resources beyond the territorial sovereignty of states (Dumbauld 1952). Some advocated natural law understanding, according to which things in the state of nature belonged to no one and were *Res Nullius* that could be exclusively appropriated by anyone. Others held to a *Res Communis* notion of non-sovereign things belonging to humanity in common—either subject to communal appropriation for the common benefit of all at or not subject to any form of appropriation, exclusive or communal (Boucher 1998). Other frameworks asserted that non-sovereign things should belong to the public, as *Res Publica*, open to common use, but never to be appropriated by any,

exclusively or not (Lachs 2010). Ranganathan (2016) linked these ideas of interacting with international spaces to the development of the concept of a tragedy of the commons, which held that common resources are doomed to over-exploitation if unregulated by the state or a corporate body representing all stakeholders.

Classical, medieval, modern, and contemporary scholars used legal, moral, political, economic, and philosophical theories to analyze the questions of the status of the evolving commons spheres and resources. Some commons zones and resources implicated include the high seas—ocean navigation, fishing, seabed resources, ocean biodiversity, under sea communications and waves). Subsequently, human technology and scientific advances enabled access to other commons spheres and resources like the atmosphere (aeronautical, satellite, radio waves, internet), Antarctica (scientific research, biodiversity), and outer space (celestial bodies, astronautical navigation, asteroid belt, and its resources, cislunar zone and its resources, and the vast unexplored galaxies with yet-to-be-determined resources.

Some key theorists such as Hugo Grotius, John Selden, Thomas Hobbes, John Locke, and Sir Henry Sumner Maine provide helpful guides on the variants of theoretical frameworks aimed at analyzing the concept of sovereign territorial jurisdictions and non-sovereign global commons in international relations. As law dean, Roscoe Pound (1925) underscored, “Any account of the development of theories of justice is likely to begin the modern history of the subject with Grotius, and to put as a classical epoch a period designated as “from Grotius to Kant” (685).

Hugo Grotius (April 10, 1583-August 28, 1645)

Hugo Grotius, the Dutch lawyer, diplomat, and political philosopher was famously designated by Italian jurist, Giambattista Vico, as “the father of international law,” “jurisconsult of the human race”- *generis humani jurisconsultus* because of his landmark legal masterpieces

that shaped the field of international law and international relations (Dumbauld 1952; ‘t Hart 2009). Grotius was born in the Dutch city of Delft on April 10, 1583. He was a child prodigy who earned his law degree at the age of fifteen (Pound 1925). In addition to the practice of law, Grotius served his homeland, The Netherlands, as an ambassador (Grotius 1609). Grotius subscribed to the liberal tenets of Dutch protestant leader Jacobus Arminius or Jakob Hermansz (1560-1609), who opposed the strict teachings of John Calvin on predestination—and developed Arminianism. In Calvin’s predestination theory, humans elected for salvation were so designated prior to “Adam’s Fall” and could not have exercised free will in the salvation process (Encyclopedia Britannica 2022).

Arminius defected from Calvin, and held instead that, pursuant to a conditional salvation theory, God elects to eternal life only those who responded in faith to the divine offer of salvation. Grotius gravitated to the Arminian theory that God’s sovereignty and human free will were compatible for salvation. The Arminian theorists converged into a minority socio-religious group known as the “Dutch Remonstrants” (1610) that held to the tenet that human dignity required an unfettered freedom of the human will. The Synod of Dort (1618-1619), made up of majority Calvinists, outlawed the Arminian theory at a time when Grotius served as a high-ranking councilor in the Arminian-controlled province of Holland. He was apprehended by the Calvinist-led central government in 1619 and sentenced to life imprisonment for rejecting the strict teachings of John Calvin (Pound 1925). The sentence, Dumbauld (1952) notes, was as a result of religious disputes about predestination which morphed into a constitutional conflict between the local and central governments of the nation. After escaping life imprisonment in his country due to the political persecutions for his Arminian faith, Grotius served as ambassador of Sweden to France between 1634 and his death in 1645.

As a political philosopher, Grotius held to the voluntary free-will-based social-compact concept drawn from Natural Law theories and later reinforced in the political philosophies of Hobbes, Rousseau, and Locke. In the social contract framework, due to concerns for security and survival, free humans, endowed—by God and Nature—with unfettered rights to life, liberty, and property, voluntarily ceded some of their rights to a communal authority framework that would ensure the security and survival of all. American legal scholar and expert on Hugo Grotius, Edward Dumbauld (1952), averred that the framework of social contract drawn from Grotius and succeeding political theorists influenced the American Founders and the principles enshrined by the Framers in the Declaration of Independence.

The late American legal scholar, Roscoe Pound (1923), traced the history of modern Western legal science through Greek philosophers (such as Aristotle), Roman Law (Cicero), the subjection of law to theology in the 13th century, and its emancipation from theology in the 16th century through the works of jurist-theologians, and Grotius. According to Pound (1921), post-Reformation, "the appeal to reason against authority led to a new conception in philosophy, in theology, in politics, and ultimately in legal theory …a new era in jurisprudence by the appearance of the great work of Grotius in 1625" (87-88). Thus, Grotius' legal theories provided the intellectual and legal foundation for the interstate relations as new international spaces emerged alongside sovereign states in Europe following the collapse of the dominance of medieval Papal Christianity and the Holy Roman Empire.

Bryce (1904) averred that Grotius' legal formulations were the intellectual foundations for the new political structure of Europe at the close of the Thirty Years' War (1618-1648) and the consequent Treaty of Westphalia in 1648. According to Bryce (1904, 436), Grotius and his successors crafted the novel law of international relations and natural resources exploitation out

of the principles which they found in the Roman law and the private law of Germanic countries. By doing so, these theorists laid the foundation upon which the system of international jurisprudence has been built up during the last three centuries.

In a bibliography of international law, Ter Meulen and Diermanse (1950) listed over 1300 items of interest to Hugo Grotius, including poetry, philosophy, philology, theology, ecclesiology, history, and law. However, it is Grotius' writings in international law, especially on the critical issue of the legal status of non-sovereign global commons that commands the attention of this study. Aspects of the undergirding principles are scattered in Grotius' works, such as his *Introduction to Dutch Jurisprudence* (1631), and his *Defense of the Lawful Government of Holland* (1622). However, the works that addressed the current international space issue more profoundly include *The Law of Prize—De Jure Praedae* (1604-1606), *Mare Liberum* or *Freedom of the Seas or The Right Which Belongs to the Dutch to Take Part in the East Indian Trade* (1609/1633), and his much-lauded masterpiece, *The Law of War and Peace* of 1625.

As a proponent of the rule of law in international politics, Grotius' thesis in both *The Law of Prize* and *The Law of War and Peace* was that violations of legal obligations established by natural law and the law of the nations by states justifies armed coercion in accordance with the rules of international engagement articulated by Grotius (Pound 1925). Grotius' *Mare Liberum* was Chapter XII of his legal treatise, *De Jure Praedae* written by Grotius in 1604/1605. Grotius was retained by the Dutch East India Company (formed 1602) to justify the capture, by one of its ships, of a Portuguese trading ship in the Straits of Malacca in 1602. *De Jure Praedae* (*The Law of Prize*) was Grotius' legal brief for the case and Chapter XII, *Mare Liberum*, was Grotius' core argument for the freedom of navigation and use of global commons, such as the high seas. *The Law of War and Peace* of 1625 (the first systematic treatise on international law) was the direct

outgrowth from that legal case and Grotius' legal representation of the Dutch East India Company.

Facts of 1609 *Mare Liberum* (as Twelfth Chapter of *De Jure Praedae*, 1604)

Grotius (1609) wrote *Mare Liberum* to refute the unjustified claims of Spain and Portugal to exclusive ownership of the high seas. Spain had claimed the Pacific Ocean and the Gulf of Mexico, while Portugal claimed the Atlantic, south of Morocco, and the Indian Ocean. The Dutch were at war with Spain at the time, and had settlements in the island of Mauritius, Java, and Moluccas (ibid.). As the Dutch East Indian Company (formed 1602) attempted to navigate and trade with the East Indies, the Portuguese ships sought to exclude the Dutch merchant vessels from the Indian waters (ibid.). Heemskerk, a captain of one of the Dutch merchant fleets, captured a Portuguese merchant vessel. Confusion arose over the sharing and ownership of the captured booty. Grotius was contacted for his legal opinion, and he wrote the De Jure Praedae (*The Law of Prize*) which outlined legal principles guiding the ownership and distributive mechanism for captured enemy booty. The chapter on the freedom of the seas, written to justify Dutch right to navigate the high seas for international trade, was later published as *Mare Liberum*. During the same era, the French, the English, and other European powers claimed adjoining and far away high seas. Those positions were later argued by jurists like John Selden, in his Mare Clausum of 1635, published to refute Grotius' *Mare Liberum*.

Grotius' Legal Reasoning in *Mare Liberum*

Grotius set out to articulate the rights, duties, and obligations of states in international law; procedures to enforce obligations; and the means of enforcing and remedying legal rights in international relations, especially with regards to resources within and beyond state sovereign jurisdictions. In his personal *Prolegomena* or prologue to *The Law of War and Peace* (1625),

Grotius rejected the notion of egoistic self-interest of states as negating the necessity for international cooperation, collaboration, and coordination under international law. Grounding human sociableness and inert impulses to cooperate on God's Natural Law, Grotius (1609) argued that "…by means of the laws which he has given, God has made those fundamental traits more manifest, even to those who possess feebler reasoning powers; and he has forbidden us to yield to impulses drawing us in opposite directions—affecting now our own interest, now the interest of others—in an effort to control more effectively our more violent impulses and to restrain the within proper limits" (Prolegomena 13). This demonstrates that those egoistic impulses must not control the relations between individual states, as dictated by the common ancestry of all peoples grounded in God's creation of the human family and the community of states that grew from it and formed social compact (ibid.). Hence, Grotius (1625) advanced common rules of conduct in the international sphere that would incline international actors to "sociableness" or cooperation.

Therefore, "it is the rule of nature to abide by pacts" (Prol. 15), and those social compacts are guided by express or implied "bodies of municipal law" (ibid.). Grotius thus held that the nature of humans "…is the mother of the law of nature" that laid the foundation for social compacts undergirded by municipal or domestic laws. Municipal law created rights and obligations based on the mutual consent of citizens and the government: "But the mother of municipal law is that obligation which arises from mutual consent; and since this obligation derives its force from the law of nature, nature may be considered, so to say, the great grandmother of municipal law" (Prol. 16). According to Grotius (1609), within the sovereign bounds of a state and international sovereign spheres, "expediency" or the law of scarcity was willed by the "author of nature…that as individuals we should be weak and should lack many

things needed in order to live properly to the end that we might be more constrained to cultivate the social life" (Prol. 16). Which means that human lack and needs supports social compact, association, cooperation, and collaborative trade and commerce.

Laws became necessary in the process, whether at the domestic or international levels: "Expediency is, as it were, the mother of what is just and fair" (Grotius 1609, Prol. 16). Grotius (1609) draws from this analogy of the law of nature to describe the law of nations or international law: "But just as the laws of each state have in view the advantage of that state, so by mutual consent it has become possible that certain laws should originate as between all states, or as great many states; and it is apparent that the laws thus originating had in view the advantage, not of particular states, but of the great society of states. And this is what is called the law of nations…" (Prol. 17). Though distinguished from the law of nature, the law of each state must not violate natural law in the realm of international relations.

Grotius (1609) held that "…the state which transgresses the laws of nature and of nations cuts away also the bulwarks which safeguard its own future peace" (Prol. 18). When a state unilaterally defects against natural law and international law, questions of justice and international compact arises, and combined force of the nations would be necessary to enforce compliance with the breached social compact of natural law (Grotius 1609, Prol. 19). The reason is because natural law is immutable and compliance with its mandator precepts equates justice, and "…justice brings peace of conscience, while injustice causes torment and anguish…Justice is approved, and injustice condemned, by the common agreement of good men…in God injustice finds an enemy. Justice is a protector" (Prol. 20). As the author of nature and its laws, God is necessarily bound by what he ordains or prohibits through Natural Law (Grotius 1625). Thus, international relations required international law to maintain an orderly and just system for the

interaction of states to ensure international goods and justice. Yet, remedies must be sought when states defy natural and international law.

Grotius (1609) set out in the three divisions of *The Law of War and Peace* the legal obligations of states and remedial procedures. In Book I, Grotius defined terms such as war and law, as he rebutted the extreme pacifist views that war was never justified and that if ever justified then it must be prosecuted without considerations to rules of engagement and disengagement. Adhering to Aristotle, Grotius recognized two categories of law: *Jus Naturale* (natural law) and *Jus Voluntarium* (volitional law). He acknowledged Cicero's definition of war as "…a contending by force" (Cicero 106-43 BC., On Duties, I.34), but added that "…war is a condition of those contending by force" (Grotius 1625, BK I.1), which is the modern state of war. To Grotius "Natural Law" or the law of nature, "…is a dictate of right reason, which points out that an act, according as it is or is not in conformity with rational nature, has in it a quality of moral baseness or moral necessity; and that in consequence, such an act is either forbidden or enjoined by the author of nature, God" (Book I.10). This law, according to Grotius, is immutable and cannot change—not even by God himself who ordained or forbade it—because God is necessarily bound to ordain what his law of nature commands or prohibits (Grotius 1625, Book I).

Grotius explained that two ways to determine natural law are antecedent (*a priori*) and consequent (*a posteriori*). An *a priori* proof must demonstrate "the necessary agreement or disagreement of anything with a rational and social nature; proof *a posteriori*…if not with absolute assurance, at least with every probability, that that is according to the law of nature which is believed to be such among all nations or among all those that are more advanced in civilization" (Grotius 1625, Book I.12). Common sense should be used in evaluating universal

cause and effect in international relations – for natural law is a law common to all rational, sentient beings, regardless of national boundaries.

Grotius (1625) divided volitional law into divine (*jus divinum voluntarium*) and human (*jus voluntarium humanum*). Divine law (*jus divinum voluntarium*) was either given to the entire human race or to a specific people. It has its origin in the divine will and is distinct from the law of nature. According to Grotius (1625), this law was "thrice given by God: immediately after the creation of man; a second time in the renewal of humankind after the Flood; lastly, in the more exalted renewal through Christ" (Book I). Grotius (1625) subdivided man-made law or human volitional law (*jus voluntarium humanum*) into civil law, family/business law, and the law of nations (jus gentium). These are broader in scope than divine law, which is specific in nature. However, the law of nations, as Grotius (1625) held, is broader than municipal law (i.e., state-level civil, family / business laws). The law of nations "is that law which has received its obligatory force from the will of all nations or of many nations" (Grotius 1625, Book I.14). At the time of Grotius, international law binding all nations was nonexistent—beyond localized interstate bilateral or multilateral treaties such as the 1648 Westphalian Treaty which Grotius helped to formulate (Bryce 1904).

Grotius recognized this by noting that "outside of the sphere of the law of nature, which is frequently called the law of nations, there is hardly any law common to all nations" (Book 1). Hence, the proof for the law of nations was to be found in customary law as articulated by legal scholars and political theorists of great nations and empires of the past, such as Aristotle, Cicero, Thucydides, and others (Grotius 1625, Book 1). Thus, the Roman law (*jus gentium*), which was not strictly international law affecting the entire world, still had relevance in understanding the actual international law that promotes the interests of all states. Grotius viewed sovereignty as a

key concept of international law that is fundamental to the behavior of states within and outside of their boundaries.

After positing Natural Law within the pre-state system of norms that governed interpersonal relations in the state of nature, Grotius (1625) synthesized Aristotelian political philosophy and Roman Law in analyzing political ideas such as sovereignty. In this legal spectrum, Grotius viewed sovereignty in terms of "sovereign power" or "sovereign authority"—using the expressions, *summa potestas* and *imperium* (Book I). Grotius employed the medieval rationale of *summa potestas* as the highest power in the land, a political authority not legally subject to the will of any superior. *The Imperium*, on the other hand, was the Roman law concept of executive power, the right to exercise coercive power in the enforcement of laws (ibid.). This personification language was used to identify the state as a sovereign natural actor in the emerging international relations of the Westphalian world (Bryce 1904).

Comparative Analysis: Grotius, Pufendorf, Hobbes, Kant

Like Grotius, Hobbes (1640) and Pufendorf (1672) likewise viewed states as individuals in a state of nature, standing distinct and autonomous in relation with other autonomous and equal states vested in self-interested outcomes, especially with regards to non-sovereign things and resources. In *Perpetual Peace*, Kant (1995) argued that the need for global security and survival of each state necessarily called for an international cooperation, collaboration, and coordination for shared beneficial outcomes rather than individualistic defections that reinforced the conflictual state of nature among states in perpetuity. Grotius (1625) reasoned that international law, or the voluntary laws of nations would effectively compel the cooperation of states on conflictual common resources questions subject to sanctions.

Hobbes (1651) reiterated the impotency of mere legal instruments in the absence of a strong-willed human agency—a *Leviathan* or *Behemoth*—strong enough to enforce cooperation against defections. Pufendorf agreed with Hobbes (1642) against Grotius that there could be no genuine international law in the absence of an authority whose will could compel international acquiescence with the "binding' international legal frameworks regarding common resources spheres. Pufendorf (1673), however resolved this by agreeing with Grotius (1625) that the law of nature and the voluntary law of the nations were synonymous. This meant that, just as individual persons, states in the international relations sphere were subject to the rules of natural law because in the state of nature, the Natural Law was the standard for justice and injustice. Thus, all these theorists converged on the view that the Natural Law governs relations among sovereign states. However, they disagreed on the nature, legal status, and designations of the multilevel property rights derivable from Natural Law within and beyond sovereign spheres of natural resources.

Whereas Grotius (1625) accepted the notion of exclusive appropriation of non-sovereign, unoccupied, unused, or unconquered lands (on grounds of it being in a state of nature), Pufendorf (1672) rejected such a notion, and deemed such appropriations as unlawful "universal dominion" (Law of Nature 1672, IV. vi. 4). In the international law prism of Pufendorf (1672), unoccupied lands without known private owners "should not at once be regarded as unoccupied and free to be taken by any man as his own, but it would be undertaken to belong to the whole people [of the immediate area]" (Law of Nature 1672, IV. vi. 4). Hence, where Grotius (1625) and Locke (1689) regarded the Indian American lands of North and South America as still in the state of nature in the 17th century, and subject to terra or res nullius appropriations by Europeans, Pufendorf (1672) held that by virtue of "eminent domain" the American Indians were entitled to

the entirety of the Americas as community property inalienable to strangers by any single Indian person or groups.

According to Pufendorf (1672), "eminent domain" meant the power of all citizens voluntarily vested by the community in the sovereign state through a compact to protect and exercise the property rights of the community subject to the common good. Rousseau (1761) termed this compact the "General Will"—and Pufendorf (1672) asserted that the compact gave the Indians the superior eminent domain power to exercise property rights of occupancy as a whole, decide on frameworks for land use, and establish natural resources distributive mechanisms against the European invaders. Notably, the theorists shifted and adjusted their positions based on the kinds of properties (movable or immovable; liquid, solid, gas) or the technology-driven loci (land, sea, the heavens; sovereign or non-sovereign spheres). Yet, if property, its use, or distribution required global agreement, when did all citizens of the world authorize the prevailing appropriation frameworks? And, if—as St. Augustine's (426) and Grotius' (1625) Natural Law ideas suggested—God gave all the terrestrial resources for the use of every individual in common, how and on what authority can small groups permanently and exclusively appropriate portions for common use, such as pre-conquest American Indian lands/resources and pre-colonial African continent? Authorities differ in their response to this issue.

Imperium and Dominium: Grotius & Sovereignty

Grotius (1625, Book I) distinguished *summa potestas* and *imperium* from the Roman law concept of *dominium*, the absolute ownership of property in private law. The exercise of *dominium* derived from Grotius' (1625) discussion of *auctoritas*, a medieval just-war theory that held that war was just if only declared by a sovereign (i.e., one with relevant politically superior

authority). With regards to the internal sovereignty of a state, Grotius followed the Aristotelian view also subscribed to by future political theorists such as John Locke, that sovereignty belonged to the people through natural law rights of freedom and liberty. However, pursuant to the collective social contract, the people may voluntarily cede to a central authority—subject to certain natural law limits— the right to use or exercise their collective sovereign power (ibid.). Thus, in Grotius' (1625) understanding of sovereignty, it is exercised by a grantor as conveyable temporary tenancy of the sovereign powers not as absolute owner of sovereign title. Ultimate ownership still resided in the people.

And, in accordance with natural law, the people cannot transfer to a central authority the powers the people themselves did not originally possess, such as right to suicide (Grotius 1625). Therefore, the state, just as the people, must be subject to natural law, divine law, and the law of the nations. Mutual dependence exists between the people and the state on these grounds. These principles converged in Grotius' (1625) description of state sovereignty as the unimpeded exercise of exclusive civil powers that "are not subject to the legal control of another, so that they cannot be rendered void by the operation of another human will" (Book 1.7). Given the prior acknowledgment of a nonexistence of global international law at the time, the question of the relationship between state sovereignty and "things which belong to men in common"— natural bodies and resources beyond the jurisdiction of states— would ultimately emerge. The preceding principles were pivotal in the international law theory of Grotius on global commons, such as the high seas.

In Book II, Grotius articulated his famous justifications for international war and approaches to property questions in non-sovereign or global commons. In Grotius' system, as with St Augustine's *City of God* (426 - *Against Pagans*, 19.7), the primary justification for

international conflict must be in response to injury – though types of injury may differ (Grotius 1625, Book II.2) The injuries may be past, present, impending, actual, or potential: "Actions, furthermore, lie either for wrongs not yet committed, or for wrongs already done" (Book II.2). Following Roman law classifications, Grotius (1625) grouped the injurious causes of "Just War" under four categories: (1) self-defense; (2) property protection; (3) reparation-enforcement of contractual duties owed; and (4) punishment (Book II.2, 3, 4). Grotius (1625) examined these causes under a threefold criterion under the law of nature, the law of nations (jus gentium or human volitional law other than civil), and volitional divine law.

In Book III, Grotius (1625) advanced rules regulating or governing the behavior of belligerent states in the conduct of war (*jus in bello*), distinct from the justifications for war in Book II (*jus ad bellum*). Grotius (1625) evaluated property protections under the law of nations in Book II and provided a detailed exposition of the acquisition and scope of rights under natural law. This section focused on things which belonged to people in common and on the common rights of humans. In Section I., Grotius distinguished between the "Common Right of mankind" and "our own Special Right" relative to things under territorial sovereignty and things beyond state territorial sovereignty. "Common Right" impacts "corporal things, or certain acts" (Bk. II.1), and "corporal things" could be "unappropriated or the property of someone" (ibid.). Unappropriated things belong to no one and may or may not be appropriated depending on what kind of thing it is and its location – whether within or outside sovereign boundaries (Grotius 1609).

To determine if a thing could be appropriated, Grotius (1625) considered the origins of property and the exercise of power (possession) and *dominium* (ownership) over things. He traced the right of "universal use" and property rights to God, the state of nature, and growth of

human society through social compact: “God gave the human race generally a right to the things of a lower nature, at the Creation, and again after the Deluge. Everything was common and undivided, as if all had one patrimony. Hence each man might take for his use what he would and consume what he could. Such a Universal Use was then a Right, as Property is now. What each one had taken, another could not take from him by force without wrong” (Grotius 1625, Bk. II.II.1). This was a statement of the customary understanding of common law res nullius – the idea that unappropriated things in a state of nature belonged to one and are subject to exclusive appropriations.

Grotius’s 1609 Mare Liberum

Following St. Augustine’s City of God (426), Grotius (1625) articulated the origins of human history in the Book of Genesis and the anthropological history of other nations to trace the progression of human history from individuals, families, communities, and nations or state. Addressing the rulers and the free and independent Christian nations in *Mare Liberum*, Grotius (1609) grounded his idea of social compact on God’s free will act. He held “…that God was the founder and ruler of the universe, and especially being the Father of all mankind, He had not separated human beings, as He had the rest of living things, into different species and various divisions, but had willed them to be of one race and to be known by one name…given them the same origin…that they all might recognize their natural social bond and kinship” (The Freedom of the Seas 1609, 1). Grotius (1625) employed the Arminian anthropological theory to show that God willed that humans have unfettered access to all things in the state of nature.

By virtue of the divine act, things became property and humans acquired property rights over all things through common ancestry to God and Adam’s family. But God also displayed to humans what could be exclusively appropriated and things that belonged to everyone in

common: “Now as there are some things which every man enjoys in common with all other men, and as there are other things which are distinctly his and belong to no one else, just so has nature willed that some of the things which she has created for the use of mankind remain common to all…Laws moreover were given to cover both cases so that all men might use common property without prejudice to anyone else” (ibid., 2). Thus, exclusive, and common property rights existed at Natural Law, but with the caveat that the common things remain common to all and not subject to unilateral appropriations.

Overall, Grotius (1625) grounded property rights at all levels on social compact as an organizing principle of state sovereignty or jurisdiction over things, such as lands. Through express or implied social compact things became property: “And thus we learn how things became property; not by an act of the mind alone: for one party could not know what another party wished to have for its own, so as to abstain from that; and several parties might wish for the same thing; but by a certain pact, either express, as by division, or tacit, as by occupation: for as soon as community was given up, and while division was not instituted, it must be supposed to have been a matter of agreement among all, that what each had occupied he should have as his own…that from the division of land arose a new origin of Rights” (Grotius 1625, Bk. II.11.5). In this manner, the external perimeters or boundaries of each state were demarcated, leaving the non-sovereign areas as international spaces.

On the strength of these principles, Grotius proceeded to make the case that “all citizens have equal and indiscriminate [non-exclusive] right to use rivers and public places” (Grotius 1609, 3) pursuant to freedom of travel and of international trade. He concluded in Book II of the Rights of War and Peace (1625) that “the sea, whether taken as a whole, or as to its principal

parts, could not become property" (Bk. II.III.1) of private persons or of the community. Grotius used arguments based on moral reason and Natural law for this position.

From the moral perspective, Grotius (1625) reasoned that "…the magnitude of the sea is so great that it is insufficient for all peoples for every use, either of drawing water, fishing, or navigation" (Bk. II.III.1). Hence it would be morally repugnant for persons or states to exclude others from a common resource provided by nature for the sustenance of all, for navigation, and for trade—especially given that the sea is inexhaustible. And, anticipating future legal questions on the status of aerospace, Grotius (1625) suggested that it be analogized to laws on the ownership of land and sea: "The same might be said of the air, if there was any use of it to which the use of the earth is not also necessary, as in bird-catching it is and therefore this employment is governed by the ownership of the land" (Chapt. II.III.1). Though Grotius lacked prescience on any future aeronautical, satellite, or radio wave technologies and other future uses of the air, he recommended the application of known global commons laws that governed land spaces to emerging new spheres.

From a Natural Law standpoint, Grotius (1625) argued that the sea cannot be made exclusive property because it was boundless liquid which was not divisible at the inception of God's creative act. As liquid, the high seas cannot be occupied like land with boundaries that can be contained—unless they are contained in something else (e.g., lakes, ponds, and embanked rivers (ibid., Bk. II.III.2). Moreover, according to Grotius (1625), "Nor are we to feign a division of the sea: for when the earth was first divided, the sea was for the most part unknown; and therefore, we cannot imagine any way in which distant nations could agree as to such division" (Bk. II.III.2). In this reasoning, Grotius (1625) conceded possibilities of sovereign appropriation of contiguous parts of the sea within coastal or territorial borders of a state as lawful partial

occupation (Chapt. III.VIII-XIII). However, the entirety of the high sea cannot be exclusively appropriated by one state. Thus, the high seas were common to all, not divided at inception of creation, and cannot become personal property by division "but by occupation and are divided only after they have become property" ((Bk. II.III.3).

Yet, Grotius (1625) introduced the nuance of "Civil Law" interference with the primeval legal status of commons properties. He held that "…when the Civil Law has settled anything otherwise, the Natural Law itself directs that it be obeyed. For though the Civil Law cannot ordain anything which the Natural Law prohibits, nor prohibit what that ordains: yet it may circumscribe natural liberty and forbid what was lawful by Natural Law; and even interfere to prevent an ownership which might be acquired by Natural Law" (Bk. II.V.). This use of positive law to circumscribe natural law featured in the debates surrounding the 1967 Outer Space Treaty and its prohibition of exclusive sovereign territorial appropriations of outer space and celestial bodies – something that otherwise is permissible under Natural Law.

Grotius' Free Seas Argument

In his legal representations of the Dutch East Indian Company, Grotius (1609) employed the argument that the sea, in part or in whole, cannot be appropriated by persons or states. The case was about the legality of exclusive appropriation of the whole of the Indian Ocean by the allied imperial Spanish and Portuguese states and consequent impediment of the right of navigation, and free trade of other states like the Dutch. The legal issues articulated by Grotius (1609) included: whether the boundless sea be exclusively appropriated by one state alone. Can any one nation have the right to prevent other nations which so desire, from selling to one another, from trading with one another? Can any nation give away what it never owned, or discover what already belonged to someone else? And does a manifest injustice of long standing

create a specific right? (Grotius 1609, 4). The issue that implicated Grotius' legal burden was the question of exclusive appropriation of the high seas by an imperial state (the Portuguese) and how Grotius responded to it.

Grotius (1609) held that God's Will, Natural Law, the need for social compact and international relations, and the Law of the Nations had manifested the intent of free navigation and trade with all persons whatsoever (Chapt. 1). According to Grotius (1609), "every nation is free to travel to every other nation, and to trade with it" (Chapt. 1, 7). Free trade and navigation of the high seas were willed by God and nature to sustain human social compact and the law of human society. For, "God Himself says this speaking through the voice of nature; and inasmuch as it is not His will to have Nature supply every place with all the necessaries of life, He ordains that some nations excel in one art and others in another. Why is this His will, except that it be that He wished human friendships to be engendered by mutual needs and resources, lest individuals deeming themselves entirely sufficient unto themselves should for that very reason be rendered unsociable?" (Grotius 1609, Chapt. 1, 7). Thus, the need and desire for reciprocal international trade cannot be frustrated by the egoistic interests of nations such as Portugal and Spain to prohibit free access to the high seas which God and nature had freely provided for the use of all mankind on planet Earth.

Grotius (1609, 11-76) effectively held that neither the Indian Ocean, the seas, nor the right of navigation thereon belonged to the Portuguese by title of discovery, conquest, occupation, claims to papal donation, title of prescription, or by any customary law. Since nature had given all things to all men, and the high seas were one of those things common to all mankind, the high seas cannot become the exclusive property of any state—especially given its boundless, limitless, inexhaustible nature. Citing eminent jurists of many nations, Grotius (1609,

Chapt V) concluded that, “It is clear therefore to everyone one that he who prevents another from navigating the sea has no support in law…the life prayed for by the Dutch rests upon a common right, since it is universally admitted that navigation on the sea is open to anyone, even if permission is not obtained from any ruler” (Grotius 1609, Chapt. 5, 44). This “common right” to use common things and to appropriate its primeval natural resources, I will show, became the basis for the framing of Title IV, Sect. 51301-03, U.S. 2015 Space Act which enshrined the principle of extraction of outer space and asteroid natural resources for the private benefits of U.S. individual and corporate citizens.

John Selden (Dec. 16, 1584 – Nov. 30, 1654) – ***Mare Clausum*** (1652)

English royalist and jurist, John Selden was a prolific writer on many subjects, including a key legal rebuttal, *Mare Clausum* (1652) against Hugo Grotius’ 1609 *Mare Liberum*. During the Grotian debates, the then dominant customary view of Res Nullius subscribed to by France and England was famously defended by French and English jurists, including Grotius’ rival, the English jurist, John Selden (1652). In Selden’s (1652) “Global Commons” ontology, the high seas were *Res Nullius* – no one’s property or masterless things. Being inexhaustible, non-defined, non-scarce resources, the seas could be exclusively claimed by states or private parties with capabilities to do so (Selden 1652). In a two-part rebuttal to Grotius’ “*Of the Dominion or Ownership of the Sea*,” John Selden (1652) first argued from the customary international law of the Greeks, Romans, and Persians. Under those legal regimes, both the Natural Law and the customary Law of the nations supported the traditional Res Nullius view that the sea and lands were not common property historically, but capable of private and state/imperial exclusive dominion.

Selden posited a two-fold thesis that: "…That the sea, by the Law of Nature or Nations, is not common to all men, but capable of private Dominion or proprietie as well as Land… [and] …That the King of Great Britain is Lord of the Sea flowing about, as an inseparable and perpetual Appendant of the British Empire…" (Mare Clausum 1652, The Author's Preface, 1). This meant that Selden (1652) endorsed the exercise of sovereign territorial jurisdiction over adjoining or contiguous water bodies (arguably, in the context of Island States such as the United Kingdom). In Book I (Chapters I to XXVI), Selden (1652) appealed to customary understandings and practices among ancient kingdoms, dominions, empires, and ecclesiastical imperialism to exclusively exercise property rights over the high seas and territorial waters. Legal authorities and ancient jurists such as Cicero, according to Selden, understood and wrote that the seas had been brought under exclusive control by numerous ancient empires and kingdoms, including Rome.

Particularly for Selden's (1652) argument, the conquest of Great Britain by Rome and other powers included dominating the water bodies around it—and was deemed incomplete without such dominance (i.e., exercising imperium over the sovereign territory and dominium over adjoining water bodies). Similarly, the Brits never considered their lands free without commensurate dominance and reclaiming of the contiguous water bodies (ibid.). Such contiguity of land and sea, to Selden (1652), meant that exclusive property rights over high seas was appurtenant to the Natural Law rights of states in international relations (especially for Island nations, it may be argued – which also means that non-Island nations may not use Selden as an analogy for taking over international waters). Having articulated the ancient historical attitudes towards exclusive exercise of individual, community, ecclesiastical, imperial, and state property

rights over the seas among Europeans and other cultures, Selden used that evidence against past *res communis* advocates.

In Book II (Chapters I – XXXII), Selden (1652) adduced further evidence of political and commercial interstate dealings between the British and other powers over many water bodies to establish the customary practice of exclusive property rights over water bodies by the various European powers. On these considerations, Selden (1652), argued for English exclusive rights over the British sea, the English Channel, and water bodies surrounding the United Kingdom. Selden (1652) showed that European powers oscillated between the sustenance of the ancient doctrine of *res nullius* "Global Commons" legal regime over the high seas, and the "modern" view argued by Grotius (1625) in *Mare Liberum* that favored a *res communis* "Global Commons" designation of the high seas. Selden (1652) concluded that against the novel idea of the high seas belonging to states in commons in perpetuity (raised by Grotius), customary law (as interpreted by Selden) proved that the high seas, especially the water bodies contiguous to the sovereign territory of a state, had been historically considered as the property of no one's under Natural Law conditions. Hence, they are subject to exclusive appropriations by the states to whose sovereign lands such water bodies are appurtenant to. Though most of these legal propositions eventually failed at the international level, they were embraced by major European imperial states in the subsequent colonial enterprises in the American and African continents.

Thomas Hobbes (April 5, 1588 – Dec. 4, 1679).

English royalist, political philosopher, materialist mechanical philosopher, and natural scientist, Thomas Hobbes, introduced his anti-Aristotelian political philosophy in an earlier work, *De Cive* or *The Citizen* (1647/1651). Aristotle's famous political theses held that human beings are naturally designed to function in a polis in which they fully realize natural potentials

as civilized citizens. Hobbes (1647/1651) countered that humanity was naturally unsuited for political life because of innate egoistic self-interests driven by natural passions. Like Grotius, Hobbes reasoned that in the absence of a rational central authority and regulatory frameworks, human egoistic self-interests would default to a perpetual animalistic state of anarchy in human societies (*The Elements of Law* 1640, Part I, Chapt. XIV.2, 3, 4, 5). Generally, Hobbes believed that moral and political decisions in rational humans were guided by considerations of self-interest: "Every man by nature hath right to all things…to do whatsoever he listeth to whom he listeth, to possess, use, and enjoy all things he will and can" (*The Elements* 1640, Pt. I, XIV.10). Therefore, humans naturally would seek to employ all means necessary for self-preservation.

Given the unequal distribution of capabilities and means, a state of chaos would exist if self-seeking egoism prevailed in human societies. Hence the need for a central authority to preserve common interests in security, peace, property, survival, and preservation of selfless, cooperative sociableness (ibid. XIV.6). It was not against natural law and reason for all to voluntarily consent at the domestic individual and international levels of the social contract, for a central authority and legal framework to preserve the interest of all (ibid.). Hence an imperative of voluntary cession of collective power or individual sovereignty of the many to the government for the protection of collective interest against self-interested egoism (ibid.). This cession of power was not total relinquishment of Natural Law rights, but a temporary transfer of whatever rights inured to the citizens at natural law, subject to good faith of the grantee authority in ensuring the general welfare and security of all (ibid.). Otherwise, the many would be justified in reclaiming ceded power from an abusive or tyrannical sovereign.

According to Hobbes (1640), "When a man divesteth and putteth and from himself his right, he either simply relinquisheth it or transferreth the same to another man. To Relinquish it,

is by sufficient signs to declare, that it is his will no more to that action, which of right he might have done before. To Transfer right to another, is by sufficient signs to declare to that other accepting thereof, that it is his will not to resist, or hinder him, according to that right he had thereto before he transferred…" (*The Elements* 1640, Pt. I, XIV.3). However, since per natural law, every man has rights to everything, "it is impossible for a man to transfer unto another any right that he had not before [in the state of nature]. And therefore, all that a man doth in transferring of right, is no more but a declaring of the will, to suffer him, to whom he has so transferred his right, to make benefit of the same, without molestation" (ibid., 3). An assertion of residual sovereignty in the citizens of the state. Hobbes articulated these political philosophies on the authority of the state to ensure collective security of all pursuant to the social compact that Hobbes (1647) theorized earlier in *De Cive* (1647/1651). According to Hobbes (1647/1651), the government derived such authority based on a fictional "social contract" that vested the responsibility for collective security on a sovereign person or entity—the government.

In his masterpiece, *Leviathan* (1651), Hobbes drew comparison between the inherent conflicts of individual self-interested egoism at the domestic level, with extensions of that state of nature in the egoistic tendencies of states in international relations. Hobbes (1651 reasoning was that the absence of a central authority or common sovereign to compel obedience to international legal frameworks exposed the international sphere to an indecisive state of neither justice nor injustice. To Hobbes, states, analogical to individuals in the state of nature, "…live in the condition of a perpetual war, and upon the confines of battel, with their frontiers armed, and canons planted against their neighbors round about" (Leviathan 1651, Pt. 1.13.62). This realism of international relations still echoes in the chambers of contemporary global commons debates. Some disagree with Hobbes' pessimistic view of states in international relations, but Hedley Bull

(1981, 721) posits that Hobbes' analogy—with unique distinctions—captured the post-Hobbesian egoistic disposition of states in international relations as expanded and systematized by Hans Morgenthau's (1956) realism in *Politics Among Nations*.

Reflecting on inherent human egoism evidenced in international relations, in *De Cive or The Citizen*, Hobbes (1647/1651) asserted that "All men in the state of nature have a desire and will to hurt" (I.4). According to Hobbes (1647/1651), this is because "The natural state of men [is] a war of all men against all men" (I.12; Leviathan Pt. I.13.62). Using the state of nature as an analytic concept, Hobbes envisioned egoism as a permanent factor within all human societies against which humans must always guard against at all levels of interstate or international relations. When dominated by passion, the default inclination for humans, even in interstate relations, would be self-interested egoism (Lamprecht 1949, in *De Cive* 1657). However, Hobbes (1647/1651) believed that restraint of "reason" or of the established procedures of civil society, as external or outside forces, could stabilize the state of nature in humans under certain conditions. A *Leviathan* capable of restraining the egoism of states must be found.

In Hobbes' idea of man in the state of nature, humans are neither purely egoistic nor embodiments of cooperative selfless virtue. Rather, the domination of passion can direct humans to either cooperate with reasonable conformity with the laws of socially beneficent ends pursuant to the social compact, or to selfish ends (Hobbes 1647/1651, XII.1). In this view, man is both a rational and passionate "animal" and social conditions could be organized by a state or group of states in which the egoistic inclinations of individuals or states would be gratified within defined limits of civilized law that regulates social requirements and egoistic self-interests. Hobbes (1647/1651) agreed with Grotius (1625) on the necessity of a law of nations drawn from the law of nature and divine will to govern the anarchical international relations sphere.

However, in *Leviathan* (1651), Hobbes posited that the Law of Nations was simply synonymous with the Law of Nature. The basic law of nature is "…to seek peace and follow it" (*Leviathan* Pt. I. XIV.64), while the right of nature is summed up in "By all means we can, to defend ourselves" (ibid.). In accordance with Hobbes' law of nature, mutual contracts or compacts are formed to transfer collective "power and strength" to a sovereign to enable him to protect the collective interests of all for peace and security (ibid.). Even if the sovereign is absolute or despotic, as far as he ensures the self-preservation of all, he should not be disobeyed, to avert a return to an egoistic, anarchical, state of nature. Hobbes (1651) writes:

> "Seventhly, is annexed to the Soveraigntie, the whole power of prescribing the Rules, whereby every man may know, what Goods he may enjoy, and what Actions he may doe, without being molested by any of his fellow Subjects: And this is it men call Propriety. For before constitution of Soveraign Power (as hath already been shewn) all men had right to all things, which necessarily causeth Warre: and therefore, this Proprietie, being necessary to Peace, and depending on Soveraign Power, is the Act of that Power, in order to the publique peace. These Rules of Propriety (or Meum and Tuum) and of Good, Evill, Lawfull, and Unlawfull in the actions of Subjects, are the Cavill Lawes; that is to say, the Lawes of each Commonwealth in particular…" (Hobbes, *Leviathan* 1651, Pt. 2. XVIII.91).

Overall, in Hobbes' property theory, the sovereign, having received the voluntary consent of all, unilaterally created and enforced property law to avoid individual discords and war over property that would exist if each pursued egoistic property interests as existed in the state of nature (De Cive 1647 / 1651). Unlike Locke's view of the state as guarantor or protector of natural rights to private property, to Hobbes, in the absence of a sovereign, private property right was nonexistent in the state nature due to discords and wars by egoistic disputants. In the new human society, the Leviathan was synonymous with property, as the "chief power" the sovereign enacted common property rules for binding all—with regards to property law (ibid.). This property view resembles the *res communis* notion of global commons in the sense of its proposition of centrist control of common property. Yet, the res nullius right to non-sovereign

global commons is evident in the inalienability of natural law rights to things still in the state of nature—as in the case of modern non-sovereign natural resources.

Unlike Locke, Hobbes reinforced [posthumously] that the state created private property rights, in *A Dialogue Between a Philosopher and a Student of the Common Laws of England* (1681): "Lawmakers were before that which you call own, or property of goods and lands…for without statute-law, all men have right to all things. You see then that no private man can claim a propriety in any lands, or other goods, from any title from any other man but the King, or them that have the sovereign power" (57). Hence, the state exercises dominion within its sovereign territory, including over all persons and property within its territory. Notwithstanding, Hobbes indicated in several places that property rights preexisted the sovereign, and that exceptions to this sovereign property rule existed in the law of booty and natural law family property divestments. The key in Hobbes is the power of the sovereign territorial jurisdiction over persons and property within a state and how this implicates property claims within and beyond sovereign boundaries.

John Locke (1632-1704)

John Locke was influenced by Hobbes's social contract theory. However, Locke's theory of private property is distinct from Hobbes' theory. According to Locke's theory of private property, all men have natural rights to private property, just as Grotius (1625) asserted. To Locke (1689), the institution of private property rights was logically prior to the emergence of states. Therefore, the state exists to protect the preexisting natural law system of property relations (ibid.). By positing the state as the guarantor of the fundamental natural rights to property, Locke advanced the "standard bourgeois theory, the classical liberal theory" of private property (Richard Schlatter 1951, 151). With some key distinctions, Locke (1689) agreed with

Grotius and Hobbes on the natural law origins of property rights, the need for social contract, and the necessity of voluntary cession of individual sovereignty to the state for collective security of rights. The common view was that nature has given all things in common to all humans—hence Locke (1689) proposed the natural equality of all humans against Hobbes' subjection of all to the sovereign monarch.

According to Locke's (1689) theory of property in *The Second Treatise*, both natural reason and biblical revelation affirm the roots of property in the natural law rights established by divine will that Locke later viewed as "Liberty": "Whether we consider natural Reason, which tells us, that Men, being once born, have a right to their Preservation, and consequently to Meat and Drink, and such other things, as Nature affords for their Subsistence: Or Revelation, which gives us an account of those Grants God made of the World to Adam, and to Noah, and his Sons, 'tis very clear, that God, as King David says, Psalm CXV. xvi. has given the Earth to the Children of Men, given it to Mankind in common" (Second Treatise 1689, Chapt. V. 25). Though by virtue of Natural Law and the will of God all humans have natural rights to property, Locke (1689) argued that things in the state of nature remained common until they were actually appropriated and used—by adding human labor and skill to make it exclusive. In Locke's view,

> "God, who hath given the World to Men in common, hath also given them reason to make use of it to the best advantage of Life, and convenience. The Earth, and all that is therein, is given to Men for the Support and Comfort of their being. And though all the Fruits it naturally produces, and Beasts it feeds, belong to Mankind in common, as they are produced by the spontaneous hand of Nature; and nobody has originally a private Dominion, exclusive of the rest of Mankind, in any of them, as they are thus in their natural state: yet being given for the use of Men, there must of necessity be a means to appropriate them some way or other before they can be of any use, or at all beneficial to any particular Man" (Second Treatise 1689, Chapt. V. 26).

In other words, in Locke's lens, things in the state of nature remained the property of no one until someone's skill and "labor" had been employed to sever it from the natural state for

exclusive possession and dominion. Under this view, Locke (1689) justified European appropriation of the North and South American continents. Locke provided an analogy: "The Fruit, or Venison, which nourishes the wild Indian, who knows no Enclosure, and is still a Tenant in common, must be his and so his, i.e., a part of him, that another can no longer have any right to it, before it can do him any good for the support of his Life" (ibid. 26). The Indian could only exercise ownership and possessory rights (i.e., legal title) over wild games, agricultural products, and whatever else had been actually captured through the employment of human labor and effort (Locke 1689, Chapt. V. 28). However, the entire land and other natural resources within the territory remained "fair game" to the rest of humanity who, due to natural law rights, retained "liberty" to appropriate what was still in the state of nature. Locke (1689) then expanded Grotius' (1625) rules of international property law and set forth the analytic principle of property law that determined the boundary between exclusive and commons property.

According to Locke (1689), by removing things from the state of nature (the commons sphere) and mixing one's labor or skill meant that the thing had been improved upon by the person—thus removing it from the commons arena. This classic notion of property is found in Chapter V.27 of Locke's Second Treatise, and it stipulates as follows:

> "Though the Earth, and all inferior Creatures be common to all Men, yet every Man has a Property in his own Person. This no Body has any Right to but himself. The Labor of his Body, and the Work of his Hands, we may say, are properly his. Whatsoever then he removes out of the State that Nature hath provided, and left it in, he hath mixed his Labor with, and joined to it something that is his own, and thereby makes it his Property. It being by him removed from the common state Nature placed it in, hath by this labor something annexed to it, that excludes the common right of other Men. For this Labor being the unquestionable Property of the Laborer, no man but he can have a right to what that is once joined to, at least where there is enough, and as good left in common for others" (Second Treatise 1689, Chapt. V. 27).

In Locke's (1689) property theory in Chapter V.27, the application or "mixing" of human labor with natural things distinguishes those things from the common properties that still existed

in the state of nature. The rationale is that "…. It being by him removed from the common state Nature placed it in, hath by this labor something annexed to it, that excludes the common right of other Men. For this Labor being the unquestionable Property of the Laborer, no man but he can have a right to what that is once joined to, at least where there is enough, and as good left in common for others" (Second Treatise 1689, Chapt. V. 27). This is an exclusive property right. Locke held that "…labor put a distinction between them and common. That added something to them more than Nature, the common Mother of all had done; and so, they became his private right" (ibid. 28). The property right became exclusive by virtue of appropriation from the natural state, and the consent of all Mankind was not necessary to establish the right or individual liberty because it inured to all by Natural law ordained by God. Unlike Hobbes and Grotius who suggested the relocation of rights from the natural law basis to the state and international sovereign through the voluntary cession of sovereignty in the social compact, Locke retained the natural law basis of property rights, regardless of sovereign security of common interests.

To Locke, the natural law right to common property was inalienable and the power ceded to the state in this regard by citizens was limited to the management of the preexisting natural law property system: "The great and chief end therefore, of Mens uniting into Commonwealths, and putting themselves under Government, is the Preservation of their Property. To which in the state of Nature there are many things wanting" (Second Treatise 1689, Chapt. IX. 124). Locke agreed with Grotius and Hobbes that social compact became necessary due to the uncertainty and insecurity of all humans in the estate of nature. For, even though God had given each person the right to freedom and liberty with regards to all things, there was perpetual concerns of being brough under the "Dominion and Control" of other competing humans. And "though in the state of Nature he hath such a right, yet the Enjoyment of it is very uncertain and constantly exposed

to the Invasion of others. For all being Kings as much as he, every man is Equal, and the greater part no strict Observers of Equity and Justice, the enjoyment of the property he has in this state is very unsafe, very insecure" (ibid. 123). Which meant, as Hobbes also highlighted, that the absence of a central authority or "Leviathan" in the state of nature, to compel order, security, and justice, heightened the need for a voluntary social compact that birthed the state or the commonwealth of international states.

Locke held that the human insecurities "makes him willing to quit a Condition, which however free, is full of fears and continuing dangers: And 'tis not without reason, that he seeks out, and is willing to join in Society with others who are already united and have a mind to unite for the mutual Preservation of their Lives, Liberties, and Estates, which I call by the general Name, Property" (ibid. 123). The purpose of the social compact then was to empower a central authority to provide those things that were lacking in the state of nature such as legal frameworks that constituted "Standard of Right Wrong" agreed to by all, and relative to property rights (ibid. 124). Also, the sovereign provided impartial adjudications to curtail "wild-wild-West" scenarios of the state of nature in which, driven by "Passion and Revenge" humans became "Judge and Executioner of the Law of Nature" (ibid. 125). And the state of nature lacked executory power to enforce its own rules since there were no structured mechanisms for mediating controversies and injustices (ibid.). Locke (1689) concluded that exclusive property right was created by appropriating commons natural resources:

> "We see in Commons, which remain so by Compact, that 'tis the taking any part of what is common and removing it out of the state Nature leaves it in, which begins the Property; without which the Common is of no use. And the taking of this or that part does not depend on the express consent of all the Commoners. Thus, the Grass my Horse has bit; the Turfs my Servant has cut; and the Ore I have digg'd in any place where I have a right to them in common with others, become my Property, without the assignation or consent of any body. The labor that was mine, removing them out of that common state they were in, hath fixed my Property in them" (Second Treatise 1689, Chapt. V. 28).

In Chapter V.28, Locke (1689) distinguishes between mere extractions of unowned things (i.e., res) from the commons spaces and any assumptions of taking the commons space for oneself. The Commons remains commonly owned by all due to the social compact, however things could be extracted from the commons and claimed as exclusive property (ibid., Chapt. V.28). The state or commonwealth exists to protect these natural law rights over the common spheres of land (Hobbes, Locke, and Rousseau), the high seas and air spaces (Grotius). Evidently, Locke's property theory constituted the guiding philosophy of American colonists and still remain a driving force in the contemporary legal and political thoughts of domestic level U.S. policymakers.

Issue of Extraterrestrial Extensions of Sovereign Territory: U.S. Perspective

In addition to the classical legal and political thinkers on the dynamics of sovereign territorial jurisdiction and non-sovereign international spaces, others such as Sir Henry James Maine, and the 1862 Homestead Act likewise shape modern debates on the scope and limitations of sovereign territorial jurisdiction on international spaces. Generally, the U.S. has not viewed expansions of extraterrestrial sovereign territorial jurisdiction favorably especially given U.S. reticence with the colonial enterprises of European nations (Johnson 2015). However, with regards to its own national expansion within the North American Continent, the U.S. aggressively expanded its borders between the Atlantic and Pacific Oceans (ibid.). In addition, the U.S. extended its maritime borders in the 19th and 20th centuries in pivotal ways that impacted international attitudes to demarcations of the Exclusive Economic Zones (EEZ) of states relative to international high seas (ibid). Along with the deep-rooted influence of English common law and political thoughts of influential figures such as John Selden and John Locke, the legacy of classical *res nullius* vision of Global Commons is entrenched within the public

policy domain of the United States through jurists such as Sir Maine, and U.S. Congress' regulatory schemes such as the 1862 Homestead Act.

Sir Henry James Sumner Maine

Another British Jurist, Sir Henry James Sumner Maine (1908), explained the idea of Res Nullius as reflected in Ancient Roman Law, and followed by English, and American jurisprudence. According to Maine (1908, 1-315), "The objects which the Roman lawyers called res nullius—things which have not or have never had an owner—can only be ascertained by enumerating them. Among things which never had an owner are wild animals, fishes, wild fowl, jewels disinterred for the first time, and lands newly discovered or never before cultivated" (Chapt. VIII, 218). Res nullius also included abandoned movables, deserted lands, and the property or territory of a defeated foe (ibid.). One of the natural modes of acquiring property rights over these was adversarial possessory takings or occupation based on the first in time principle—i.e., whoever gets it first. This involved "taking possession of that which at the moment is the property of no man" (Maine 1908, 218). The purpose of such a legal step was to acquire property in it for oneself by exercising dominion over what has been captured or taken into possession.

As Maine (1908) explained, "in all these objects, the full rights of dominion were acquired by the occupant, who first took possession of them with the intention of keeping them as his own—an intention which, in certain cases, had to be manifested by specific acts" (218). Maine (1908) envisioned that the elements of ownership under *res nullius* were possession, adverseness of possession—i.e., a holding not permissive or subordinate, but exclusive against the world—and prescription, or a period of time during which the adverse possession has continued uninterrupted. On whether the act of physical possession conferred title to non-

sovereign unowned things, Maine (1908) averred that "it is only when the rights of property have a sanction from long practical inviolability, and when the vast majority of the objects of enjoyment have been subjected to private ownership, that mere possession is allowed to invest the first possessor with dominion over commodities in which no prior proprietorship has been asserted" (228). In William Blackstone's (1387, 304-) *Commentaries on the Laws of England, Second Book, First Chapter on Property*, Blackstone affirmed that things in the state of nature originally existed as common property (304-310). However, the expansion and advancement of human societies necessitated the res nullius unilateral appropriations. This understanding was exemplified in the westward expansion of the United States which was formalized under the 1862 Homestead Act.

The 1862 Homestead Act

Passed on May 20, 1862, and signed into law same day by U.S. President, Abraham Lincoln, the Homestead Act was a piece of national legislation that accelerate the settlement of the western territories of the United States. The law achieved Western settlements by granting adult heads of families, who never bore arms against the U.S. during the civil war, 160 acres of surveyed Government land if they filed an application, improved the land, and filed for deed of title (Homestead Act 1862). This offer of free title to public land was aimed at encouraging the settlement of the western parts of the United States and ultimately gave birth to the rivalrous "Wild, Wild, West" aimed at claiming the land for America by Americans. This Westphalian model of unilateral, competitive, or conflictual assertions of territorial sovereignty over non-sovereign territories is embraced by most contemporary U.S. populists and nationalists in many sectors of U.S. public and foreign policy domains.

Conclusion

In the past, debates about the scope of sovereign territorial sovereignty relative to non-sovereign international spaces have involved philosophical, political, and legal thoughts of pivotal figures such as Hugo Grotius, John Selden, John Locke, Hobbes, and Sir Henry James Maine. These thinkers theorized variously about the international spaces or Global Commons against the background of empires and states in tension, bloodshed, and wars. The 1500s and 1600s were bloody times as political projects expanded and emerging nations fought over land and sea resources beyond sovereign territorial borders. As demonstrated in the key theorists surveyed above, the interest in common spaces and sovereign territorial appropriations was motivated by a shared desire for global peace. As the 19th and 20th centuries dawned, with technological advancements driven by the Industrial Revolutions that enabled states and individuals to extend their reaches beyond sovereign territories on land, sea, and air, triggering similar concerns with regards to the status of emerging international spaces. Therefore, analogies were drawn from the theories of most of the thinkers discussed above.

CHAPTER THREE

Space Mining Policy Under International Space Law: 1967 OST

Introduction

The 19th, 20th, and 21st centuries witnessed monumental growth in technologies that increased the capability of leading global states to reach far beyond the limits of sovereign territories as well as opened up new international spaces on land, seas, and air. During the same period, nations fought wars over terrestrial resources, ultimately necessitating a universal need for some globally acceptable international legal instruments to entrench global peace, international cooperation, collaboration, and coordination among global states. To accomplish these objectives, the international community looked back to the theorists of the past for analogical frameworks. For instance, following the end of WWI, the U.S. President, Woodrow Wilson, proposed on January 8, 1918, a League of Nations to resolve international disputes to ensure the rule of international law (U.S. Department of State 2023, Milestones 1914-1920).

Though the U.S. was never a member of the League of Nations, the Covenant of the League of Nations stated that it was formed "in order to promote international cooperation and to achieve international peace and security by the acceptance of obligations not to resort to war, by the prescription of open, just and honorable relations between nations, by the firm establishment of the understandings of international law as the actual rule of conduct among Governments…" (UN League of Nations 1920 – Official Journal, Feb. 1920, 3). This appeal for international law as the rule in international relations was finally achieved with the 1945 Charter of the United Nations and the International Court of Justice which superseded the League of Nations at the end of WWII.

As stipulated in Article I of the 1945 UN Charter, the United Nations was established "to maintain international peace and security…develop friendly relations among nations….to achieve international cooperation in solving international problems….and to be a center for harmonizing the actions of nations in the attainment of these common ends…." (UN Charter 1945, Art. I, p.2-3). Chapter XIV of the 1945 UN Charter established the International Court of Justice described in Article 92 as "the judicial organ of the United Nations" (ibid., 37). As designed, "It shall function in accordance with the annexed Statute, which is based upon the Statute of the Permanent Court of International Justice and forms an integral part of the present Charter…." (ibid., 37). All members of the United Nations are ipso facto under the jurisdiction of this international court. Under the auspices of the United Nations, the postwar global order was premised on international law, especially with regards to the key global commons domains that implicate international relations post-WWII. These international policy domains includes the high seas, Antarctica, aerospace, and outer space.

Having been grounded in international law, the UN set out to establish global institutions that would ensure that the international relations of international spaces are based on the principles of general (public) international law. Consequently, the international space of the high seas was brought under the jurisdiction of the 1958 UN Convention on the Law of the Seas and its modified versions; the Antarctic region was put under the 1959 Treaty of Antarctica, and, when rocket technology opened the outer space domain, the 1967 Outer Space Treaty was enacted to govern the outer space domain. Currently in the 21st century, innovative robotic and Artificial Intelligence technologies have opened up the domain of outer space mineral resources and possibilities of space mining operations loom larger than ever. As in other international spaces like the high seas and Antarctica, space law also draw from past theorists to resolve the

normative controversy of the scope of national sovereign territorial extensions to international spaces.

International Space Law

International space law has been defined by experts as “a branch of general (public) international law, a subset of rules, rights, and obligations of states within [international law] specifically related to outer space and activities in or with respect to that realm” (Von der Dunk 2019, 29). The consequence of international space law being a branch of general (public) international law is that the fundamental rules of international law, particularly those included in the U. N. Charter, are applicable to activities in outer space (Tronchetti 2013, 3). Public international law is defined in accordance with the 1945 Statute of the International Court of Justice, which is annexed to the 1945 UN Charter, and forms an integral part of it (UN Charter 1945 (UN Charter 1945, Introduction). The United Nations can act on a wide variety of issues due to its unique international character and the powers vested in its 1945 Charter, which is considered an international treaty (ibid.).

As such, the UN Charter is an instrument of international law, and UN Member States are bound by it. The UN Charter codifies the major principles of international relations, from sovereign equality of States to the prohibition of the use of force in international relations (ibid.). Thus, public (general) international law consists of a first level treaties and customary international law; and at a secondary level general principles of law; the writings of the most authoritative experts; regulations from reputable international organizations; and non-binding norms or “soft law” (Von der Dunk 2019, 30). States jointly draft and enact public international law, especially treaties, and are bound by them under the 1969 Vienna Convention on the Law of Treaties (ibid.).

This chapter evaluates the relevant portions of the 1967 Outer Space Treaty that most experts believe have interpretive bearings on contemporary space minerals mining law and policy. As discussed in the preceding chapter, the context for the 1967 OST was the Cold War era launch of the artificial satellite. Sputnik 1, by Russia in 1957 (Kopal 1967/2008). Arguably, the brevity and general nature of the 1967 OST (compared to similar global commons instruments such as the UNCLOS and the Antarctic Treaty) could be linked to the urgency of the security need at the time. Therefore, a key characteristic of the 1967 OST is the lack of comprehensive treatment of most of the policy domains identified at the time or complete silence on other known but unaddressed domains – such as potentials for space minerals and their extractions.

According to the IISL-American Branch (2016/2022), one of the basic characteristics of the Outer Space Treaty is the relatively general wording of its 'principles' – in many cases broad enough to cover even activities with today's or tomorrow's space technology, in other cases falling short of this adequate coverage of the future. So, while the treaty covers space activities, it is not exhaustive in its treatment" (Introduction, 5). With regards to space minerals – which received the "silent" treatment in the treaty – contemporary experts draw meanings from Articles I, II, III, V, VI, VII, VIII, and IX of the 1967 OST, as well as the relevant portions of the 1979 Moon Agreement. Some leading interpretations, theoretical perspectives, and topical issues related to the space mining policy are surveyed below.

The 1945 UN Charter

Among the four purposes of the United Nations in the 1945 Charter of the UN, Chapter I.1., signaled a strong commitment to the idea of terra/res communis omnium designation of common spaces in international law and international relations: "To maintain international peace and security, and to that end: to take effective collective measures for the prevention and removal

of threats to the peace, and for the suppression of acts of aggression or other breaches of the peace, and to bring about by peaceful means, and in conformity with the principles of justice and international law, adjustment or settlement of international disputes or situations which might lead to a breach of the peace (Charter of the United Nations 1945, Chapter I.1). It further reinforces that the post-WWII world order was committed to principles of cooperation geared towards active "suppression of acts of aggression or other breaches of the peace" (ibid.). Article III of the 1967 OST integrated the 1945 UN Charter and general international law as part of the intricate web in interpreting and applying modern space law and policy.

The new world order was meant to construct a new spatial order to govern the entirety of the globe. Borders became entrenched by linking sovereignty to territory. The entrenchment of territorial borders became a mechanism through which the great powers sought to contain the imperial impulses that had repeatedly led to war (Blount and Robinson 2016, 169). Thus, under the 1945 UN Charter states are barred from extending sovereignty to international spaces or Global Commons spheres to avoid rivalrous interstate territorial claims and wars. Between 1958 and 1982 the United Nations General Assembly held conferences aimed at designing a universally acceptable legal framework for the peaceful uses of international spaces such as the high seas, deep seabed and ocean floors, aerospace, Antarctica, and outer space.

UNCLOS 1958

Simultaneously, the UN General Assembly developed the law of the high seas in the 1958 Convention on the Law of the Seas (UNCLOS 1958/2008, 1). In its Preamble, the UNCLOS aimed to "…to settle, in a spirit of mutual understanding and cooperation, all issues relating to the law of the sea and…to the maintenance of peace, justice and progress for all peoples of the world" (UNCLOS 1958/2008, 21). Incorporating principles of international cooperation modeled

after Hugo Grotius' (1609) *Mare Liberum* as enshrined in general international law, the UNCLOS specified the legal status of the territorial sea, the air space over the territorial sea and of its bed and subsoil (UNCLOS 1958/2008, Articles 2-16, 23-26).

A key figure at subsequent modifications of UNCLOS, which focused on the legal status of deep seabed in the early deliberations, was Ambassador Arvid Pardo of Malta. Pardo (1967, 1-14). He made a persuasive argument for the adoption of Hugo Grotius' (1609) *res communis* or global commons concept of the high seas for the seabed and ocean floor. The proposed regime designated the seabed and ocean floors as the sphere of international activity which belonged in common to all states for freedom of navigation and scientific activities, and not subject to exclusive sovereign territorial appropriation (Pardo/UN Gen. Assembly 1967, 22nd Session, First Committee, 1515th Meeting, Official Records, Agenda Item 92, 1-14).

Specifically, Pardo (1967, 1) warned against the "incalculable dangers for mankind as a whole were the seabed and ocean floor beyond present national jurisdiction to be progressively and competitively appropriated, exploited and used for military purposes by those who possess the required technology…." (1). Pardo (1967, 1-2) reasoned that it would be wise to establish some form of international jurisdiction and control over the seabed and the ocean floor underlying the seas beyond the limits of present national jurisdiction. A subsequent modification to the UNCLOS in 1982/2004 established a seabed regime that distinguished rights to natural resources such as fish, from international commons that are not subject to sovereign appropriations.

The 1959 Treaty of Antarctica

Similar to the high seas, and outer space, experts debated whether the non-sovereign Antarctica region should be designated as *res extra commercium (*things subject to exclusive

commercial appropriation), *res communis* (and area or territory not subject to any title of any state), or *res communis omnium* (things common to all mankind and free to common use of all under the regulation of public international law (Lachs 2010, 41-46). Each of these designations carry with it unique rights and obligations that enables states to set special national legal frameworks that will balance the interests of states against the international goal of security, peace, and cooperation (Von der Dunk 2020, 1-27). The bar against exclusive sovereign territorial claims in Antarctica has been considered for outer space by some experts.

UN General Assembly Resolution 1721 (XVI), 1961

This resolution was titled "International Co-operation in the Peaceful Uses of Outer Space" (UNOOSA 1961, Res. 1721 (XVI)). Section A of the resolution recognized "…the common interest of mankind in furthering the peaceful uses of outer space and the urgent need to strengthen international cooperation in this important field" (UN General Assembly Resolution 1721 (XVI), 1961, Sec. A). The clause "common interest of mankind" would become "the province of mankind" found in Article 1, 1967 OST (Dembling and Arons 1966/67). Accordingly, the community of states believed "that the exploration and use of outer space should be only for the betterment of mankind and to the benefit of States irrespective of the stage of their economic or scientific development…" (UN Gen. Assembly Res. 1721 (XVI), A., 6). It commended States to the guidance of general international law and the 1945 UN Charter principles in A.1(a) (ibid.). Under A.1(b) the resolution stipulated: "Outer space and celestial bodies are free for exploration and use by all States in conformity with international law and are not subject to national appropriation…." (ibid.). This was enshrined later in Article I, 1967.

UN General Assembly Resolution 1802 (XVII), 1962

Resolution 1802 (XVII) focused primarily on international co-operation in space pursuant to Article I, 1945 UN Charter which mandated the UN to enshrine less-rivalrous principles in the

post-1945 global spatial order (Lachs 2010, 14-16). This resolution tacitly reinforced and incorporated the terra/res communis vision of space and celestial bodies as spheres of interstate activities subject to UN international regime and jurisdiction, governed by the principles of international cooperation advanced by the preceding Resolution 1721 (XVI) of 1961. Particularly, Section 1.2 of the resolution called on UN member states to "co-operate in the further development of law for outer space" (UN General Assembly 1192nd Plenary Meeting 1962, 5).

UN General Assembly Resolution 1962 (XVIII), 1963

Resolution 1962 (XVIII) of 1963, in addition to highlighting the aforementioned international cooperation principles of the 1967 OST, gave prominence to the fundamental understanding of the outer space realm as an international space or global commons - in the first four principles that were adopted in 1963.It required that the "exploration and use of outer space" by spacefaring States "shall be carried on for the benefit and in the interests of all mankind" (UNGA Res. 1962 (XVIII), 15). These terms clearly reflect the designation of the space sphere and celestial bodies as a Global Commons not subject to exclusive national territorial acquisitions (Von der Dunk 2017; Lachs 2010).

The COPUOS Legal Sub-Committee Report 1966 – Fifth Session

Between July 12 to August 4, and September 12-16, 1966, the Legal Sub-Committee of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) held its fifth session under the chairmanship of Judge Manfred Lachs of Poland (UN COPUOS 1966, 1). The Legal Sub-Committee reviewed and debated draft treaty proposals and draft articles submitted by the U.S., the Soviet Union, their various allies, legal scholars, and various non-state interest groups and organizations (ibid., 1-10). Following rigorous discussions, debates, and reviews of

the various draft treaty proposals, the Working Group of the Legal Sub-Committee finally approved a final draft of the articles. It was approved by the United Nations General Assembly in 1967 as "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, the Moon and Other Celestial Bodies" or the 1967 Outer Space Treaty (UN COPUOS 1966, 12-16). The text of the treaty was published in Chinese, French, Russian, English, and Spanish (ibid., 16). It was grounded on preceding codifications of the principles of international cooperation in previous UN Resolutions such as the ones discussed above.

Lachs (2010), Dembling and Arons (1966/67) noted that the two streams of theoretical arguments that dominated the outer space treaty discussions were the *Mare Liberum* (envisioned outer space as *terra communis* or *res communis* omnium) and the *Mare Clausum* line of legal philosophies that viewed outer space generally as "res nullius." However, there were also experts who envisioned outer space as *res extra commercium* or things not subject to ownership, commerce, or trade – i.e., outside of commercial intercourse (Gangale 2016). In the literature of the field examined in this study, the predominant views at the international level are the notions of outer space as Global Commons – a *terra communis omnium* / *res communis omnium*. The *res nullius* theorists are located primarily at the national space policy levels where they contend for the right of unilateral space minerals extractions – and sometimes imperial colonization of outer space. This research study adopted the prevailing notion of *res communis omnium* designation for the space realm.

Fundamental Principles of International Space Law

Space law is the body of law governing space-related activities (UNOOSA 2023, 1). Space law resembles general (public) international law in that it comprises a variety of international agreements, treaties, conventions, and United Nations General Assembly resolutions as well as rules and regulations of international organizations that articulates

international space policy (ibid.). Most experts agree that “space law” at the international level refers to the rules, principles and standards of international law that are enshrined in the five international treaties and sets of principles governing outer space that have been developed under the auspices of the United Nations (ANGELS 2023; Tronchetti 2013, viii). The core substance of international space law is the UN space treaties, and the 1967 Outer Space Treaty is the foundation of space law because it represents the most fundamental and all-encompassing of the space treaties (Von der Dunk 2019, 49).

The five space-specific treaties include the 1967 Outer Space Treaty (113 ratifications, 23 signatures – Croatia’s accession on March 13, 2023), 1968 Rescue and Return Agreement (99 ratifications, 23 signatures), 1972 Liability Convention (98 ratifications, 19 signatures), 1975 Registration Convention (72 ratifications, 3 signatures – Paraguay accession January 19, 2023; Romania on February 10, 2023), and the 1979 Moon Agreement (17 ratifications, 4 signatures – Saudi Arabia withdrawal on January 5, 2023, effective January 2024) (UNOOSA 2022/2023, Status of International Agreements relating to Activities in Outer Space, 1, 10). In addition, at the national level, many states have national legislation governing space-related activities and these are mostly closely tailored to the international instruments (UNOOSA 2023, 1). Von der Dunk (2019) envisions international space law as "…a branch of general (public) international law, a subset of rules, rights[,] and obligations of states within the latter specifically related to outer space and activities in or with respect to that realm" (2019, 29). Thus, the international and national space laws define the multilevel space policies on the various aspects of space activities.

The scope of space policy extends to Earth-centered space activities as well as space-centric activities such as, “the preservation of the space and Earth environment, liability for damages caused by space objects, the settlement of [space-related] disputes, the rescue of

astronauts, the sharing of information about potential dangers in outer space, the use of space-related technologies, and international cooperation….” (UNOOSA 2023, 1). An array of fundamental principles guide the conduct of space activities as provided in Articles I and II, 1967 OST, including the notion that the freedom of exploration and use of outer space by all states without discrimination is the “province of mankind,” and the principle of non-appropriation of the outer space sphere and celestial bodies (ibid.). These basic frameworks of international space law are summarized under the following principles articulated within the 1967 OST:

- The exploration and use of outer space shall be carried out for the benefit and in the interests of all countries and shall be the province of all mankind.
- Outer space shall be free for exploration and use by all States.
- Outer space is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.
- States shall not place nuclear weapons or other weapons of mass destruction in orbit or on celestial bodies or station them in outer space in any other manner.
- The Moon and other celestial bodies shall be used exclusively for peaceful purposes.
- Astronauts shall be regarded as the envoys of mankind.
- States shall be responsible for national space activities whether carried out by governmental or non-governmental entities.
- States shall be liable for damage caused by their space objects; and
- States shall avoid harmful contamination of space and celestial bodies.

(UNOOSA 2023, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html)

Most of these core principles embedded in the 1967 OST are usually invoked by international space law and policy experts in current legal analysis of the embryonic space minerals mining policy domain, especially contemporary issues raised by the national space mining instruments of certain states. The most relevant provisions frequently employed by scholars in these space mining policy debates are Articles I, II, III, VI, VII, VIII, IX, and XII of the 1967 OST. In addition, some scholars extend the interpretive nexus to some related principles or reinforcements lodged within the Preamble, Articles 1, 2, 3, and 11 of the 1979 Moon Agreement.

Significantly, Tronchetti (2013) highlights that even though international space policy is construed by a central body of laws, namely the five U. N. space treaties, "space law does not exist as a single, coherent, and comprehensive body of legal principles and rules governing human activities in outer space. Rather it can be seen as a 'box' containing many different types of norms to deal with the practical problems connected with the exploration and use of outer space. Consequently, regulation of space activities is achieved through amalgamation and application of all possible rules" (ix). Likewise, interpretive approaches and philosophies differ among the experts, and requires some form of amalgamation, especially in the context of contemporary comparative interpretations of emerging national space mining laws.

Delimitation of Airspace and Outer Space.

Since its inception in 1957, the Committee on the Peaceful Uses of Outer Space (COPUOS), has left open on its agenda questions of the legal delimitation of the upper limit of airspace and the lower limit of outer space (Tronchetti 2013). The 1967 OST does not explicitly define the inner and outer limits of "outer space" as a policy domain so there is no ironclad consensus on the legal definition of the upper limit of airspace and the lower limit of outer space (Von der Dunk 2017). According to Tronchetti (2013), "….international space law does not include a definition of ''outer space,'' nor gives a precise indication of where outer space begins. Scholars and diplomats have been unable to reach an agreement on these two points since the beginning of the Space Age. Nevertheless, many argue that the lower border of outer space should be set at an altitude of 100 km above sea level (62.5 miles)…." (viii). This altitude is also preferred by the international community, including the Federation Aeronautique Internationale (FAI) (NASA 2021).

However, as NASA (2021) explains, “For purposes of spaceflight some would say at the Karman line, currently defined as an altitude of 100 kilometers (60 miles). Others might place a line 80 kilometers (50 miles) above Earth's mean sea level. But there is no sharp physical boundary that marks the end of atmosphere and the beginning of space…” (NASA 2021. “The Edge of Space.” 1). Yet some current views suggest the exosphere -i.e., the very edge of Planet Earth’s atmosphere, 6000 miles (10,000 km) above Earth’s surface (NASA 2022, The Atmosphere, 1). The Karman Line has been adopted by most spacefaring states as the beginning of outer space.

Thus, “it is considered clear that international space law applies to objects in orbit and beyond…to things that may be described as ‘space objects’ including rockets from at least the moment of ‘intentional ignition,’ it applies to astronauts, and it applies to any conduct that may be described as a ‘national activity in outer space.’” (ANGELS / Spacelaws.com 2023, 1). The current trend of such “national activities” involves the emerging 21st century technology-driven endeavors of private and state space actors to harvest and sell valuable asteroid and space natural resources that range from water ice in the Moon and Mars, to minerals such as iron, nickel, and platinum (Von der Dunk 2017; Erik Kulu 2020/2021). According to Von der Dunk (2017; 2019), these plans raise legal questions on “their compatibility with international space law…” (Von der Dunk 2017, 84; 2019, 29-30). In other words, the emerging national space mining laws must be evaluated for consistency with international space law to establish whether such laws have a solid basis in international law.

Article I, 1967 OST

The 1967 *Outer Space Treaty* provides in Article I that: “Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without

discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies." (UNOOSA 1967, Art. I). All space law and policy authorities agree on this cardinal principle – that all States are free to use and explore outer space. Most space policy experts interpret this provision to mean that no limitations can be presumed - every State can develop and use rocket technology and satellite technology, regardless of the possibility that the rockets could conceivably be used as missiles and the satellites used for spying (Gorove 1958/59; Von der Dunk 2016). Particularly, this stipulated freedom to use and explore outer space in Article I, must be consistent with international law, including the 1945 *Charter of the United Nations*, which prohibits the threat or use of force against other States in Article 2(4) (UN Charter 1945, Art. 2.4). Article III (below) explicitly reinforces the authority of international law.

Article I, 1967 OST: The "Benefit and in the interests" Clause

Article I, 1967 OST provides: "The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development …" (UNOOSA 1967, Art. I). The exploration and use of outer space is to be for the benefit and in the interests of all countries (not "benefit of mankind" as often misquoted in the literature). Notably, Article I, says nothing about the often-used phrase, "benefit of mankind" even though most authorities consulted in this research study assign this phrase to Article I. Arguably, "for the benefit and in the interest of all countries" (emphasis on independent territorial sovereignties or places) is inherently different from the nebulous "benefit of mankind" (emphasis on the male specie of the human race; though also connoting "humanity") often imposed on Article I, 1967 OST by interpreters. For instance, in *Routledge Handbook of Space Law* Jakhu and Dempsey (2017, 30)

asserted that: “Mankind”, which is named in the first paragraph of Article I of the Outer Space Treaty is, however, not a subject of international law” (30). But “Mankind” is not “named” in Article I at all. As evidenced by the relevant text of Article I above, the focus of the drafters at the inception of the 1967 OST was on geopolitical entities that constituted the United Nations – i.e., countries – not “mankind” as later introduced into the reading and interpretations of Article I, 1967 OST.

The question is whether interpretations based on this seemingly inadvertent or “harmless” replacement of “all countries” with “mankind” should be adjudged inconsistent with Article 31, (especially 31.1) of the 1969 Vienna Convention on the Law of Treaties (VCLT) which provides that, “A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose.” (VCLT 1969, Art. 31.1, p.12). In addition, questions arise as to how the choice of terms may impact meanings relative to the implementation and actualization of Title IV, U.S. 2015 Space Act. Perhaps this particular alteration of the exact word used in this Article I clause ought to be explored by future researchers since it raises questions of whether states as political entities, or individual human beings as members of a specie, was originally intended for free exploration and use of outer space, celestial bodies, including the Moon.

Von der Dunk (2017, 86-87) articulated other sets of questions that may be implicated, such as “…how the benefit of mankind would have to be interpreted in the context of possible mining operations. Should everyone share in the proceeds? Should the mined resources be made available on the world market? Or does it merely mean that no other state should suffer harm from whatever mining activities would take place?” (86-87). And there is more. Assuming “the benefit and interests of all countries” ambiguity still surrounds the extent to which a space

mining activity of a State or its legal entities, for example, must "be for the benefit and in the interests of all countries," as opposed to the benefit only of the State involved in the activity or its licensed legal entities. Space law theorists are still debating the actual meaning and applicability of this provision.

Some, such as Tronchetti (2019, 769-812) reason that only a global organization established under an internal regime, as stipulated in Article 11 and 18 of the 1979 Moon Agreement, can execute an equitable appropriation that inures "for the benefit and in the interests of all countries." This is based on a strict interpretation that the non-appropriation principle of Article II, 1967 OST constitutes an absolute bar against all forms of resources appropriation from any parts of outer space by individual states and non-state actors (ibid.). Other experts such as Von der Dunk (2017, 85-86) and Blount and Robinson (2016) reject the very assumption of an absolute bar against space mining in Article II, 1967, and instead severally hold that this provision reinforces the freedom granted to all states to explore and use outer space for their benefit and interests – subject to zero tolerance for imperial impulses of territorial grab under any guise. Arguably, Tronchetti's (2019) "absolute bar" notion would hurt the implementation and actualization of the policy goals of the evolving national level space mining laws; while the "better" interpretations of Von der Dunk (2017) and Blount and Robinson (2016) would harmonize and advance both national space mining laws and Articles I and II, 1967 OST.

Article I, 1967 OST: The "Province of Mankind" Clause

Article I, 1967 OST stipulates that: "The exploration and use of outer space, including the Moon and other celestial bodies, … shall be the province of all mankind…" (UNOOSA 1967, Art. I). Clearly, what this clause conveys grammatically is that the activities of "exploration and use" of outer space is "the province of mankind" - not outer space itself. This element is one of

the most discussed in the literature, especially relative to current debates over national space mining laws. Most authorities interpret this clause to mean that Article I provides to States the rights of equal, non-discriminatory, freedom of "exploration and use" of the space sphere, celestial bodies, including the Moon. However, this right is subject to all other conditions and requirements of international space law and international law (Von der Dunk 2017; Blount and Robinson 2016).

In addition, "use" in this clause has been generally accepted to encompass activities such as space mining (ibid.). But question of original intent of the drafters would arise here - whether at the inception of the 1967 OST the drafters specifically contemplated "space minerals" at the deliberations of Article I in particular. Regardless, commentators have pointed out that the "province of mankind" (that is freedom of "exploration and use" of space) is unrelated to the unique concept of "Common Heritage of Mankind" used specifically by the 1979 Moon Agreement in Article 11 to designate outer space and its natural resources, including celestial bodies, plus the Moon (Von der Dunk 2017). Hence the two concepts should not be confused with each other.

Article II – "Non-Appropriation" Clause

Article II of the *Outer Space Treaty* provides: "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" (UNOOSA 1967, Art. II). A key provision of Article II, 1967 OST that has generated robust debates in the literature is that there shall be no sovereign territorial appropriation of any part of outer space by States or non-States. Article 11, 1967 OST is part of the rudimentary or general international policy framework of outer space that uses general language without specific comprehensive articulation of a particular space domain policy details (Blount and Robinson 2016). On its face, Article II simply states that no

nation-state can claim the outer sphere, the physical body of the Moon and other celestial bodies for itself – in a territorial or imperial sense. This has been interpreted by some experts such as Tronchetti (2017; 2019, 769-813) to mean a complete bar against any assertions of sovereign territorial rights over any parts of space and celestial bodies or unilateral extractions of space resources by any State, commercial entity, or private persons. However, whether Tronchetti's (2019) strict "non-appropriation" bar correctly applies to space resources once they have been extracted from a celestial body remains uncertain and a subject of ongoing scholarly debates in this field.

Other experts such as Von der Dunk (2017) reason that "Article II provides that national appropriation of celestial bodies, whether by sovereignty or by other means, is prohibited" (85). In this view, Article II, 1967 OST "has generally been perceived to establish outer space as a "global commons," an area not subject to any individual state's legal authority and jurisdiction yet free for all states to access, as long as they are in compliance with any other applicable rules of international law" (ibid. 86). The Article II clause is the most fundamental assertion of outer space as a realm beyond national territorial jurisdiction (Von der Dunk 2019, 56-57). Thus Article II prohibits "any colonization in the legal sense of the word-that is, exercising territorial sovereignty over a piece of land as if it were an outlying part of the motherland and exercising complete and exclusive jurisdiction over it" (86). The consequence is that no state may extend the scope of its territorial jurisdiction to outer space and/or celestial bodies, including to minerals and archeological treasures to be found in the space realm (Von der Dunk 2019, 56).

However, states can still exercise some jurisdiction in outer space by exercising national sovereign territorial jurisdiction over unmanned space activities usually controlled from their territories (ibid., 56). In addition, under the responsibility to license and continually supervise

space actors in Article VI, states are required to exercise personal jurisdiction over manned space activities by their legal entities (ibid.). Likewise, the concept of liability of states in Article VIII constitutes a confirmation of the character of outer space as non-sovereign "global commons" – a res communis (ibid., 55). Further, states can exercise "quasi" territorial jurisdiction over space objects registered with them and personnel on board those objects.

Relative to space mining, this view raises questions of who has Article VI licensing authority and under what sets of criteria (ibid.). Von der Dunk (2017, 91) highlights the lack of "any helpful specific reference to space mining" in Article II but notes that this is offset by the fact that even though the terms "commercial exploitation" is absent in the 1967 OST, "most experts would agree that the reference to the freedom of use in Article I would include commercial exploitation" (85). Moreover, "Use' has generally come to be acknowledged as including commercial use and exploitation (Dembling and Arons 1967, 429-432). From the early 1960s onwards for instance outer space was used by commercial satellite communication operators…." (Von der Dunk 2015, 4). Individual territorial jurisdiction or unfettered unilateral usage of space is further constrained by references to international law, international cooperation, and the interests of all countries in Articles I and III.

Article II, 1967 OST prohibits the conception of space as a res nullius or a terra nullius (Hertzfeld et al 2015). This preventative step was taken to prevent a "colonial" land rush on celestial bodies (Cheng 1997, 229), and a tragedy of the global commons – such as abuse, overuse, waste, and pollutions (Von der Dunk 2019, 55). Although controversial and subject to interpretation by nations, *res nullius* does not address the use of resources on celestial bodies (Hertzfeld et al 2015). Since exploring and using space is specifically encouraged in the treaties, the extraction and use of minerals and other resources on or in celestial bodies implies that they

may be taken or owned by a nation in the course of their use of space, even though the actual celestial body is not under the sovereignty of any nation (Hertzfeld et al. 2015, 6-7; Von der Dunk 2019, 55-60).

In a related interpretation, Blount, and Robinson (2016) assert that, "Article II of the Outer Space Treaty is fraught with ambiguity. It not only fails "to anticipate all the realities of our current world," but also seems to purposely use language that allows for multiple conflicting interpretations that are not always reconcilable. Even when confronted with a "plain language" reading using the purpose and scope of the treaty, Article II still defies a universally accepted definition…." (163). This view proceeds to highlight some ideological patterns of interpreting Article II, even though the text itself is designed to "exclude imperial logics from extending into space, while avoiding ideological differences" (164). Blount and Robinson (2016) identify three key ambiguous issues that revolves around Article II, 1967 OST.

These include the concept of "use and occupation," the issue of private actors, and the issue of resource extraction as a type of appropriation (ibid.). They proposed that "use and exploration" of space should be construed in favor of space mining; while private space mining actors must be viewed as justified under the licensing and continuing supervision of Article VI in which states can exercise personal jurisdiction over legal entities engaging in space activities from the sovereign territory of a state (ibid.). And, with regards to resources extraction, Blount, and Robinson (2016) theorize that the lawful extraction of space or asteroid minerals does not equate to territorial appropriation in contravention of the "non-appropriation" principle of Article II.

A Synthesis of Article II, 1967: Global Commons, terra / res communis omnium

First, regarding the ambiguity based on "use and appropriation," Article II of the *Outer Space Treaty* provides that, "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" (UNOOSA 1967 OST Art. II). According to Blount and Robinson (2016), when read in conjunction with Article I, this provision in Article II "establishes a regime of *res communis* in outer space. In short, the Treaty regime allows for the free use and exploration of outer space and prohibits any claims of sovereignty as a mechanism for establishing the first right. Specifically, Article II implements a ban on appropriating space through use or occupation." (164). Occupation and use are synonymous with sovereign territorial assertions, especially in colonial times, and while the imperial land grab is barred under Article II, "use" of outer space is permissible under Article I (Von der Dunk 2002).

This conforms with Von der Dunk's (2020) interpretation that Articles I and II, 1967 OST basically apply a *terra communis* approach, if not explicitly, then at least as the most appropriate interpretation of Art. I and II 1967 OST. Some other authorities such as Jakhu and Dempsey (2017) generally perceive these provisions as establishing outer space as a "global commons." Most authorities agree that this designation means that outer space remains an area not subject to any individual state's legal authority and unilateral national jurisdiction yet free for all states to access, as long as they are following any other applicable rules and obligations of international law (Hertzfeld et al 2015; Von der Dunk 2019).

Apparently, authorities vary on the exact terms used by each for the outer space sphere, such as "global commons" (Von der Dunk 2019, 55), "terra communis omnium" (Tronchetti 2013 / 2019), or "res communis omnium" (Hertzfeld et al 2015; Von der Dunk 2019, 55). In light

of the rights and obligations enshrined in Article I, 1967 OST and related articles, the phrase "province of mankind" demonstrates that the activity of exploring and using outer space is a right held by all, and that no State can lawfully deny another State's freedom to access and use space (Hertzfeld et al 2015; Von der Dunk 2019). The most closely related legal term for this freedom to conduct activity, as a right held by all, is that outer space is a *res communis* (Hertzfeld et al 2015, 7; Von der Dunk 2019, 55). The nuance is that a "res" is a thing, while Articles I and II, 1967 OST are concerned with a right to explore and use outer space.

As noted previously above, the phrase "res communis" or "res communis omnium" does not appear in the 1967 OST, or in any other treaty related to outer space (ibid.). The Latin terms res communis, or res communis omnium, relates to a thing held by all (Hertzfeld et al 2015). However, in general (public) international law, there is no res communis omnium or thing which is under the joint sovereignty of all subjects of international law (ibid.). In light of "province of all mankind" being the freedom to explore and use outer space under the auspices of the 1967 OST and international law, *res communis omnium* might be the more applicable Latin term. This is because res communis omnium explicitly suggests that the "use and exploration" of outer space, specifically the activity of human or robotic presence in space, is the *res communis omnium* (Hertzfeld et al 2015, 7). Thus, without prejudice to the foregoing terms preferred by other authorities to designate the outer space realm, this research study determined that res communis or res communis omnium is the most appropriate term among the dueling typological terms employed by space law experts to describe international spaces such as the outer space realm.

With regards to use and occupation in Article I, 1967 OST, Blount, and Robinson (2016) explain that "this language was chosen to differentiate outer space from terrestrial territories that

can be subject to claims of national appropriation. In fact, use and occupation are not necessarily unlawful as a result of Article II…" (164). And Von der Dunk (2017; 2019) likewise explained that it is conceivable that during the "exploration and use" of outer space, temporary occupations may occur that will never rise to the level of "national appropriation" under Article II. In this view, occupation is exclusive occupation if it: (1) is without any reasonable time limit; and (2) does not in any other way purport to establish territorial sovereignty of a particular state over the area (ibid.). The rationale is that if you would not allow someone to 'exclusively occupy' a particular location on celestial bodies, the 1967 OST rules allowing for the establishment of facilities etc. on celestial bodies would not mean much (Von der Dunk 2023)According to Blount and Robinson (2016), the drafters intended the use of outer space and possibility of occupation of space in terms of temporary inhabitation (ibid., 164). This is because Article I provide States with a baseline freedom of "exploration and use" of the space sphere and celestial bodies (Von der Dunk 2020).

While Article XII provides rights of reciprocal access to "stations, installations, equipment, and space vehicles on the Moon and other celestial bodies" (UNOOSA 1967 OST, Art. XII). Hence, the 1967 OST specifically differentiated mere temporary "occupation" associated with the permitted "exploration and use," from sovereign territorial claims associated with permanent colonial intentions. Yet, these lines of "occupation" may become blurred especially given other related provisions such as the "due regard" and freedom from "harmful interference" of Article IX. Under this provision, States are to consider one another's needs and concerns resulting from an ongoing exploration or use of space. However, given that these activities are yet to occur in the future, the question of potential temporary occupations in space is currently unresolved.

Von der Dunk (2017) underscored that "Article II's prohibition is a very specific one—it is a prohibition on sovereign appropriation that historically resulted from such use and occupation" (95). Both Von der Dunk (2017) and, Blount and Robinson (2016) agree that Article II's bar against sovereignty in space "decreased incentives for States to engage in a tension heavy extraterritorial land grab yet left the door open for innovation through a cooperative structure…" (Von der Dunk 2017). This leads to nuances as Articles I and II cannot be interpreted in isolation from related principles in Article III, VI, V11, VII, and the cooperation, mutual assistance, and "due regard" clauses of Article IX. A key point noted by these experts here is that states can exercise sovereignty in some ways such as national personal jurisdiction over their legal entities engaged in space activities through the licensing and continuing supervision required under Article VI, as well as "quasi-jurisdiction" over registered objects and instruments extended to outer space through a states' sovereign territory. Other core issues related to Article II in comparative evaluation with a contemporary national space mining law, are discussed in the synthesis portion of Chapter Five.

Article III

The core principle of Article III is that all relevant international law applies to outer space, not just the space-specific treaties (Von der Dunk 2019)**.** Article III provides that: "States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the Moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international cooperation and understanding" (UNOOSA 1967, Art. III). Generally, given that space law is a subset of general (public) international law, this has been understood as conveying that outer space is subject to the application of a broad range of the body of

international law, including the 1945 Charter of the United Nations (Tronchetti 2013; Von der Dunk 2017 / 2019; Blount and Robinson 2016). Thus, interpretations of the principles of Articles I and II, 1967 OST must take into consideration not only other related Articles of the 1967 OST, but the full range of applicable international law provisions.

Article V

The main principle of Article V specifies that States have some obligations of rescue and return of astronauts and space objects. Article V, 1967 OST, was expanded by the 1968 *Rescue and Return Agreement 1968 (which also expanded Article VIII)* and both dwell on the obligation of rescue and return of astronauts. The 1968 *Rescue and Return Agreement* encompasses a positive or complementary obligation to rescue astronauts, even outside a state's jurisdiction, if the State is able to do so and return them to the 'launching authority' (UNOOSA 1968, Articles 1 – 10; Von der Dunk 2020, 25-27). In addition, there is an obligation to recover and return space objects that has fallen within a state's jurisdiction. But in areas beyond the State's jurisdiction, the obligation only arises if the space object is passively 'found' in such areas (UNOOSA 1968, Articles 1-6). The costs of recovery and return can be claimed from the 'launching authority' (Art. 5.5). Some authorities contend that the term 'launching authority' in the *Rescue and Return Agreement*, as opposed to 'State of registry', or 'launching State' elsewhere, creates some confusion and uncertainty about the scope of the phrase. Experts are still discussing the potential implications of Title IV for Article V and the 1968 Rescue Agreement.

Article VI

Article VI is the basis for national legislation in international space law. A key proposition of Article VI is that States are responsible for all national activities in outer space, even activities that are entirely independent, or carried out by non-governmental entities. This

means that Article VI, 1967 OST establishes a regime of government responsibility for all "national activity in outer space", even by non-governmental entities unrelated to the government whatsoever (Von der Dunk 2002, 463). This responsibility creates a duty on Party States to 'authorize and continually supervise' the space activities of non-governmental entities (ibid., 463; Blount and Robinson 2016). According to Von der Dunk (2020), pursuant to exercise of national jurisdiction under Article VI, States can use either personal jurisdiction or nationality-based jurisdiction over national citizens regardless of where they operate. On the other hand, states may use territorial jurisdiction over anyone undertaking space activities from within national territory (ibid.).

Furthermore, the channel of "quasi-territorial sovereignty" over space objects is equally available to states under Articles VII and IX, 1967 OST. Thus, national jurisdiction is justified as long as states do not exercise territorial sovereignty over anybody undertaking space activities from other states' territories or from within outer space itself (ibid.). Most States implement Article VI through national legislative licensing regimes (as is the case in Australia), or through federal agency licensing (as in the U.S. where the Department of Transportation/Federal Aviation Authority oversees the process). There are nuances of Article VI that are beyond the scope of this study, such as those related to licensing non-citizens, dual licensing, foreign launches, and unauthorized / non-licensed operators. However, the intricate connection of Article VI to interpretations of Articles I and II, has been discussed above.

Under Article VI, States seek to discharge their responsibility, and mitigate their exposure to liability through licensing, permits and insurance requirements (Von der Dunk 2020, 28-33). As this survey of the space-minerals related provisions of the 1967 OST demonstrates, with respect to national space activities, space-specific treaties place a heavy burden of responsibility

upon states as in Article VI, and exposure to liability per Article VII. Even in situations where a non-governmental entity is otherwise unconnected with the government (and perhaps operates in open defiance of the government), the State burdens remain intact. The question then is how would states discharge the required responsibilities with minimal liabilities and consistent with international law? The answer is that in general, States seek to discharge their responsibility under Article VI, and mitigate their exposure to liability under Article VII, by actively authorizing (or denying) licenses and permits for space activities and by requiring that non-governmental entities have insurance for their activities that covers the government. (Von der Dunk 2020, 28-30). It is hoped that this would extend to the emerging space mining policy domain.

Article VII

Article VII has implications for 21st century space minerals mining (Von der Dunk 2017). This provision stipulates that a "launching State" is absolutely liable for damage by its space objects on Earth, but only liable for damage between two space objects in space where the State is at fault. The 1972 *Liability Convention* expanded on Article VII, 1967 OST. In Article II, 1972 Liability Convention, the launching State is strictly liable for damage caused by its space objects on Earth (including to an aircraft in flight) (UNOOSA 1972, Art. II). However, in space, the launching State is only liable if the damage is due to its fault or the fault of someone for whom it is responsible (Articles III, IV). The 1972 *Liability Convention* defines the term 'launching State' as the State which launches or procures the launch of a space object, or whose territory or facility is used for the launch of a space object (Article I c i-ii). The *Liability Convention* covers circumstances where there are two or more launching States and the manner of making and settling a claim, including through a multi-national Claims Commission. There has been no

definitive instance of the application of the *Liability Convention*, so there is considerable uncertainty about how it would operate in practice with regards to the emerging policy arena of space mining. Experts also include Articles VII, VIII, and IX in interpretations of Articles I and II, 1967 OST since liability issues are inherent in all forms of mining activities anywhere – given the complexities, technologies, equipment, and dangerousness of such activities.

Article VIII – Jurisdiction over Space Objects ("Quasi-Territorial" Jurisdiction)

Article VIII has been discussed in full above in relation to Article II, 1967 and possible "quasi – jurisdiction." In full, it provides: "A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body. Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts, is not affected by their presence in outer space or on a celestial body or by their return to the Earth. Such objects or component parts found beyond the limits of the State Party to the Treaty on whose registry they are carried shall be returned to that State Party, which shall, upon request, furnish identifying data prior to their return" (UNOOSA 1967, Art. VIII, ARES-21-2222E, p.14). The 1975/76 *Registration Convention* expanded on Article VIII. According to UNOOSA (2023) the *Registration Convention* was considered and negotiated by the Legal Subcommittee from 1962.

It was adopted by the General Assembly in 1974 (General Assembly resolution 3235 (XXIX)), opened for signature on 14 January 1975 and entered into force on 15 September 1976 (UNOOSA 2023, 1). According to Von der Dunk (2020) the Registration Convention elaborated Article VIII "which had already fundamentally linked the possibility to exercise jurisdiction on a quasi-territorial basis to space objects registered by that State, by detailing the key elements of

such registration" (33). Thus, Article VIII is one of the channels for legitimate extensions of the authority of States in space.

Article VIII states that a "launching state" in respect of a space object, is responsible for registering the space object. Thus Article VIII anticipates that States will maintain a national register of space objects. The 1976 *Registration Convention* imposes an obligation on 'launching States' to register it in an appropriate national registry (to be established if not already in existence, and to inform the UN Secretary -General of any establishment of such registry (Art. II(1). The State of registration shall then provide relevant details of the space object to the UN Sec. General for inclusion in an international register maintained by UNOOSA. Specific requirements are articulated in Article IV(i) (UNOOSA 1976, p.17-18). The term 'launching State' is defined as the State which launches or procures the launch of a space object, or whose territory or facility is used for the launch of a space object – giving rise to the possibility of more than one 'launching State' in respect of a single space object (ibid., Art. I) In Article II, the 1976 *Registration Convention* anticipates this scenario and provides that 'launching States' shall determine between them, which is to be the State of registry (p.17-18). According to Von der Dunk (2020), the obligation of registration flows from the status of the 1967 OST as a customary rule of international law.

According to Bernhard Schmidt-Tedd (2017), "…Registration is divided into a national and an international level. The State Party establishes a national registry for its space objects, and those registrations have to be communicated via diplomatic channel to the UN Register of space objects' (95). This UN Register is handled by the UN Office for Outer Space Affairs (UNOOSA) and is an open source of information for space objects worldwide. Registration is linked to the so-called "launching state" of the relevant space object. As Article II, 1976 Registration

Convention provides, there might be more than one launching state for the specific launch event, but only one state actor can register a specific space object. Thus, “The state of registry gains "jurisdiction and control" over the space object and therefore no double registration is permissible. Based on the established UN Space Law, registration practice was subject to some adaptations due to technical developments and legal challenges…” (Schmidt-Tedd 2017, 95). Thus a form of “quasi territorial jurisdiction” could be exercised by States over space objects or equipment that would be used in space mining, including robotic space mining equipment. This is particularly important because of the nature of the outer space activity which predominantly is carried out by Earth-based humans and legal entities – mostly use of remote-controlled, unmanned, robotic, or AI-enabled technologies.

Jurisdiction and Control v. Ownership of Space Object

According to Von der Dunk (2020), the two concepts (registration and ownership) are separate. Under Article VIII, the state of registry of a space retains jurisdiction and control of the space object – but not necessarily ownership of the space object as a whole. Experts agree that regardless of the impact of the laws and activities of other states on a space object, control and jurisdiction over a space object remains with the state of registry at all times (Von der Dunk 2020, 30-36). This means that only the State of registry can take enforcement action involving the space object. However, Article VIII recognizes that another State might own parts of the space object or even the whole of the space object, independently of the State of registry (ibid.). Arguably, a State with proprietary interests, but not the State of registry, would probably protect its interests by some other means, such as a contract and/or a bilateral treaty. All of these have implications for space mining.

Summary of principles based on Article IX, 1967 OST

Article IX, 1967 OST has been discussed in connection with Article II, 1967 OST above and relative to the 2014 U.S. ASTEROIDS ACT discussed in Chapter IV below. In this summary, it is notable that Article IX stipulates that states are to be guided by the principle of cooperation and mutual assistance as they exercise their freedom of "exploration and use" of outer space. Experts agree that "cooperation and mutual assistance" is a broad, guiding principle, even though it is manifested in more definitive obligations, such as "rescue and return," "due regard," and necessary international consultations prior to any expected harmful interference (Von der Dunk 2020, 21-28). Also, States Parties shall conduct their activities with due regard for the activities of all other States Parties. Article IX provides that: "States Parties to the Treaty … shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty" (UNOOSA 1967, Article IX). Though the term "due regard" was not defined in the treaty, Von der Dunk (2017; 2020, 21) notes that it would help to enhance international peace and security in contexts such as space minerals mining.

Further, Article IX provides that: "If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment" (UNOOSA 1967, Art. IX). In sum, interpreters affirm that Article IX provides that States must undertake appropriate international consultations prior to any expected harmful interference (Von der Dunk 2017; IISL-American Branch 2016/2022). Similarly,

authorities agree that the established State practices suggest that a relatively high threshold of harm should be anticipated before a State would be subject to the obligation to undertake appropriate international consultations with other states (ibid.).

Article IX also stipulates that States shall avoid harmful contamination of Earth by extra-terrestrial matter and of celestial bodies by matter from Earth. This probably anticipates future space mining activities and provides a legal basis for future space environmentalist activism. The relevant parts state that: "States Parties to the Treaty shall pursue studies of outer space, including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose." The term 'harmful contamination' is not further defined and would require expert clarifications as national and international space mining frameworks take shape.

Long-term Presence on a Celestial Body: Imperium

In the relevant part, Article IX, 1967 OST provides that, "States Parties to the Treaty shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty…." (UNOOSA 1967 OST, Art. IX). Blount and Robinson (2016) identified an ambiguity in Article II related to issues of long-term stay on a celestial body that may raise concerns of violations of the non-appropriation principle. Frances Lyall and Paul B. Larsen (2013) asserted that what Article II actually prohibits is the "intention to act as sovereign in relation to the occupied location" (60-61), and not the occupation itself. Thus public international space law remains primarily grounded on the

absence of any territorial sovereignty in outer space - i.e., “exclusion of sovereignty and legal control on a territorial basis” (Von der Dunk 2002, 462-481, in Gerard Kreijen et al (eds.), Chapt. 20).

Blount and Robinson (2016) also conclude that the ambiguity caused by the potential for long term presence on a celestial body can be resolved by “requiring the legal structure governing that presence to flow from a claim of jurisdiction distinct from the barred territorial sovereignty” (165/166). As discussed above under Article VI, Von der Dunk (2017; 2020) affirmed that States can assert national jurisdictions in terms of personal jurisdictions over legal entities engaged in space activities (through licensing / continuing supervision), as well as provide “quasi-territorial jurisdiction” over space objects registered in their registries. This is why Article VI 1967 OST requires the responsibility of states to license and provide continuing supervision and Article VIII requires the registration of space activity objects (Von der Dunk 2002).

Article VI partly stipulates that “States Parties to the Treaty shall bear international responsibility for national activities in outer space…” while Article VIII partly provides that: “A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object . . . .” (UNOOSA 1967 OST, Articles VI and VIII). Thus, Von der Dunk (2002) affirms that the 1967 OST provides for, and requires, other methods to extend State jurisdiction to fit commercial enterprises within the cooperative structure governing space activities – including emerging space mining activities.

Comparative Keynotes on the 1979 Moon Agreement v. Title IV, U.S. 2015 Space Act.

The U.S. in 2015, and the state of Luxembourg in 2017, passed national space minerals mining legislations that purport to grant property rights over any resources extracted from

asteroids and space by the legal entities of these states. These unilateral actions by the U.S. and Luxembourg remains a matter of considerable controversy and the issue of an authoritative legal regime for space minerals mining remains a matter of theoretical debates in the Legal Sub-Committee of the Committee on the Peaceful Uses of Outer Space (COPUOS) and among contemporary multilevel space law and policy experts. The nuanced debate is between the evolving Title IV unilateral approach to space minerals mining and those who favor the international regime approach of the 1979 Moon Agreement.

As at the writing of this research study in July 2023,only 17 States have ratified the 1979 Moon Agreement, with 4 signatories. Saudi Arabia withdrew its ratification from the Moon Agreement in January 2023. Comparatively, the 1967 OST has acquired a total of 112 ratifications, i.e., the number of ratifications, acceptance, approval accession or succession by States, and with 23 signatories (COPUOS Legal Subcommittee 2022/2023, A / AC.105 / C.2 / 2022 / CRP.10, 5-10). For most U.S. allies such as Canada, France, the United Kingdom, and Australia, the issue is complicated by the fact that some allies like France and Australia are part of the current seventeen States Parties to the *Moon Agreement*. As already demonstrated in detail above, Article 11 of the Moon Agreement reiterates the strict theory of "Non-appropriation" that bars any assertions of unilateral space minerals rights over space natural resources, or the exercise of territorial sovereignty over any parts of the space sphere. But the Moon Agreement also adds a concept of outer space as the 'common heritage of mankind' – which designates the entirety of outer space and its resources as belonging in common to all humanity, imposes a mandatory equitable sharing of those resources and technology, and requires a futuristic international regime to oversee and manage equitable space mining and resources distribution.

Articles 11(5) and 11(7)(a-d) of the *Moon Agreement* foreshadows the establishment of this international and describes its roles. Major spacefaring states declined to ratify this Moon Agreement provisions. Yet, it is significant that most U.S. allies that are still wary of the unilateral approach of Title IV as a preferred contemporary space mining policy model, have not zealously enacted comparable unilateral national space mining policies. Instead, these States are signing up through the indirect channels of intergovernmental and non-governmental collaboration mechanisms that has embraced the Title IV ideals – such as the 2020 Artemis Accords (NASA/Artemis Accords 2023). The question is whether the increasing membership of the Artemis Accords (currently 27 – and counting) compared to the diminishing prospects of the 1979 Moon Agreement (currently 17 – and dropping) does not signal a trend of Title IV's ultimate accession to customary international law status.

Compared with Title IV, the 1979 Moon Agreement has not fared well because on average, since 2015, more States and intergovernmental bodies have adopted the Title IV policy approach or viewed it more favorably relative to the low rating of the 1979 Moon Agreement. This is evidenced by the 2023 United Nations Treaty Collection database which itemizes the yearly status of international legal instruments. As of January 2023, the signatories of the Moon Agreement has dropped to 17 with the withdrawal of Saudi Arabia (UN Treaty Collection / Status of UN Treaties 2023). Unlike the Moon Agreement, since the 2015 U.S. enactment of Title IV, the state of Luxembourg tailored its 2017 space mining legislation to the policy framework of Title IV (De Man 2017). Similarly, other states such as the United Arab Emirates (UAE) and Japan (JAXA) have modified their national space agency protocols to accommodate the evolving contemporary trends of national space mining policies.

These positive reactions towards Title IV may indicate that Title IV is most likely on its way to attaining customary international law status as more states joins the U.S. and Luxembourg in enacting comparable unilateral space mining legislations. In addition to states, non-state space exploration coordination and collaboration bodies such as the 2020 Artemis Accords and the International Space Exploration Coordination Group (ISECG) are pursuing coordinated short and long-term human exploitation of celestial bodies in the tradition of Title IV. As of July 2023, ISECG reported an incremental membership of 27 that encompasses all the principal national space agencies such as NASA, ROSCOSMOS, CNSA, ESA, JAXA, Luxembourg Space Agency, Australian Space Agency, UK Space Agency, Brazilian Space Agency, and Canada Space Agency (ISECG 2022, 3).

Analogous momentum in growth was reported by the Artemis Accords that was established 2020 by NASA and seven other founding member states in coordination with the U.S. Department of State (NASA 2023). As at this research study in July 2023, the Artemis Accords has been signed by 27 states that has united for peaceful exploration and exploitation of deep space (ibid.). The current members include Australia, Bahrain, Brazil, Canada, Colombia, Czech Republic, Ecuador, France, India, Israel, Italy, Japan, Luxembourg, Mexico, New Zealand, Nigeria, Poland, Republic of Korea, Romania, Rwanda, Saudi Arabia, Singapore, Spain, Ukraine, United Arab Emirates, United Kingdom, and the United States of America (NASA / Brian Dunbar 2023, Artemis Accords Online, 4).

Critically, the Artemis Accords signatories affirm that “The ability to extract and utilize resources on the Moon, Mars, and asteroids will be critical to support safe and sustainable space exploration and development. The Artemis Accords reinforce that space resource extraction and utilization can and will be conducted under the auspices of the Outer Space Treaty, with specific

emphasis on Articles II, VI, and XI…" (NASA 2023, 3). Arguably this integration of Title IV, U.S. 2015 Space Act (Space resources extraction and utilization) into Articles II, VI, and XI, 1967 OST demonstrates the inherent compatibility of these space mining policy instruments at the practical level – regardless of theoretical dissent on this issue.

Another significant point to note here is that most of the 27 signatory States to the Artemis Accords have not manifested explicit enthusiasm for the underpinning res nullius of Title IV and has not enacted a similar national framework. The clear exception is the state of Luxembourg whose 2017 space legislation explicitly mirrored Title IV by declaring space and asteroid resources as unowned non-sovereign things subject to private appropriations (Luxembourg Space Agency 2017, Art. I). In addition, a cross-reference of the Artemis Accords with the 1979 Moon Agreement reveals that states such as Australia, France, and India, signed on to both instruments but has not replicated any *res nullius* framework as their national space minerals mining policy model. But some states like Saudi Arabia recently, in January 2023, revoked its membership of the Moon Agreement in preference for membership in the Artemis Accords – thereby reinforcing the diminution of the 1979 Moon Agreement.

Suffice it to say that the political and international law developments mentioned in Chapter 1, which resulted in cumulative support for a different, non-exclusive global commons approach to the outer space domain in the 20th century as demonstrated by the 1967 Outer Space Treaty, has begun to wane as evidenced by decreasing support for the 1979 Moon Agreement relative to the 1967 OST. Moreover, increasing support for unilateral approaches to space mining has resulted in the emergence of a new trend of national space mining legal instruments, especially the pivotal and controversial Title IV, U.S. 2015 Space Act discussed in the next chapter.

CHAPTER FOUR

U.S. Space Minerals Mining Policy Under Title IV, §§51301-403, U.S. 2015 Space Act

Brief Historical Context of Title IV

The preceding chapter demonstrates that the UN itself, and subsequent legal frameworks such as the 1958 UNCLOS, 1959 Treaty of Antarctica, and the 1967 Outer Space Treaty, were designed to prevent the kind of nationalism and excess that characterized World War II, *and* the kind of violence and possible interstate bloody conflicts that characterized the 16th and 17th centuries of the legal and political thinkers discussed in Chapter One. But recent national level legal developments appear to threaten this 20th century progress. Specifically, space mining under the current public policy of Title IV, U.S. 2015 Space Act in particular, seems—to some influential commentators—to reintroduce the kind of "free for all" that early theorists of the state of nature feared, and that the UN and related global instruments in the mid-20th century were set up to avoid. Remarkably, this 2015 law was passed by a Republican house and Senate, and signed into law by President Barack Obama, a Democrat. What were they thinking? Were the populist supporters and nationalist actors involved not able to appreciate the risks, and dangers, of moving away from an understanding of outer space, traditionally rooted in the cooperation-oriented multilateral thoughts of classical thinkers such as Hugo Grotius, and instead embracing one that relied exclusively on the acquisitive version of John Locke or John Selden?

Influential space law experts such as Tronchetti (2019) and Oduntan (2015) bemoaned the U.S. 2015 law as a rollback of the settled multilateral cooperation approach to outer space and as a frontal attack on the customary principles of the 1967 OST and the notions of non-appropriation of *res communis* Global commons that went all the way back to Grotius and Roman law - and which underpin the 1967 OST. If these ominous concerns are proven from the

text of the U.S. 2015 law, this is alarming because those principles governing the use of common spaces that do not belong exclusively to any nation are intended to keep the peace in our world. It would mean that what this 2015 U.S. law risks, therefore, is a return to the Wild, Wild West—to an arms race that may ultimately lead to a nuclear confrontation among superpowers like the U.S., China, Russia, and the union of European states. However, other influential authorities such as Von der Dunk (2017; 2019), Blount and Robinson (2016), Gangale (2016), and the International Institute of Space Law (IISL 2015) contend to the contrary that the U.S. space mining policy may not after all portend such a doom to international law and peace as conveyed by the previous influential commentators. Prior to navigating these conflicting expert interpretations of the 2015 U.S. space mining policy, it is important to examine how and why this national space framework came about.

Space Resources v. U.S. Domestic Free Market Enterprise Mindset

Outer space resources includes energy, helium-3 (found on Moon surfaces and atmospheres of outer planets), mineral or materials such as water ice, oxygen (located on the Lunar poles, Moon surface, Mars, and carbonaceous asteroids), inert gases (found in the Moon and Mars). Metals and non-metals (located in stony asteroids, the Moon, and Mars), and the "real estate" of outer space such as microgravity or vacuum expanses and planetary surfaces (Michael B. Duke 2020, *Space Resources*, 1-40). The latter was specifically barred from sovereign territorial claims under the "non-appropriation" principle of Article II, 1967 OST, while all of the above are freely accessible under the freedom of equal "exploration and use" of Article I, 1967 OST (Von der Dunk 2017; Blount and Robinson 2016). But the proven presence of strategic mineral resources in outer space and the potential for harvesting them for use on Earth has for a long time fascinated many states and non-state actors.

For instance, from the early days of NASA's Apollo Missions, sample regolith were returned to earth and studied. Likewise in the current 21st century, Japanese and Chinese missions returned with quantities of space minerals that are being studied (Goswami 2019/2020). The assumption is that strategic space minerals exists in unfathomable quantities in-situ in space that could alter the economies of planet Earth if safely, responsibly, and successfully extracted. Significantly, the governing 1967 Outer Space Treaty was unhelpful in providing definitive regulatory guidance on space mining law and policy (Gangale 2016). This ignited regulatory attempts at the international level resulting in the 1979 Moon Agreement.

But disputes over the 1979 Moon Agreement's Article 11 formula of creating an international regime to conduct an equitable system of mining and sharing resulted in a deadlock and rejection of that formula by major spacefaring states including the U.S. (Von der Dunk 2020). In a 2006 national space policy, U.S. President, George Bush, asserted U.S. rejection of multilateral regimes, as a matter of principle, and reinforced that "The United States will oppose the development of new legal regimes or other restrictions that seek to prohibit or limit U.S. access to or use of space" (President George Bush 2006, Unclassified 2006 U.S. National Space Policy, 2). These nationalist tendencies of U.S. domestic space policymakers to appeal to the inherent Free Market Enterprise is rooted in the political and legal theories of English jurists and political thinkers such as John Selden, John Locke, and Sir Henry Maine (Johnson 2015).

As demonstrated in Chapter One, while some thinkers such as Hugo Grotius erred more on the side of common ownership of res communis global commons—as not subject to sovereign territorial appropriations—others such as John Selden and John Locke clearly favored the idea of unilateral and individual appropriations of non-sovereign things and territories. These English political and legal thinkers later influenced American Founders who predominantly reflected a

strong nationalist thinking with regards to unoccupied territories and unowned things (Johnson 2015). Arguably, this also shaped the civil war era 1862 Homestead Act that enshrined the proverbial Wild, Wild, West policy used by the U.S. to expand national sovereign territorial land grabs in the western parts of the United States. Therefore, President George Bush's 2006 affirmation of the traditional American Realpolitik reflects a long tradition of the dualistic ideological streams that dominate U.S. domestic space-oriented policymaking – the realist Right versus the liberal Left. The Republicans are to the Right, while Democrats are mostly to the Left of the U.S. ideological paradigm. U.S. public policy on space / space mining swings back and forth on this ideological pole.

Hence, the rejection of the 1979 Moon Treaty by major spacefaring states, including the U.S., left a definitive regulatory void in the 20th and early 21st century as new unilateral space mining corporations emerged at the U.S. domestic level, such as (the now defunct) Planetary Resources and Deep Space Industries (Mike Wall 2013, 1-5). The U.S. 113th Congress was subjected to intense lobbying by these corporations; sympathetic space law academia; investors such as Space Angels, Google's Eric Schmidt, Hollywood filmmaker James Cameron; and Amazon's CEO, Jeff Bezos (Abrahamian 2019, 1-2). NASA funded asteroid mining research, while the Colorado School of Mines created an asteroid-mining degree program (ibid., 1). This constellation of forces created the necessary momentous context that activated a space mining regulatory revolution in response to the U.S. national level demand by the space industry for regulated innovative space mining. At the same time, tensions arose over the legality of any such national space mining framework, and concerns for responsible space mining emerged.

Impact of the 1862 Homestead Act

Particularly for outer space, the shift in the 21st century from national security and prestige-driven exploration of space to potential scrambles for space mineral resources mining has rekindled the flames of the Cold War era "space race" – only it is for strategic space minerals this time around (Weichert 2020). The nationalists theorists envision a hegemonic scenario in which the U.S. would extend sovereign territorial jurisdiction over the outer space sphere, claim space strategic natural resources, colonize celestial bodies by mounting U.S. flags on them – protected by the new U.S. Space Force (Weichert 2020). Under this approach, the U.S. would then issue Homestead-Act-like licenses and titles to U.S. legal entities that are interested in occupying and developing the colonized space territories. In this view, the Homestead Act model is the best practice that advances U.S. free market values and competitiveness in space mining operations (Weichert 2020, 5-6). As this study demonstrates, this approach is *prima facie* unlawful under Article II, 1967 OST and would disrupt global peace. Notwithstanding, it was this kind of deeply-rooted res nullius that emboldened the 2014 ASTEROIDS ACT – a forerunner of Title IV, U.S. 2015 Space Act.

The 2014 ASTEROIDS ACT

Following the enactment of the 1967 OST and U.S. domestic approval of the treaty, the U.S. has actively used the part of national and "quasi-territorial" jurisdictions provided for in Articles VI and VIII, 1967 OST, to regulate domestic space activities of U.S. legal entities. And, prior to the pivotal Title IV of 2015, a plethora of space regulatory regimes of the U.S. Congress had been shaping space activities at the U.S. domestic level. Some of these includes the Commercial Space Launch Competitiveness Act of 2015 on which this study is based; the Commercial Space Launch Amendments Act of 2004; the Commercial Space Transportation

Competitiveness Act of 2000; the Commercial Space Act of 1998; the Land Remote Sensing Policy Act of 1992; the Commercial Space Launch Amendments Act of 1988; and the Commercial Space Launch Act of 1984 (Casey 2021, 1-7).

Within the procedural records of each of these federal statutes at the subcommittee levels of debates in both houses of Congress, parties representing dueling perceptions of outer space—as terra/res communis of international law versus as res nullius of nationalist / populist—argued their cases to the equally divided U.S Congress committees and subcommittees (CRS 2015/2016, 1-29). Likewise, special interests, space law experts, theorists, practitioners, space policy experts, space-related agencies, and institutions provided materials evidence to support their positions (ibid.). In 2014, a major shift occurred with the introduction of the ASTEROIDS ACT in the U.S. House of Representatives. On July 10, 2014, at the 113th U.S. Congress, 2nd Session, Republican Congressman Bill Posey, representing Florida's 8th District, Mr. Bill Posey, for himself and co-sponsor Mr. Kilmer, introduced to the U.S. House of Representatives, a bill, H. R. 5063. The purpose of the bill was "To promote the development of a commercial asteroid resources industry for outer space in the United States and to increase the exploration and utilization of asteroid resources in outer space" (Authenticated U.S. Government Information / GPO 2014, H.R. 5063, 1-5).

Section I, provided that the bill must be cited as the ''American Space Technology for Exploring Resource Opportunities In Deep Space Act'' or the ''ASTEROIDS Act'' (ibid.). Other parts of the "ASTEROID ACT" included Section 51301 that articulated the specific roles of the U.S. President in the commercialization of asteroid resource exploration and utilization in outer space. Section 51302 provided the Legal framework, while Section 51303 dealt with definitions of terms. The legal framework of Section 51302 (a) explicitly granted private rights over space

mining to private U.S. commercial space mining operators. It provided that : “Any resources obtained in outer space from an asteroid are the property of the entity that obtained such resources, which shall be entitled to all property rights thereto, consistent with applicable provisions of Federal law….” (Authenticated U.S. Government Information / GPO 2014, H.R. 5063, Sec. 51302, 1-2). Hence this declaration of property rights over extracted asteroid minerals was not grounded on the authority of international law but on the “Federal Law” of the United States alone (ibid.). Section 51302 (b, c, d) protects the proposed explicit commercial space mining activities in 51302(a) under the “freedom from harmful interference” clause of Article IX, 1967 OST.

Opponents at both the U.S. domestic and UN international levels challenged this novel explicit assertion of “national sovereignty” over asteroid resources (Tronchetti 2014). The contention was that a literal reading of the ASTEROID ACT in the absence of a clear definition of outer space resources, “affirms to the world that the U.S. Congress may have acted in defiance of international space law” (Blount and Robinson 2016, 174). According to Blount and Robinson (2016), skeptical international level space experts argued that the proposed ASTEROIDS ACT of 2014 “incidentally undermined the core principles of Article II by providing property rights that may conflict with the obligation to not appropriate space by means of use or occupation” (174). Others reasoned that this proposed legislation by Rep. Bill Posey ultimately opened the door to a legitimate discussions of private property rights in outer space within the U.S. House of Representatives (Gangale 2016).

And by May 2015, when California congressman (and House Speaker from 2023), Rep. Kevin McCarthy sponsored a broader 2015 space law, the CSLCA, the 2014 ASTEROIDS ACT was modified, amended, and included as Title IV. It uniquely provided a narrower space minerals

policy that seemed to have solid basis in international law (as opposed to the ASTEROID ACT grounding on Federal Law) and was unanimously enacted the U.S. Congress. On 25 November 2015, U.S. President, Barack Obama, signed into law the U.S. Commercial Space Launch Competitiveness Act (H.R. 2262), Public Law 114-90, also known as the U.S. 2015 Space Act. Title IV is the specific subject of this research study.

U.S. 2015 Commercial Space Launch Competitiveness Act (H.R. 2262), Public Law 114-90

Contents

It consists of four Titles as listed, but The only provision of interest to this research study is Title IV, as amended.:

I. Spurring Private Aerospace Competitiveness and Entrepreneurship.
II. Commercial Remote Sensing
III. Office of Space Commerce; and
IV. Space Resource Exploration and Utilization.

TITLE IV - Space Resource Commercial Exploration and Utilization Act of 2015

Contents

Title IV provides the world's first preliminary space minerals resources exploitation policy. According to Von der Dunk (2015), "Without a doubt Title IV the Space Resource Exploration and Utilization Act (Chapter 513 of 51 USC)[pdf], which addresses in a preliminary fashion space resource exploitation by that token is the most innovative and disputed part of the Act, certainly in an international context" (1). It consists of four sections: 51301, 51302, 51303, and Section 403. Here is a brief overview of Title IV with some relevant expert interpretive commentaries.

The Purpose of Title IV:

The International Institute of Space Law (2015) has summarized the purpose of Title IV based on Sections 51302 and 51303 as follows: "the facilitation of "commercial exploitation for

and commercial recovery of space resources by United States citizens"; discouragement of "government barriers to the development in the United States of economically viable, safe, and stable industries for commercial exploration"; and promotion of "the right of United States citizens to engage in commercial explorations for and commercial recovery of space resources free from harmful interference, in accordance with the international obligations of the United States and subject to authorization and continuing supervision by the Federal Government" (1). Most authorities agree with this summary. Next are the sections.

Section 51301: Definitions

This section defines "asteroid resource," "space resource," and "U.S. Citizen" as used in 51303 below. Accordingly, the term "asteroid resource" means a space resource found on or within a single asteroid." (ibid.). "Space resource" means an abiotic resource in situ in outer space and includes water and minerals (ibid.). The term "abiotic" is not defined here, but *Black's Law Dictionary* online defines "abiotic" as "A non-biological element that has an effect on the ecosystem. The opposite of a naturally occurring environmental element" (*Black's Law Dictionary* Online 2023). The online *Dictionary of Biology* (2023) clarifies that "abiotic" refers to "Nonliving, as in abiotic factor, which is a nonliving physical and chemical attribute of a system, for example light, temperature, wind patterns, rocks, soil, pH, pressure, etc. in an environment" (1). Authorities concur that this demonstrates the carefulness of U.S. lawmakers to say distinctively and explicitly what may be "extracted" from the outer space sphere consistent with international law (Blount and Robinson 2016; Von der Dunk 2017 / 2020).

Lastly, Section 51301 defines the term "United States Citizen" as having "the meaning given the term `citizen of the United States' in section 50902" (ibid., 51301). In U.S. Code 51, Section 50902 (IA, B, C) "citizen of the United States means, an individual who is a citizen of

the United States; an entity organized or existing under the laws of the United States or a State; or an entity organized or existing under the laws of a foreign country if the controlling interest (as defined by the Secretary of Transportation) is held by an individual or entity described in subclause (A) or (B) of this clause" (Legal Information Institute 2023, 51 U.S. Code Section 50902 (1)(A)(B)(C)). These are the legal entities of the U.S. implicated in Title IV.

Section: 51302: **President's Roles in Commercial Exploration and Commercial Recovery**

> "(a) In General.--The President, acting through appropriate Federal agencies, shall - (1) facilitate commercial exploration for and commercial recovery of space resources by United States citizens; (2) discourage government barriers to the development in the United States of economically viable, safe, and stable industries for commercial exploration for and commercial recovery of space resources in manners consistent with the international obligations of the United States; and (3) promote the right of United States citizens to engage in commercial exploration for and commercial recovery of space resources free from harmful interference, in accordance with the international obligations of the United States and subject to authorization and continuing supervision by the Federal Government.
>
> (b) Report.--Not later than 180 days after the date of enactment of this section, the President shall submit to Congress a report on commercial exploration for and commercial recovery of space resources by United States citizens that specifies - (1) the authorities necessary to meet the international obligations of the United States, including authorization and continuing supervision by the Federal Government; and (2) NOTE: Recommendations. recommendations for the allocation of responsibilities among Federal agencies for the activities described in paragraph (1)" (Title IV, Sec. 51302, U.S. 2015 Space Act).

As described in the "Purpose" discussion above, Section 51302 stipulates the specific roles of the United States President in the actualization of the policy goals of Title IV. In 51302(a), acting through appropriate federal agencies, the U.S. President shall (1) facilitate commercial exploration and resources recovery by U.S. legal entities; (2); the President shall discourage government barriers to an effective actualization of this activity; and the President shall (3) promote the right of U.S. legal entities to engage in this activity subject to Articles VI, IX, 1967 OST and U.S. international obligations. According to Von der Dunk (2015), Section 51302 further reinforces U.S. commitment to international law by enacting Title IV pursuant to

its licensing and continuing obligations under Article VI – which ensures that domestic U.S. legal entities do not engage in unregulated anarchical space mining.

In this view, this section "calls upon the US President to ensure that such authorization and continuing supervision will actually be properly provided for in the near future – that is before such commercial resource harvesting activities will actually take off" (ibid., 4). Simultaneously, this section "requires the President to work on the international level towards an appropriate regime for such activities, further elaborating the embryonic regime provided under the Outer Space Treaty, as the United States cannot obviously regulate this for other countries or their operators" (ibid.). And "In that sense, the Act is also an invitation to the international community to work together towards such an international regime, hopefully along the same lines as the US national one to be further developed" (ibid.). Blount and Robinson (2016) agree with this view of Title IV as a valid state interpretation and application of international law under these considerations.

Section 51303: Asteroid Resource and Space Resource Rights

> "A United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States" (ibid.).

According to most experts, Section 51303 is the most controversial provision in Title IV, and it has generated much debate among experts at both levels and on all spectra. In Von der Dunk's (2015) perspective, Section 51303 "ensures that US citizens, which includes US commercial operators, will enjoy ownership (even though the terms 'ownership' or 'property' are not used) over space resources once harvested, "in accordance with applicable law, including the international obligations of the United States" (2). This, according to Von der Dunk, " means firstly that the recognition of such ownership rights is only applied to the extent of US

jurisdiction, essentially meaning US territory and/or US courts, as the US cannot dictate what other states should do or the extent to which non-US citizens outside of the US could be given such rights or be held to corresponding obligations." (ibid.). This point is explicitly stated by the phrase in Section 51303 above: "A United States citizen engaged in commercial recovery…." And reinforced by the definition of "U.S. Citizen in Sections 51301 and 50902. Moreover, under Article VI, 1967 OST the U.S. is responsible for its own space-acting citizens.

The IISL (2015) reinforced that "The Act determines in § 51303 that United States citizens engaged in commercial recovery of an asteroid resource or a space resource under this chapter "shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States" (2). Significantly, as part of a key amendment to the ancestor of Title IV – i.e., the 2014 ASTEROID ACT – Section 51303 grounded "in accordance with applicable law, including the international obligations of the United States" all the activities of "commercial recovery of an asteroid or a space resource" and associated property rights "to possess, own, transport, use, and sell the asteroid resource or space resource obtained." With this specific reference to international law and Section 403, the arguments raised by opponents like Oduntan (2015) against the prior ASTEROID ACT is inapplicable to Title IV – which has explicitly demonstrated solid grounds in the 1967 OST and international law.

Von der Dunk (2015; 2017) explained that "the reference to "the international obligations of the US" refers to the aforementioned Article II of the Outer Space Treaty, which prohibits "national appropriation by claim of sovereignty, by means of use or occupation, or by any other means" (2015, 2-3). In combination with U.S. disavowal of "sovereign extraterritorial

jurisdiction" in Section 403, Title IV affirms that no part of the outer space can be privately appropriated under the guise of commercial appropriation of asteroid or space resources. But Blount and Robinson (2016) also highlight that the interpretive puzzle with Title IV "is not whether it violates international law but instead, what it tells us about the content of Article II" (181). According to this view of interpretation, "This distinction focuses on Title IV as a valid interpretation of Article II but not necessarily the valid interpretation of Article II. As an epistemic unit in the negotiation of international law, Title IV is a State interpretation that raises questions of whether other States will accept the interpretation or not…" (ibid., 181). This point was validated by Von der Dunk's (2017, 100-101) conclusion that Title IV still represents an embryonic but viable regime still being weighed for acceptance, modification, or rejection by state and non-state space actors.

Section 403: Disclaimer of Extraterrestrial Sovereignty

This section provides that, "It is the sense of Congress that by the enactment of this Act, the United States does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body" (ibid.). In Section 403 the U.S. explicitly disavows the barred sovereignty route and affirms that it was employing the national jurisdiction over American legal entities / space objects engaging in space activities - permitted to States under Articles VI and VIII, 1967 OST. According to the IISL (2015), "Section 403 of the Act assures that the United States does not assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body" (1). Von der Dunk (2015) concurs that this section, "….ascertains that, at least from the US perspective, this Act does not violate the recognized obligation under Article II of the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (also known as the Outer Space Treaty)" (2). Blount and Robinson affirmed that

"Indeed, the U.S. legislation specifically disclaims territorial sovereignty, which is tied directly to the non-appropriation principle in Article II" (180). This means that Section 403 demonstrates that the assertion of permissible national jurisdiction by the U.S. – pursuant to Article VI, VIII, and IX – does not equate to a *de facto* assertion of sovereign territorial claim by the U.S. However, other authorities remain skeptical, such as Tronchetti (2019, 777-784, in Von der Dunk and Tronchetti 2019) and Oduntan (2015, 1-3). These latter authorities, regardless of Section 403, interpret Title IV holistically as an unlawful "frontal attack" against the 1967 OST.

Theoretical Approaches to Title IV v. Articles I and II, 1967 OST

IISL 2015:

First, the International Institute of Space Law (IISL 2015) released an authoritative position paper on the implications of the legal situation relating to space resource exploitation under International Space Law as it relates to Title IV. According to the IISL (2015, 1-5), the adoption of Title IV resulted in an expert evaluation of the current legal situation of international space law. First, the 1967 OST contains the basic legal framework for outer space and celestial bodies. Article II, 1967 OST provides that "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" (UNOOSA 1967, Art. II). Most authorities conclude that it is uncontested under international law that any appropriation of "territory" even in outer space (e.g. orbital slots) or on celestial bodies (i.e., the "real estate" of outer space – Michael B. Duke 2020) is prohibited. What is less clear among scholars is whether this "non-appropriation" principle of Article II, 1967 should be conclusively interpreted as also a prohibition against the taking of natural resources lodged within the space territory. This issue is unresolved by international law and Title IV is the first national affirmation that asteroid and space resources could be taken without violating Article II, 1967OST.

Next, Article I paragraph 2, 1967 stipulates the right of States to the free exploration and use of outer space and celestial bodies, without discrimination of any kind, on the basis of equality and in accordance with international law (UNOOSA 1967, Art. I). Yet, there is no international agreement on whether this right of "free use" includes the right to take and consume non-renewable natural resources, including minerals and water on celestial bodies (IISL 2015, 2). Some authorities such as Gorove (2020/1971), Tronchetti (2013; 2019), and Oduntan (2012; 2015) rejects the notion of "free use" as including unilateral space minerals extractions for private benefits. According to Gorove (2020/1971, 100) the requirement that the exploration and use of outer space must be carried out "for the benefit and in the interests of all countries" defeats the idea of unilateral resources appropriation – which normally serves the self-interest of States. Others such as Von der Dunk (2015; 2017) argue that 'use' has generally come to be acknowledged as including commercial use and exploitation.

For instance, in the early 1960s onwards, outer space was used by commercial satellite communication operators, while in the 1980s the "use" of seabed included unilateral fishing (ibid.). Still Von der Dunk (2017) and other commentators like Gangale (2016), Blount and Robinson (2016) moved the conversation beyond interpretive debates over the term "use" in Article I, to ground Title IV on U.S. national jurisdictional authority under Articles VI, VII, VIII, and IX of the OST. And this study also queried what if Articles I and II, 1967 OST were not drafted in contemplation of space natural resources at inception as evidenced in the *travaux preparatoires* of international law? In that case space minerals extraction cannot be imposed on the term "use" or on "non-appropriation" as referring to those natural resources, but Title IV could be grounded on the aforementioned relevant portions of the 1967 OST plus the 1927 "Lotus" principle due to the apparent silence of the body of international law on a

comprehensive space minerals mining policy (i.e., neither explicitly prohibited nor permitted). Evidently, these are matters of ongoing debate among scholars in this field.

Further, twelve years after the 1967 OST, the 1979 Moon Agreement of 1979 was concluded and adopted by consensus in the United Nations General Assembly (UNOOSA 1979, The Moon Agreement). In Article 11 (3), it provides that space natural resources cannot become the "property of any State, international intergovernmental or nongovernmental organization, national organization, or non-governmental entity or of any natural person" (UNOOSA 1979 Moon Agreement, Art. 11 para. 3). According to the IISL (2015), State Parties to the Moon Agreement agreed to establish an international regime to "govern the exploitation" of mineral resources "as such exploitation is about to become feasible" (3). This clause, whether interpreted "as a moratorium or not, is binding upon the sixteen States that have so far ratified the Moon…Agreement, but not upon the United States. Moreover, Article 11 has not gained the status of a rule of customary international law " (ibid.). As at this research in 2023, the Moon Agreement signatories stand at 17 from a prior total of 18 in 2022 – Saudi Arabia having dropped its membership in January 2023, effective January 2024 (UNOOSA 2023).

Therefore, given "the absence of a clear prohibition of the taking of resources in the Outer Space Treaty one can conclude that the use of space resources is permitted. Viewed from this perspective, the new United States Act is a possible interpretation of the Outer Space Treaty" (IISL 2015, 3). Authorities such as Von der Dunk (2017) agree, while Blount and Robinson (2017) concur that Title IV is not simply a "possible interpretation" of Article II, but "one small step' that would ultimately result in a "giant leap" for international space minerals mining policy. This is because Title IV is best viewed as a "legislation that represents a step towards defining the content of Article II and the law concerning the specific activity of space mining" (Blount

and Robinson 2016, 182). The open question remains whether and to what extent the Title IV interpretation of Article II, 1967 OST is shared by other States. So far, only Luxembourg (2017) has mirrored the U.S. Title IV while states like the UAE and Japan have modified their national agencies to incorporate the evolving space policy shifts to space mineral resources commercial exploitation – from explorations, military research, and scientific uses.

IISL Conclusion on Title IV

Title IV's assertion of national jurisdiction over U.S. citizens engaged in the extraction of asteroid or space resources is independent from the claim of sovereign rights over celestial bodies, which the United States explicitly does not make, as the disclaimer of sovereign extraterrestrial jurisdiction in Section 403 affirms (IISL 2015, 3-4). In addition, the expressed purpose of Title IV is to entitle U.S. citizens to asteroid or space resources if "obtained in accordance with applicable law, including the international obligations of the United States" as Section 51303 demonstrates. Therefore, according to the IISL (2015), Title IV "thus pays respect to the international legal obligations of the United States and applicable law on which the property rights to space resources will continue to depend" (ibid, 4). Hence the greater weight of international law experts are favorably disposed towards the compatibility of Title IV with the settled principles of international law under the 1967 OST, and relative to the exploitation of space minerals (about which the 1967 OST is silent).

IISL – American Branch (Directorate of Research 2016/2022): Background Paper

Authorities in a 2016/2022 "Background Paper" by the American branch of the IISL, on whether space mining is permissible or prohibited, argued that both Title IV and Articles I and II, 1967 OST can be anchored on Article 11, 1979 Moon Agreement that mandates an international space mining regime for equitable sharing of the fruits of the mining activities (IISL 2022, 1-46).

In defense of Article 11, 1979 Moon Agreement, these authorities contend that "the legal framework governing activities in space does not prohibit the exploitation of resources as an activity open to States, but it nevertheless requires that such exploitation shall take place under the conditions laid down in the Outer Space Treaty which are to be shaped in an appropriate international legal order multilaterally" (42). However, there are still unsettled questions with the 1979 Moon Agreement whose membership dwindled further in January 2023 with the withdrawal of Saudi Arabia from the Moon Agreement framework.

But the IISL-American Branch "Background Paper" (2016/2022) concluded that, "Taking the fact that outer space law is not particularly outspoken with regard to space mining, the plea of the Moon Agreement to establish an international regime for mineral resource mining should be undertaken only as an effort of the international community" (42). Which means that IISL - International and IISL-American Branch have some nuanced differences on each institution's preferred legal framework on space minerals mining policy. What if the preference of most states of the "international community" gravitates towards Title IV instead? Does this signal a dualist schism in which an international regime-governed space mining operations under the Mon Agreement would be in competition against unilateral national level space mining activities grounded on Title IV-style regulations?

Title IV Grants Rights over "Extracted" Asteroid or Space Resources – Only.

Blount and Robinson (2016) argue that "Title IV enumerates certain rights from the traditional bundle of rights that a commercial entity might have over chattel property. Therefore, the rights granted by Title IV are narrower than the rights granted in the ASTEROIDS Act, making them less likely to run afoul of the prohibitions found in Article II" (175). In this view, this particular language in Section 51303 does a better job in ensuring that private entities only

have property rights to resources extracted from asteroids or other celestial bodies – not over the space real estate or celestial bodies themselves. Moreover, the more specific definition of outer space resources as contained in Sections 51301 and Section 51303 of Title IV further conveys that U.S, legal entities only have rights to resources and not to the body from which they were extracted (Blount and Robinson (2016, 180-82). Thus, Title IV specifically defines two categories of resources: asteroid resources and space resources (ibid.).

It further elaborates the definition of space resources to include "water and minerals" in Section 51302. With this narrow definition of the rights that U.S legal entities have to such specific resources, U.S. legislators have arguably avoided showing an intent to allow private entities to have exclusive control over a celestial body or a portion of a celestial body from which resources could be extracted (ibid.). Blount and Robinson (2016) aver that, the concluding language of Title IV in Section 403 (phrasing that was absent in both the 2014 ASTEROIDS Act and H.R. 1508), explicitly reaffirms the U.S. intent to comply with Article II by stipulating that, "this Act . . . does not thereby assert sovereignty or sovereign or exclusive rights or jurisdiction over, or the ownership of, any celestial body" (U.S. 114th Congress 2015, Title IV, U.S. 2015 Space Act, Sec. 403).

Title IV Interprets Article II, 1967 OST International Space Law

Does Title IV violate international space law, or does it have a solid basis in international space law? This is an unresolved question currently being debated by space law and policy experts since the content of Article II, 1967 OST is yet to be conclusively determined. Title IV generated primary criticisms that it violates the "non-appropriation" principle of Article II, 1967 OST (Oduntan 2015; Tronchetti 2014, 2019). However, given the unresolved ambiguities of Article II, 1967 OST itself, attacks of Title IV premised on Article II apparently faces some

problems. Therefore, Blount and Robinson (2016, 177-182) adduced prima facie evidence of the 1967 OST itself to demonstrate that in the absence of any decisive understanding of the non-appropriation principle relative to space minerals mining policy, it is better to read Title IV as a state interpretation of the ambiguous content of Article II, 1967 OST. To this end, they concluded that the U.S. Title IV can help build the meaning of international law – i.e., of Article II, 1967 OST.

In Blount and Robinson's (2016) rationale, "The ambiguities of Article II cannot be sufficiently resolved by applying a few general sources of international law" (177). The interpretation and application of international obligations are ultimately dependent upon the actions of various States as they engage in the process of fulfilling their treaty obligations (ibid.). This conveys that instead of being considered as a fossilized or static framework, as some at the U.S. national level charge, "international law grows incrementally as States act and react within legal lacunae" (ibid., 177). Significantly, Article II, 1967 OST barred the extension of any form of sovereign territorial or imperial impulses to any parts of the space realm, yet states are granted rights of freedom of "exploration and use" of outer space on the basis of equal access in Article I, 1967 (Von der Dunk 2017). The exploration and use of outer space is the "province of mankind" according to Article I, 1967 OST.

Title IV Extends U.S. National Jurisdiction over U.S. Legal Entities – Not Globally

Sovereignty operates in international spaces in the guise of various forms of national and quasi jurisdictions (Von der Dunk 2002). It extends into all global commons through a variety of means and, in the case of outer space, specifically through Articles VI and VIII, 1967 OST (Blount and Robinson 2016). Accordingly, "The extension of jurisdiction is not a de facto extension of sovereignty, as can be seen in Article VIII of the Treaty which affirmatively grants

to States "jurisdiction and control" over spacecraft on their registries. What this means is that this important concern in relation to Title IV is not whether it violates international law but instead, what it tells us about the content of Article II" (ibid., 180). With this distinction, Blount, and Robinson (2016) conclude that Title IV should be envisioned as "a valid interpretation of Article II but not necessarily the valid interpretation of Article II" (181). In other words, Title IV is not the final word on national space minerals policymaking, but an important first step.

The point made by many experts in the foregoing discussion, which Blount, and Robinson (2016) reiterate is that "as an epistemic unit in the negotiation of international law, Title IV is a State interpretation that raises questions of whether other States will accept the interpretation or not" (ibid., 181). The IISL (2015) "Position Paper" and Von der Dunk (2017; 2019) also underscored this point. And if the future national space mining policies of spacefaring states unanimously endorse Title IV and mirror the language and spirit of this space mining policy, then Title IV will be on its way to attaining the status of a rule of customary international law. Thus, most authorities concur that, under Title IV, the U.S. lawfully asserted national jurisdiction over U.S. legal entities engaged in commercial extractions of asteroid or space resources for private benefits pursuant to Article VI, 1967 OST as well related principles of Articles VII, VIII and IX. Moreover, the U.S. explicitly reinforced international law by correctly disclaiming extraterrestrial sovereignty over any parts of space and celestial bodies, including the Moon under Title IV, Section 403. Thus, Title IV is inherently compatible with applicable principles of international law and the 1967 OST.

Title IV is a "Frontal Attack" on 1967 OST and Unlawful

As noted above, opponents of Title IV argue that the "non-appropriation" principle of Article II, 1967 OST constitutes a complete bar against any extractions of space natural resources

by states or non-states (Tronchetti 2019). In this view, only an international regime based on the Article 11, 1979 Moon Agreement would be justified in conducting an equitable mining of outer space resources for equal sharing of the fruits of that venture among all states (Oduntan 2012/2015). This perspective is further evaluated in Chapter Five as a leading "Strict Non-Appropriation" theoretical perspective.

Some Open Questions: Future perspectives on Title IV v. Articles I and II, 1967

There are many nuanced issues arising from Section 51303's nascent incursion into the hitherto legally undecided policy domain of space minerals mining. This study has highlighted some of those novel legal issues but since they have not risen to the level of U.S. official position, they are not within the scope of this public policy research. The core ongoing debates based on Section 51303 and Articles I and II, 1967 are further surveyed below. Von der Dunk (2015) has noted that the question of "whether the prohibition of ownership of 'space estate' would also give rise to the prohibition of ownership of specific resources or even of commercial exploitation thereof as such, has not been addressed by the Outer Space Treaty, and essentially has not been conclusively settled at an international level" (3). The U.S. has not addressed such in Title IV either, so this study would recommend this issue to future researchers in the space law field. And, as at this writing a comprehensive space mining licensing regime grounded on Title IV and requisite provisions of international law has not yet been published by the U.S. Also open is the question of what happens if Title IV does not attain customary international law status through wide acceptance and long practice of its tenets. Thus far (in 2023), Title IV is making sustained strides in terms of State and non-state acceptance as discussed elsewhere in this study.

Also, Blount and Robinson (2016) have pointed out that despite U.S. attempt in Title IV to demonstrate that it does not condone violations of Article II, Title IV does not contain many

explicit provisions that would necessarily prevent private entities from compromising other important Treaty provisions, specifically Article IX's prohibition against "harmful interference." For example, a private entity could rightfully lay claim to resources from an asteroid or other celestial body but could wrongfully make a claim of "harmful interference" against another party who may attempt to extract resources from the same body that is not subject to the jurisdiction of any one State or private actor. This, in effect, would violate the principle of Article II by indirectly laying exclusive claims to a particular body in outer space. Ultimately, while hypothetical violations can be posited, it seems as though the United States intends to promulgate further comprehensive elaborations of Title IV consistent with its obligations under international law and the 1967 OST.

According to the IISL (2015), it is still an open question whether the legal situation created by positing Title IV as compatible with international space is satisfactory to all theorists and practitioners at other levels. Whether the United States' Title IV interpretation of Art. II 1967 OST is followed by other states will be central to the future understanding and development of the non-appropriation principle (ibid.). As noted above, most scholars agree that Title IV "is a starting point for the development of international rules to be evaluated by means of an international dialogue in order to coordinate the free exploration and use of outer space, including resource extraction, for the benefit and in the interests of all countries" (IISL 2015, 3). This means that Title IV does not represent a foregone settlement of all other inherent issues of space mining in the entire content of Article II and the 1967 OST.

Arguably, Title IV does not even represent a final settlement of U.S. domestic extraterrestrial resource extraction policy as evinced by the reporting requirements of Section 51302 on the proper future regulatory regime to manage these activities. Moreover, as this study

demonstrates in the final section, the attitudes of U.S. Presidents towards Title IV revolves around ideological motivations. For instance, at the time of this research in 2023, U.S. President, Joe R. Biden (a Liberal Democrat – "Left"), shifted his national space policy from the previous Trump administration's "Right" leaning national populist space policy centered on Title IV, to a 1967 OST-centered international cooperation approach that effectively muted Title IV (see Biden 2021 – national space policy). Thus, the domestic and international levels are embroiled in an unabated ongoing space minerals mining debate, but some states are adapting also, such as Luxembourg, the United Arab Emirates, and Japan (JAXA).

Luxembourg (2017): National Space Resources Exploitation Policy

In 2017, the state of Luxembourg modeled the U.S. lead in a Res Nullius policy on space minerals exploitation. The Luxembourg framework of eighteen articles was aimed at inspiring competitive exclusive appropriations of outer space and asteroid natural resources in the spirit of an unfettered free market enterprise in space (De Man 2017, 5-6). As the first European country to enact a Res Nullius framework for exclusive private appropriations of outer space natural resources for private benefits, Luxembourg held that space natural resources are subject to exclusive appropriations under her 2017 Draft Law on the Exploration and Use of Space Resources (State of Luxembourg 2017, Art. 1). Under Articles 2-4, European and Luxembourg space exploitation private sector with registered offices in Luxembourg may commercially extract outer space and asteroid natural resources for private benefits subject to authorization from the Government of Luxembourg (ibid., Articles 2-4).

In Article 18, unauthorized exploitation and use of space natural resources are subject to imprisonment between eight days and five years and/or a fine of €5,000 to €1,250,000 (ibid.). The point is that together, the Title IV, 2015 U.S. and 2017 Luxembourg public space mining

policies embody the shifting trends in national space policies embracing the res nullius doctrine of space minerals in the 21st-century (Von der Dunk 2017, 96-97). These novel space policy perspectives and emerging practices of outer space natural resources exploitation are trending away from the restraints of strict notions of the terra/res communis omnium global commons designation of outer space in Article I, and the consequent non-appropriation principle of Article II, 1967, relative to space minerals exploitation (ibid.). Other states such as the United Arab Emirates, Japan, China, and Russia have signaled explicit or implicit inclination to similar res nullius policy shifts specific to space mineral resources exploitations for private benefits.

The United Arab Emirates (UAE): Space Resources Exploitation Policy (2016 and 2019)

The United Arab Emirates (UAE) has a national space sector governed by Federal Law No. 12 of 2019 on the Regulation of the Space Sector (UAE Government 2022, 1-18). In Chapter 1, Article 1, the UAE space law defines "space resources" as "Any non-living resources present in outer space, including minerals and water" (ibid.). It is "abiotic" in Title IV, Section 51301 of the U.S. 2015 Space Act. The UAE framework regulates, in Article 4(i) and (j), space resources exploration or extraction activities as well as activities for the exploitation and use of space resources for scientific, commercial, or other purposes. Unlike the explicit assertion of a Res Nullius exclusive appropriations theory by U.S. 2015 Space Act and Luxembourg's 2017 space legislation, the UAE 2019 hearkened back to the UAE 2016 National Space Law.

That legal framework was grounded on the Res Communis cooperative theory as the UAE highlighted principles of international cooperation, coordination, and collaboration in space activities, consistent with Articles I and II, 1967 OST (UAE 2016, 4.6). Also, Title IV, Sec. 51303, U.S. 2015 Space Act explicitly grants exclusive ownership rights to space actors engaged in the mining of space mineral resources. Conversely, the UAE scheme does not grant such

exclusive rights but makes it subject to a national board's decision, according to Articles 14 and 18 of UAE's 2019 space law. Arguably, the UAE framework is distinguishable from the U.S. and Luxembourg *res nullius* models in that the UAE grants permits to private space actors as fronts for the national agenda in space—probably to avert any appearance or semblance of a breach of Articles I and II, of the 1967 OST that barred direct national sovereign territorial appropriations in space. Von der Dunk (2023) notes that the UAE law almost exclusively focused on the establishment, role, and structure of the UAE Space Agency, rather than dealing with any substantive (international) space law and how to implement it in a domestic context.

Japan (JAXA): 2021 Japan National Space Resources Exploitation Policy

Following the U.S., Luxembourg, and the United Arab Emirates, and continuing with trend of nations (formally or informally) moving towards a *res nullius* policy of space minerals exploitation, Japan is the fourth country in the world to explicitly enact a national space resources policy and legislative framework. The Japanese Act No. 83 of 2021 was enacted by the Diet on June 15, 2021, and came into force on December 23, 2021. It is titled "Act on Promotion of Business Activities Related to the Exploration and Development of Space Resources" (Japan Official Gazette June 23, Reiwa 3, Extra No. 141, Law 83). Similar to the space minerals exploitation frameworks of Title IV, Sec. 51303, U.S. 2015 Space Act, Articles 1-3 of Luxembourg 2017 Space Resources legislation, and UAE's 2019/2021 space resources legal framework, Japan's 2021 Act explicitly permits a licensed Japanese person or company to undertake commercial mining of space resources. The framework also provides that such a space actor engaged in the mining activity will acquire ownership right or title to the extracted space resources (Japan Space Act 2021, 1-16). The Act is a departure from Japan's earlier reticence to unilateral commercial mining of space minerals.

Just like Title IV, Section 403 U.S. 1015 Space Act, Japan has not endorsed sovereign territorial appropriations of outer space, but rather invested in private space actors like I-space Inc., that are primarily interested in space-mining operations (JAXA 2021, 1-14). Also, similar to Title IV, U.S. 2015 Space Act and Luxembourg's 2017 space resources law, the Japanese Act defined "space resources" as water, minerals, and other natural resources that exist in outer space, including on the Moon and other celestial bodies" (Japan Act 2021, 1). These evolving national space mining policies, coupled with the non-state international frameworks such as the Artemis Accords (2020), ISECG (2023), IISL (2015), and the Hague Working Group's "Building Blocks" (2019/2022) all point to an increasing trend in the direction of unilateral space mining. However, a correct interpretation of Article II, 1967 relative to Title IV, would harmonize these instruments for a universal space mining protocol that spacefaring states and international organizations would rally under.

Conclusion

As demonstrated in this chapter, this 2015 U.S. public policy instrument on space mining is dreaded by some influential commentators as constituting a repeal of the 1967 OST and an erasure of the underpinning res communis designation of the outer space realm. Others even envisioned Title IV as a rollback of, and a frontal attack on, the 1967 OST and the notions of interstate cooperation, collaboration, and coordination going back to Grotius and Roman law, that underpin the 1967 OST, the UN Charter, and modern general (public) international law. This is alarming because those principles governing use of common spaces that do not belong exclusively to any nation are intended to keep the peace. But from the section-by-section unpacking of expert interpretations of Title IV above, it does not appear that the law risks a return to the Wild, Wild West, to an arms race that may result in a 21st century nuclear

confrontation among global states. Rather what is apparent is that experts vary in their comparative interpretive perceptions of Title IV relative to Articles I and II, 1967 OST. Chapter Five synthesizes the key theoretical perspectives of Title IV relative to Articles I and II, 1967 OST, especially how to conduct proper multilevel comparative analysis of both legal instruments to avoid the kind of Wild, Wild, West outcomes and doom scenarios dreaded by some experts.

CHAPTER FIVE

Synthesis

Beginning with an introduction to the necessity of a research study of multilevel theoretical perspectives of contemporary U.S. public policy on space mining, the first chapter revealed the problem posed by a lack of coherent legal framework to guide the emerging global interests in the massive financial opportunities inherent in the mining of strategic space mineral resources for private benefits. Noting the danger of a Wild-Wild West scenario in this novel domain in the absence of a congruent international space mining framework, the study took a tour of earlier legal and political thinkers that theorized against the backdrop of imperial logic and rivalrous conflicts over terrestrial resources. The thoughts of thinkers such as Hugo Grotius, John Selden, and John Locke helped in crafting two possible ways of approaching non-sovereign territories and resources – either as res communis Global Commons that are not subject to unilateral sovereign territorial appropriations or as non-sovereign res nullius unowned things subject to unilateral sovereign territorial or individual appropriations.

The crux of the matter is that "in an increasingly interdependent world, state sovereignty is inherently limited in order to protect the equal sovereignty of other states…" (An Hertogen 2016, 901). Classical and contemporary theorists faced the arduous task of defining the precise constraints on states in an ever evolving technologically driven sovereign reaches of global states to the equally evolving international spaces such as the high seas and outer space. These thoughts guided the 20th century post-WWII world in designing pivotal legal frameworks to construe interstate relations especially as modern rocket technology had opened up possibilities of extending the scope of national sovereign territorial boundaries and the reaches of global states.

Significantly, the post-WWII world operating under the auspices of the United Nations and the newly minted rule of general international law affirmed, as best practices, principles of cooperation, collaboration, and coordination among states and international organizations. To avoid the conflicts and wars (i.e., state of nature) that has historically befallen global states due to fights over non-sovereign territories and resources, the UN designated non-sovereign territories such as the high seas and outer space as *res communis omnium* global commons, not subject to sovereign territorial appropriations. Uniquely for outer space, states could reach that realm by means of innovative unmanned technologies operated from the terrestrial loci of states. The embryonic 1967 OST was then designed to constraint the propensity of states to unilaterally extend sovereign territorial influences beyond their terrestrial geographic boundaries by planting national flags there in order to keep others out.

Hence, the 1967 OST in Articles I and II, provided free, equal, access to explore and use outer space and celestial bodies, without the need for the loathed national appropriation of space or celestial bodies and territories. In the tradition of classical theorists confronted with the same dilemma, the drafters of the 1967 OST sought to avert potential interstate wars and global conflicts over outer space. This regime remained in force and unchallenged until a 2015 pivotal U.S. public law was enacted to permit U.S. legal entities to extract asteroid and space mineral resources for private benefits. This unilateral national legislation generated intense ongoing debates among influential commentators, expert theorists, and space actors at both the international and U.S. domestic levels. The major dueling perspectives are surveyed in this chapter in a synthesis of the competing interpretive frameworks of Articles I and II, 1967 OST relative to the Title IV, U.S. 2015 Space Act.

This chapter also articulates the novel propositions contributed by this researcher in furtherance of ongoing multilevel debates. This researcher adds two novelties to the ongoing discourse of space mining law and policy. First, the study proposes that contemporary theorists of space mining law and policy and their various theoretical constructs are best understood in a structured categorization of the competing views consistent with the underlying ideological spectrum that shaped a theorist's legal thoughts. The study demonstrates this in the synthesis of prevailing perspectives of space mining law and policy below. The research design descriptions shows how to identify the ideological elements in the extant theoretical works in the literature using the qualitative Grounded Theory research approach and the NVivo qualitative research software.

Second, to reinforce the pragmatic and realist perspectives (discussed below) that claim implicit presence of space mining activities in the 1967 Outer Space Treaty and perspectives of legal-historical analysis of the *travaux preparatoires* of international space law, this researcher proposes that the legitimacy of Title IV, U.S. 2015 Space Act—as having a solid basis in international law—is best definitively established on grounds of the 1927 "Lotus" principle of international law discussed below. This is due to the explicit silence of space mining policy in the body of general international law and its cognate international space law. The study substantiates this claim in the following synthesis of views, the policy tool of original intent analysis, the 1927 "Lotus" principle, and by way of key interpretive stipulations in the 1969 Vienna Convention on the Law of Treaties.

Specifically, this chapter articulates some key theoretical constructs that theorized whether Title IV has a solid basis in international law under Articles I and II, 1967 OST and related provisions of international space law. In addition, it presents a comparative survey of

some ongoing debates on some aspects of Articles I and II, 1967 OST and Title IV. From a thorough evaluation of these leading theories of space mining law and policy, what emerges is an overarching framework. Using Grounded Theory (Glaser and Strauss 1967), I show that a proper interpretation of the "non-appropriation" principle of Art. II, 1967 OST, would not necessarily or legally stand in the way of maintaining the space mining policy of Title IV, U.S. 2015 Space Act. Thus, this research study stands for the proposition that Title IV has a solid basis in international law when the totality of current theoretical constructs are considered and further strengthened through the lens of the 1927 "Lotus" principle and original intent policy analysis using the interpretive regime of relevant provisions of the 1969 Vienna Convention on the Law of Treaties (VCLT 1969). But first a summary of the research design demonstrates how the theoretical integration was performed leading to the synthesis in this chapter.

A Summary of Research Design: **Methodology** & **Method**

The nature of the phenomenon of dueling theoretical constructs space minerals policy being studied lends itself to a qualitative methodology. The method employed is Glaser & Strauss' (1967) classical Grounded Theory (GT). The GT process involved the use of the NVivo qualitative research software to upload, catalogue, and analyze a copious compendium of extant documentary data of space minerals mining policy themes, concepts, and theories. The data was drawn from the space policy empirical sources domiciled within the United Nations Office for Outer Space Affairs (UNOOSA), the UN Committee on the Peaceful Uses of Outer Space (COPUOS), the UN International Law Instruments library, and the U.S. Congressional Research Service. Most theoretical or secondary sources such as journal articles and books by experts on space policy were drawn from open access academic online domains and local libraries. These were organized, catalogued, and analyzed in an iterative open coding of space minerals policy

themes, axial coding of concepts, and selective coding of the dueling theories, for an over-arching theory that resolved the research question.

Document Analysis & Data Collection

Already published (extant) documents of outer space law and policy related primary and secondary sources documents and texts were sampled, gathered, and evaluated for relevance. The hundreds of such documents and texts that spoke to contemporary space minerals mining policy were ultimately catalogued and digitally uploaded to folders primarily created by this researcher for this research study purpose in the purchased version of the NVivo qualitative research software. The documents were organized digitally using NVivo to conduct the iterative Grounded Theory procedure that included theoretical sampling (using "word-cloud"), open, axial, and selective coding. Using the coding process, the documents were granulated or broken down into bites of thematic, conceptual, and theoretical research data. The prolific use of "word cloud" exposed the key terms and themes related to the elements of the ideological spectrum underpinning the extant document being examined (See the graph below)

Data Analysis

The study used a comparative, inductive foreign policy analysis process to examine the organized data pursuant to understanding the conceptual and theoretical construct emerging from the text being examined. This also assisted this researcher to understand how the emerging themes, concepts and theories could be relevant in constructing an overarching theory that helps to answer the question of whether Title IV has a solid basis in international law, and therefore, whether it is conceptually reconcilable with the 1967 OST and general international law. The gist of this inductive quest was to examine the orderly framework of space law and policy literature as data, and to uncover how those bits of data within the examined texts could be harmonized to

advance the needs of a modern international community under the 1967 OST, including the foreign policy goal of the United States in the prosperity of its legal entities under Title IV, U.S. 2015 Space Act.

A Space Minerals Mining Research Process

As used in this qualitative research study, the term "space policy" refers to the official approach of the United States to the mining of outer space and asteroid mineral resources. This sense comports with the perspectives of experts in this field who also agree that a ''space policy'' describes a nation's strategy regarding its civilian space program and the military and commercial utilization of outer space (Stuart 2013, 1-2). Further, according to Tronchetti (2013), "…space policies include both the making of space policy through the legislative process and the execution of that policy by civilian, military bodies, and regulatory agencies…" (ibid., ix). Thus, the dueling multilevel theories of space mining constitutes contemporary phenomena for qualitative research. Particularly since the prevailing theoretical constructs encompass the rules, norms, practices, and procedures governing multilevel space minerals extraction questions. Hence, the subject matter of space mineral resources exploitation policy lends itself both to Regime Theory (RT) literature examination and to a qualitative study methodology using the comparative inductive process found in Glaser and Strauss' (1967, 1-57) Grounded Theory technique. The classical GT technique employs the process of theorical sampling, open coding, axial coding, and selective coding in an iterative evaluation of the empirical and theoretical documentary data for answers to the specific research question of this study.

To properly investigate the empirical / primary source documents of space law and policy, this research study drilled into the ground or foundation of the 1967 OST (and its *travaux preparatoires*) and Title IV, U.S. 2015 Space Act (U.S. Congress Report Services), applying Glaser and Strauss' (1967) classical qualitative Grounded Theory (GT) method which is

normally used for qualitative studies of novel fields, such as the space minerals mining policy domain. In this GT process, the study employed the strategies of open (thematic), axial (conceptual), and selective (theoretical) coding, to granulate the collected empirical and theoretical documents of multilevel space law and policy into coded / labeled bits of data. And, in a constant comparison process, the study catalogued, categorized, and inductively analyzed the diverse sets of themes, concepts, and theoretical constructs in an iterative process. At the selective coding stage, the study drew from the categorized sets of data to isolate an overarching theoretical construct that helped to answer the research question. An account of the Grounded Theory method "Open coding" process is graphically detailed in the following representative graphs.

For instance, in the following graph of an initial "Word Cloud" conducted under the "open coding" category, by uploading Articles I and II, 1967 (as empirical source) and triggering "word cloud" one can see the absence of terms currently associated with space mining, such as "Asteroid resource," (open-coded, "AR"), "space resources" (coded "SR"), and "commercial recovery" (coded "CR"). In fact even an expanded "word cloud" of the entirety of the uploaded 1967 OST, the 1945 UN Charter, and the relevant UN General Assembly Resolutions leading up to the 1967 OST turned up similar absence of terms currently used in the 21st century for space mining activities. Conversely, a similar search in the 2015 U.S. Space Act generally, and Title IV specifically, yielded high counts of space mining terms and concepts.

Likewise, these same tests were conducted to uncover ideological terms and concepts underpinning secondary sources (i.e., theoretical texts) such as Tronchetti (2013; 2019), Von der Dunk (2017; 2019; 2020); Blount and Robinson (2016); Gangale (2016); and Oduntan (2012; 2015). Using color-coded "word-cloud" trigger that assigned different colors to ideological

streams such as Neoliberal, Pragmatic, Neorealist, and Nationalist the terms and concepts related to the characteristics (or elements) of an ideology became apparent, including the numerical occurrences in a given text. This helped in categorizing the texts and their author in the various theoretical blocks discussed below in this chapter. For purposes of required brevity, those graphs are not included in this version of the manuscript.

Table 4. Sample "Open Coding" using iterative "Word Cloud" in NVivo to identify, isolate, and code space minerals themes.

Key/Buzz Words	**Articles I & II, 1967 OST**	**Title IV, U.S. 2015 Space Act**	**Code (Label)**
Asteroid Resource (AR)	0	7 x (including in headings)	ARes.
Space Resource (SR)	0	16x (including in headings)	SRes.
Commercial Exploration (CE)	0	8x (including headings)	CEx.
Commercial Recovery (CR)	0	7x (including headings)	CRec.
U.S. Citizen (s)	0	7x	U.S. Citz.
Exploration	2x	10x	Expl.
Utilization / Use	3x (use); Utilization,1x (in Preamble 4(b))	5x – (Utilization 4x; Use 1x)	Utlz/Use
Authorization	0 (in Articles I & II); 1x (in Article VI)	2x	Auth.
Supervision	0 (in Art. I & II); 1x (in Art. VI)	2x (in 51302 (a) (3))	Supvs.
Obtain, possess, own, sell, transport	0	Obtain – 1x (51303); Possess – 1x (51303); Own – 1x (51303); Ownership – 1x (Sec. 403); Sell – 1x (51303); Transport – 1x (51303)	OPOST
United States	0 (in Art. I & II). 1x (as "Depository" in Article XIV (2)	12x	US
International	21x	4x	Int'l
International law	1x (in Art. I)	0	IL
Equality	2x – in Art. I & Art. X	0	Eq.
Outer space / space	4x (in entire1967 OST)	18x (including headings)	OS
Moon	30x (in entire 1967 OST): 3x in Art. I; 1x in Art. II.	0	CB (celestial body)
Asteroid (s)	0	8x	Ast.
Celestial bodies	34x	1x (Sec. 403)	CB
Int'l cooperation	1x (in Preamble). 1x (in Art. I)	0	IC
Int'l obligation (s)	0	4x (3x in 51302; 1x in 51303	IO
Appropriation	1x (in Art. II)	0	Approp.
Sovereignty	1x (in Art. II)	2x (in Sec. 403)	Sov.

Exclusive	1x (in Art. IV – exclusively for peaceful uses)	1x (in Sec. 403 – exclusive rights or jurisdiction…).	Excl.
Mankind	4x (2x in Preamble; 1x in Art. 1; 1x in Art. V).	0	Mknd.
States / nations/countries	States – 41x; Nations - 13x; Countries – 1x	States, as in other countries – 0; Nations – 0; Countries – 0	SNC

The Overarching Theory

The overarching theory is that Article II, 1967 OST and Title IV, U.S. 2015 Space Act can straightforwardly be harmonized and are compatible. Together, these instruments are mutually compatible with the needs of a modern 21st century international community seeking responsible extraction of outer space mineral resources for private benefits. Hence, this research study finds that under the better, more coherent, and plausible legal interpretation of contemporary multilevel space minerals mining policy, there is no inherent incompatibility between the *res communis omnium* philosophical basis of Article II, 1967 OST that protects the overall interests of the co-equal sovereign nations of the world, and the *res nullius* policy framework of Title IV, U.S. 2015 Space Act that provides a rational legal framework for the enrichment of all nations through space mining. Thus the U.S. does not need to unilaterally modify or withdraw from the 1967 OST in order to implement and actualize the policy goals of Title IV, Sec. 51301-03, U.S. 2015 Space Act. This finding does not however foreclose the ongoing nuanced and dueling policy debates by influential commentators on the implications of Title IV for certain provisions of the 1967 OST and general international law.

Who can Engage in Space Mining: States or Private Space Actors?

Scholars are still debating to what extent Article II, 1967 OST applies to private actors, and the scope of limitations it places on the ability of States to enable private space actors. According to Blount and Robinson (2016) and Von der Dunk (2017; 2019), Article II, 1967 OST,

is extended to private actors through Article VI - which imputes to States “international responsibility” for their non-governmental actors. The effect of this Article VI clause is that States will not pass an international obligation to the individual that would result in an international crime (Blount and Robinson 2016, 166; Von der Dunk 2019). Rather, Article VI makes the acts of non-governmental actors attributable to the State as contemplated by international law under Article 11 of the UN 2001 Articles on State Responsibility for Internationally Wrongful Acts (UN Legal 2001, Responsibility of States for Internationally Wrongful Acts, Articles 1- 59).

Article 11 of the 2001 “Responsibility Act” provides that “Conduct which is not attributable to a State under the preceding articles shall nevertheless be considered an act of that State under international law if and to the extent that the State acknowledges and adopts the conduct in question as its own” (ibid., Chapter II, Art. 11). According to the foregoing experts, it means that a State is obligated to maintain control over all commercial actors, but it must extend rights and obligations to them within a narrow jurisdictional framework constructed by Article II, Article VI, and Article VIII of the Outer Space Treaty (Von der Dunk 2002; Blount and Robinson 2016). Thus, commercial activities are limited by a State’s ability to authorize space activities that would result in Article II, 1967 OST prohibition of “national appropriation” of space, celestial bodies, including the Moon.

Yet questions still remain on what scope of activities a State can control without appropriating space or celestial bodies in breach of the “non-appropriation” principle of Article II, 1967 OST. According to Blount and Robinson (2016), this is “the central question raised by Title IV of the CSLCA.” The issue is whether the principles of res communis prohibit the exploitation of removable resources in outer space? Although Article II does not explicitly

prohibit or permit the extraction and appropriation of natural resources, this is a critical point of much disagreement in the literature of Article II that was surveyed in this study as discussed in the synthesis of theories in Chapter Five below. Is there necessarily a connection between appropriation of the real estate of space / celestial bodies and resource extraction, and does one equate or entail the other? Experts disagree based on underlying ideological visions of space and preferences of legal authority in that sphere (international versus national) (IISL-American Branch 2016/2022).

Despite the lack of a textual, affirmative prohibition or permission of space mining activities in particular in Article II, most experts agree that it does place some limitations on States vis a vis their ability to extract resources because of the frustration of incentives for states to expand their sovereign territorial boundaries through occupation and use of outer space or celestial bodies. Von der Dunk (2017) averred that by designating outer space and celestial bodies as Global Commons, Article II eliminated colonial impulses of states, but the bar does not constitute a legal barrier to space resources mining. Yet, not every kind of space activity can be permitted such as the deployment of weapons of mass destruction or subtle territorial claims under the guise of space mining on a particular space location or celestial body such as an asteroid. Regardless, Blount and Robinson (2016) highlight that an undefined gap still exists between the act of "appropriating" space resources versus the act of either "using" space resources or using space generally as permitted in Article I, 1967. These nuances cannot be resolved in this policy study since these are purely matters of legal technicalities reserved for space law experts – who are currently debating these.

This research study argues that the drafters of the 1967 OST properly barred sovereign territorial ambitions from being extended to space under Article II, 1967 because the express

policy of the 1945 UN Charter recognized the equality of states and the limits of sovereignty. In a postcolonial rule of international law, the principle of equality of states and limitation of sovereignty were adopted to prevent the rivalrous spatial expansions of imperial borders, which had already resulted in two World Wars, the geopolitical tensions of post-WWII Cold War, and Space Race. However, under original intent analysis, this study did not find corroborating evidence that the drafters of the 1967 OST intended to use Article II's "non-appropriation" principle as an all-time complete bar against space minerals mining policies by states, individuals, or international organizations.

Article II, 1967 OST - The Territory vs. Property Debate

Blount and Robinson (2016, 169) averred that the current theoretical debates over the legality of Title IV relative to Article II, 1967 is due to some scholars interpreting Article II to implicate property rights directly. The term "appropriation" is primarily concerned with the expansion of State territory, not property (ibid.). "It is the indirect connection between the spatial concepts of territory and property that creates an unresolved ambiguity…." (169). According to some experts, the general prohibition in Article II, 1967 OST against claims of territorial sovereignty over outer space, celestial bodies, including the Moon, extends to the exploitation of space natural resources (Tronchetti 2019, 769-813).

For instance, Gorove (1977) asserted that "Any use involving consumption or taking [of natural resources] with the intention of keeping for one's own exclusive use would amount to appropriation" (82). In this rationale, Tronchetti (2009) and Gorove (1977) interprets "appropriation" in the 1967 OST to read that "because the Outer Space Treaty never makes a distinction between outer space and its natural resources . . . the term outer space must be understood as resources. Moreover, the appropriation of natural resources for the exclusive benefit of the user appears to be in contrast with Article I" (32).These interpretations "compress

territory, real property, and chattel property in such a way that resource extraction is a functional equivalent to appropriation" (Blount and Robinson 2016, 170). But resource extraction cannot be equivalent to space territory or real estate itself.

Other commentators such as Von der Dunk (2017), Bin Cheng (1997), Blount and Robinson (2016) make the distinction between space territory (generally protected by Article II) and space natural resources (not specifically addressed in the 1967 OST). Some authorities such as Lachs (2010) rejects the notion of outer space as "res" or thing, to emphasize its appropriateness as international space, a sphere, or realm– which no state can appropriate for itself to the exclusion of all others. These experts contend that the right to freely explore and use outer space under Article I, 1967 OST, is analogous to the rules underlying other international spaces such as the high seas where fishing is permitted without any part of international waters being subject to territorial sovereignty of any states (Von der Dunk 2017).

For outer space, the crux of the reasoning is that international law grants spacefaring States and private actors the right to appropriate outer space natural resources (Von der Dunk 2017). These actors may conduct space mining as long as their activities does not involve any permanent appropriation of the areas from which the resources are appropriated and meets all other obligations under relevant provisions of the 1967 OST and international law(ibid.). And, Von der Dunk (2020) has interpreted the "freedom of use and exploration" as implicitly including space mining regardless of the lack of any express mention of the terms "space mining" or "commercial extraction" of natural resources within the text of the 1967 OST. This insightful interpretation bodes well for the compatibility of Title IV with the 1967 OST because the space mining policy which is implicit in the 1967 OST became more explicit in Title IV – hence the two legal instruments cohere. But this new reality raises more questions.

What constitutes “permanent” or “temporary” mining operations duration for purposes of Article II, 1967 OST, is a legal question for experts to resolve as the field of space mining evolves. Nuances also arise as to whether a particular rich deposit piece of space body or real estate would be freely accessible to all comers per Article I, 1967 OST; and whether resource areas could be reserved or rented out over long durations as in terrestrial fossil fuel and other resources mining laws. In addition, subject to Article I and Article IX, of 1967 OST, such activities should not prevent others from conducting the same activities (IISL 2015, 1-3). Thus, Article II, 1967 OST is interpreted by most experts as having specific application to the concept of territory and not to property (Blount and Robinson 2016). Hence Article II functions to exclude the outer space realm from the territory of States to international space of global commons (ibid.). Therefore, “appropriation” only occurs when property rights flow from territorial claims. What then is the legal condition of property in international spatial areas?

Property in the International Spaces

The spatial areas that do not belong within any particular sovereign borders of States are known in international law as either “res communis” (Blount and Robinson 2016), “terra communis” (Tronchetti 2019), or “Global Commons” (Von der Dunk 2019). Scholars are at odds with these terms and how they use them. For instance, Hertzfeld, Weeden and Johnson (2015) argue that the use of these terms leads to “pitfalls’ in the interpretation of space law and policy because these terms are not explicitly used in the text of the 1967 OST. In this view, problematic terms include, “space is a global commons,” “common pool resources,” “anticommons,” “res nullius” and “res communis” (Hertzfeld, Weeden and Johnson 2015, 1). They concluded that “In reality, none of these terms clearly fits the full legal or economic conditions of outer space, and none of them provide an adequate framework for the future handling of space resources, space exploration, or even for resolving the unavoidable future issues when there will be competing

interests or major accidents occurring in outer space…" (ibid., 1). But authorities differ on this perspective because the use of legal analogies and typologies is well rooted in international law.

For instance, Blount and Robinson (2016, 170-171) contend that those who reject the designation of outer space as "global commons" always run into mistaken analysis of Article II as primarily concerned with property and engage in a historical analysis of "commons" which obfuscates the actual meaning of that provision. Moreover, most authorities consider some of these terms, including "global commons" as permissible legal typologies that provide interpretive meanings to space law concepts and theories (Tronchetti 2013). In this sense, "global commons" has two aspects and denotes an area outside of or beyond the sovereign control of a nation-state and not subject to claims of any state's territorial sovereignty (Blount and Robinson 2016, 171). Namely, "global commons" is a legal typology and has general legal content.

"Global Commons" as Typology of Legal Space

According to Oduntan (2012), the term "global commons" is a typology of legal space in international law. The root of the term "commons" is found within Roman law and English common law but has traditional applications to economic or property interests (Hertzfeld, Weeden, and Johnson 2015, 5-6). But in modern international law, the term "commons" does not refer to "property" but describes a settlement of territory (ibid.). Blount and Robinson (2016) explain that "While economic and property interests are implicated in spatial settlements, international law is structured through the broader allocation of territory among sovereigns to avert international conflict…." (171). Thus, micro economic and property interests are encapsulated within the macro territorial sovereignty of states (ibid). Each state manages those internal economic and property interests within its sovereign territory.

Beyond the territorial boundaries of states are the non-sovereign territories that cannot be owned by any state (Von der Dunk 2002; Tronchetti 2013). International law employed the typology of "global commons," to categorize this spatial matrix, which is "primarily about rights of exclusion maintained by States…." (Blount and Robinson 2016, 171). This means that as an area that is outside of the sovereign control of a nation-state and not subject to claims of territorial sovereignty, each state has the right to contest any extensions of sovereign territorial intent or activity by any other actors in the Global commons (Tronchetti 2014). No state can own it, but all have access to "use" global commons domains contingent upon applicable international regulations. Article I, 1967 guarantees the right of freedom of "exploration and use" to all states on the basis of equality and without discrimination.

Lex Specialis **in the Global Commons**

As a legal typology, the term "global commons" only has general legal content and can only describe the legal state of a global commons in the least restrictive sense. It follows that each commons has its own unique *lex specialis* that applies within the framework of international law (Von der Dunk 2019). According to the *Oxford Guide to Latin in International Law 1st ed.*, the maxim, *lex specialis derogat legi generali* (special laws repeal general laws) describes the difference between specific, unique regulatory mechanisms that address narrower matters and the general nature of the principles of international law. Thus, *lex specialis* is principle according to which a rule of *lex specialis* is deemed to apply notwithstanding contrary general principles of international law (Aaron X. Fellmeth and Maurice Horwitz 2011, in *Oxford Guide to Latin in International Law*, 1st ed., online, 1).

The priority given to *lex specialis* is "considered justified by the fact that the *lex specialis* is intended to apply in specific circumstances regardless of the rules applicable more

generally where those circumstances may be absent" (ibid., 1). For instance, the non-sovereign domains of the high seas, the deep seabed, Antarctica, and outer space all have distinct specialized legal regimes that create unique rights and obligations for States, such as Article VI, 1967 OST licensing and continuing supervisions responsibility of states over national space activities of their legal entities. This means that even though no state can claim sovereign territorial rights over any parts of outer space, national sovereignty still plays a role in regulating the outer space global commons through personal jurisdiction under Article VI and "quasi territorial jurisdiction" over registered space objects and personnel in them (Von der Dunk 2002, 462-481).

Extensions of National Sovereignty to Specific Areas of "Global Commons"

According to (Blount and Robinson 2016, 171-172), in actuality, the creation of unique rights and obligations for States "means that for each "global commons" [the high seas, the deep seabed, Antarctica, and outer space] States are free to adopt a *lex specialis* that they perceive as the proper balance between international peace and security and their own self-interests. Each "commons" results from a settlement that reflects the physical characteristics of the area, current technology, historical perspectives, and specific geopolitics at the time of negotiation" (171/172). Under such consideration, States can allow for the presence of national jurisdictions within the "Global Commons" spaces (ibid.).

This is then how the national sovereignty of states is exercised in the non-exclusive outer space "Global Commons" - through such routes as personal jurisdiction over the legal entities licensed and continually supervised under Article VI, and "quasi-territorial" jurisdiction under the registration regime of Article VIII (Von der Dunk 2002, 462, 481). Particularly, as the focus in space shifts from the founding era military/security concerns to Cold War geopolitics, late 20th

century emphasis on radio / satellite economics, and 21st century evolving commercial interests in space tourism and space minerals mining, this translates to changing perceptions, uses, and relevance of the legal concept of sovereignty in space activities like space mining (ibid., 481).

Appropriation of Space Territory v. Extraction of Space Minerals

A current open issue confronting the continued exercise of jurisdiction-based sovereignty in global commons revolves around the contention of some authorities that a violation of the "non-appropriation" principle of Article II, 1967 occurs with any unilateral extractions of space minerals or placing of national flags on any part of space real estate or celestial body (Tronchetti 2019). In the new policy domain of space mining, the question is whether an appropriation of territorial sovereignty occurs "by any other means" in violation of Article I, 1967 OST through commercial extraction of outer space natural mineral resources under national jurisdiction regulations like Title IV (Blount and Robinson 2016). The various competing views on this issue shape the contemporary theoretical schools discussed elsewhere in this study. Von der Dunk (2017) and Blount and Robinson (2016) demonstrated that analogies drawn from the 1982/2004 UN Convention on the Law of the Seas and the 1959 Antarctic Treaty establish that legal extractions of natural resources within specific limits in these global commons spaces does not constitute an appropriation of territorial sovereignty "by any means" because no international spaces are taken in the process.

Further, the specific clauses in these instruments clearly define the scope of natural resources extraction within these international spaces. For example, in Article 87 of 1988/2004 UNCLOS, the "high seas" is an area of broad liberal usage in which the extraction of resources from the deep seabed is governed by an international authority as stipulated by Articles136, 137, and 156. Similarly, Article 7, of the January 14, 1998, Protocol on Environmental Protection to

the Antarctic Treaty, prohibits any commercial exploitation of mineral resources in Antarctica. Under these considerations, "resource extraction for commercial purposes therefore can be interpreted as a valid "use" under general international law that govern international global commons. Therefore, the lack of a specific clause prohibiting space minerals extractions within the body of the 1967 OST indicates that the extraction of those resources was considered a valid "use" within the *lex specialis* of outer space (Blount and Robinson 2016, 172)

A Novel Contribution by this Researcher: Emerging Theoretical Perspectives

This research study examined some sets of contemporary theoretical perspectives that are currently debating the legal and policy implications of emerging national space minerals mining policies, such as Title IV, on the well-established principles of international space law under Articles I and II, 1967 OST and related provisions. The primary question that guided this aspect of theoretical delineation process in space law and policy literature was whether the rights purportedly granted by the national law of Title IV, U.S. 2015 Space Act are with or without solid basis in the existing international legal regime under Articles I and II, 1967. In a unique application of foreign policy analysis to the emerging field of space mining policy, this study identified, categorized, and organized these evolving leading theoretical constructs using the thematic, conceptual, and theoretical processes of the Grounded Theory method of literature organization and analysis. This researcher evaluated relevant interdisciplinary theoretical texts under response-categories such as "Yes," "No," "Possibly," "Absolutely / Necessarily," "Inherently" relative to the research question: Does the U.S. national level right to extract asteroid or space resources for private benefits under Title IV have a solid basis in international space law and general international law?

To test which theoretical perspective a space law and policy expert fits into, the collected published works of that scholar was uploaded in digital form to the NVivo Qualitative Research

Software. An initial “Word Cloud” of each of the collected text would highlight the dominant terms and themes used in that text. Those terms and themes were then used to query the types of concepts in the space law and policy literature that commonly used them. From the identified occurrences, themes were matched to concepts, and the specific concepts were then traced to instances of their occurrences in a theoretical construction that analyzed the question posed above, within the collected texts. The same process was used to pinpoint ideological underpinnings of each theory in the texts examined for this research study. While this criterion may not be universally practiced in every qualitative research study of this field, it fits within the classical Grounded Theory recommended by Glaser and Strauss (1967) for little known novel domains such as the space minerals policy sphere.

Based on this process the study organized the results of the contemporary theories that were uncovered under the analytical captions that reflects their general dispositions towards Article II, 1967 OST versus Title IV, U.S. 2015 Space Act. The Directorate of Research (American Branch) of the International Institute of Space Law (IISL 2016/2022, 8-9) organized contemporary outer space sovereignty debates along the lines of “monist” versus “dualist” perceptions based on whether a commentator advocates the primacy of international law in that realm (monist) or allows for both national and international law to govern the outer space geophysical and spatial territory (dualist). Under this distinction, the “monists” do not distinguish the spatial and geophysical outer space from any mineral resources deposited therein and are inclined to reject contemporary national space mining frameworks such as Title IV, while strictly applying the provisions of the 1967 OST and principles of general international law to shield the space realm from all forms of national encroachment (ibid.).

Also, monistic perspectives involve perceptions of whether international law alone (strict internationalist) or domestic national space regulatory schemes (strict nationalist/populist) must govern the space policy domain in question (ibid.). To the contrary, “dualists” and variants drawn from it tend to recognize a distinction between mineral resources lodged in spatial / geophysical outer space from the political issue of sovereign territorial takings in outer space. In addition, dualists generally consider reasonable national space legislations, such as Title IV, as an integral part of the wider development and progression of international space law. Thus, dualists mostly would restrict the “non-appropriation” principle of Article II, 1967 OST to protecting space real estate from sovereign territorial appropriation, while natural resources may be lawfully extracted, but not under Title IV, instead under Article 11, 1979 Moon Agreement (IISL-American Branch 2022, 8-9).

What this research study contributes to this is to further widen the monist-dualist category into a broader category that accounts for specific political ideologies that drive particular space mining legal philosophies relative to comparative perceptions of Articles I and II, 1967 OST and Title IV, U.S. 2015 Space Act. On this analytic basis, the emerging theoretical constructs include strict non-appropriation/inherent incompatibility (monist), pragmatic appropriation/mild compatibility (dualist), realist appropriation/strong compatibility (dualist), nationalist hegemonic appropriation/Absolute compatibility (monist). The institutional theoretical positions of the IISL (2015), The Hague International Space Resources Governance Working Group (2019), and the IISL-American Branch (2022), are also articulated as parts of an emerging international theoretical construct that contributes to the general theoretical landscape of contemporary space minerals mining law and policy.

The Harmonized Appropriation/ Mutual or Inherent compatibility (dualist) is the proposition of this research study. Finally, respectively, each theoretical category was assigned their explicit or implied operational principle – whether Cooperation, Collaboration, Coordination, Revoke Title IV (Multilateral only), Retain Title IV and Remain in 1967 OST (Moderate / Pragmatic), Modify 1967 OST, Revoke/Withdraw from 1967 OST (Unilateral / Nationalist). These categories are not arbitrary, but arguably sine qua non in streamlining and understanding contemporary literature and theoretical constructs of modern space mining law and policy.

Strict Non-Appropriation / Absolute Incompatibility Theory (Monist)

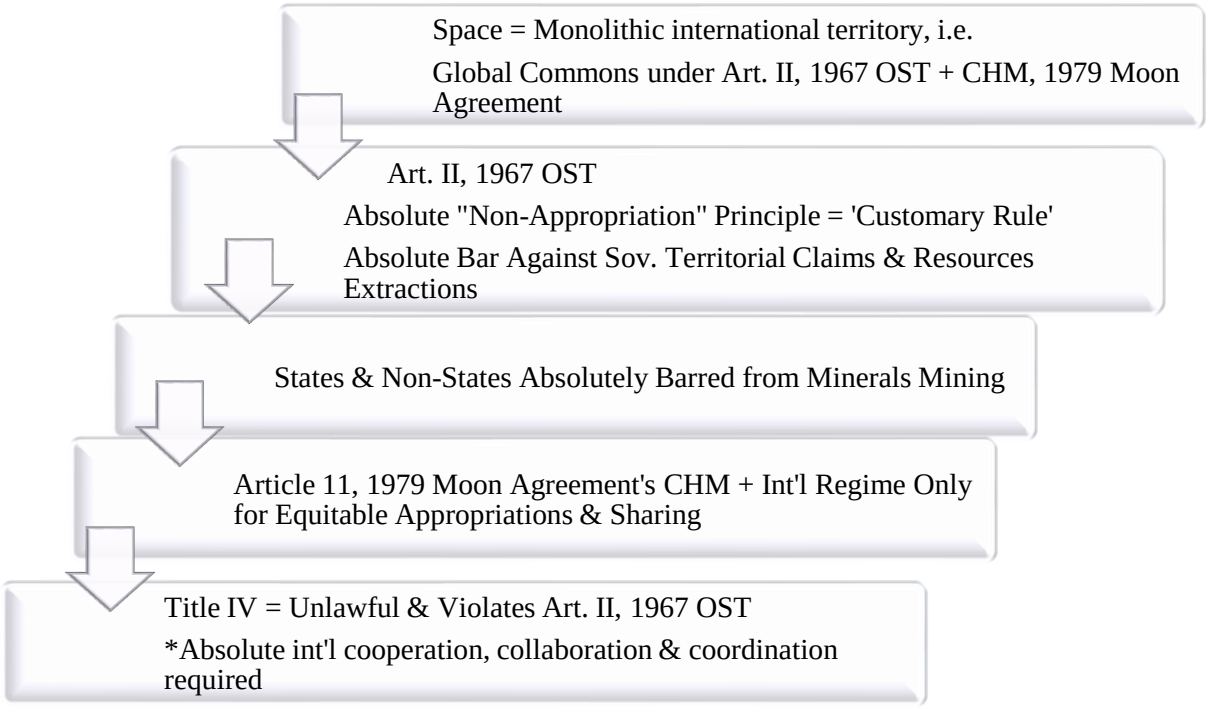


Fig. 8. Summary of SNA / AI Theory

To the question of whether the rights purportedly granted by the national law of Title IV, Sec. 51303, U.S. 2015 Space Act are with or without solid basis in the existing international legal regime under Articles I and II, 1967, this body of literature unanimously indicated a strong

"no, without solid basis" in the 1967 OST. The strict non-appropriation theory argues that outer space and its natural resources cannot be appropriated by states or private space actors, and that emerging unilateral national space mining policies, such as Title IV, are *per se* inherently incompatible with international space law, and violate international law (Tronchetti 2019). These national frameworks should be revoked. The rationale is that the non-appropriation principle of Article II imposes an absolute bar against States extensions of territorial sovereignty to the space realm in order to protect the equal sovereignty of other states in that "global commons" realm (Oduntan 2012; 2015). Consequently, states can neither exercise property rights over any part of the space territories and their natural resources, nor assign those non-existent rights to private actors or legal entities (Jakhu and Dempsey 2017). Thus, this theory bars both state imperium and dominium when extended directly or indirectly to the outer space territory and/or mineral resources (Tronchetti 2007).

In a 2015 article in The Conversation, captioned, *Who Owns Space? U.S. Asteroid-Act is Dangerous and Potentially Illegal*, space law expert, Gbenga Oduntan (2015) argued that the U.S. space mining policy "…goes against a number of treaties and international customary law which already apply to the entire universe….The act represents a full-frontal attack on settled principles of space law which are based on two basic principles: the right of states to scientific exploration of outer space and its celestial bodies and the prevention of unilateral and unbridled commercial exploitation of outer-space resources. These principles are found in agreements including the Outer Space Treaty of 1967 and the Moon Agreement of 1979" (1-2). Given that this perception is commonly shared among most theorists in this category, the implication is a general consensus on the revocation of Title IV as a frontal attack on, and inconsistent with, the 1967 OST.

Arguably, Title IV enumerated only commercial property rights over asteroid or space minerals “extracted” and nothing more (Title IV, Sec. 51303, U.S. 2015 Space Act). By contrast the 2014 American Space Technology for Exploring Resource Opportunities In Deep (ASTEROID) Space Act, H.R. 5063, explicitly granted property rights to commercial space mining operators over space natural resources (113th U.S. Congress 2014, ASTEROID Space Act). Hence, the rights granted by Title IV are narrower than the rights granted in the originally proposed ASTEROIDS Act of 2014 that was amended along with H.R. 1508 – the Space Resources Exploration and Utilization Act of 2015 - to become Title IV or CSLCA of Public Law 114-90 signed into law by President Obama on November 25, 2015 (CRS 2015/2016 - Space Resources Exploration and Utilization Act of 2015, H.R. 1508, 114th Congress 2015). Thus, contrary to the concerns of strict appropriation theorists, this specific narrow regulation of space minerals makes Title IV and space actors operating under it less likely to breach the “non-appropriation” principle of Article II, 1967 OST. Moreover, Title IV, Section 403 explicitly disclaims sovereign territorial intents and acts under its authority.

The strict non-appropriation framework reinforces rigid international conformity of all states with the norms of international cooperation, collaboration, and coordination mechanisms of international law and international space law based on the 1967 OST and the 1979 Moon Agreement (regardless of the non-customary status of the Moon Agreement), with potential sanctions and/or punitive consequences otherwise (Tronchetti 2019; Oduntan 2012/2015). And this perspective proposes that space and its resources are the “Common Heritage of Mankind” and that only a futuristic international regime under Article 11 of the 1979 Moon Treaty can conduct an equitable space mining for equal sharing of proceeds to all humanity (Tronchetti 2013; 2019, 769-813). Some key proponents include experts like Gorove, Tronchetti, Oduntan,

Jakhu and Dempsey, amongst others. Some key distinctions between these theorists and the pragmatists are their opposing interpretations of the "non-appropriation" principle, the role of national space mining instruments, and dueling perceptions of the nature of the outer space territory versus mineral resources lodged within that sphere.

Pragmatic Appropriation / Conditional Compatibility Theory (Dualist)

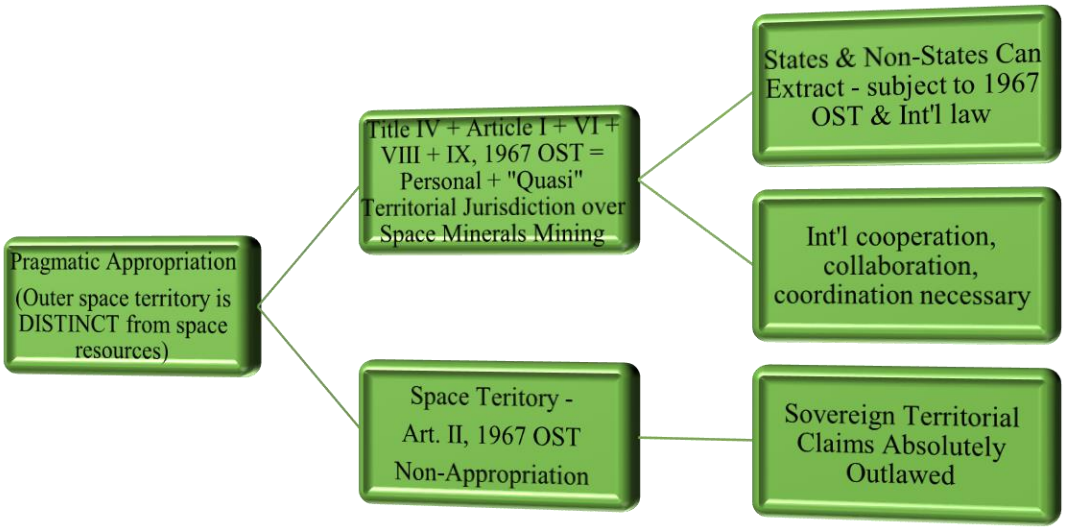


Fig. 9. Summary of PA / CC Theory

To the question of whether the rights purportedly granted by the national law of Title IV, Sec. 51303, U.S. 2015 Space Act are with or without solid basis in the existing international legal regime under Articles I and II, 1967, this body of literature unanimously indicated a "yes" possibly with a solid basis in the 1967 OST. Pragmatic appropriation theorists contend that international space law cannot be considered interpretively static or fossilized in time, rather it should be amenable to changing realities of the science, technology, politics, and law of the outer space policy domain, such as the emerging national space minerals mining frameworks (Rapp

2018). The rationale is that space is made freely accessible to all states by virtue of Article I, 1967 OST's freedom of exploration and use (Von der Dunk 2017). And through the licensing and continuing supervision responsibility of states under Article VI, liability of Article VII, the registration regime of Article VIII, and the due regard and avoidance of harmful interference clauses of Article IX, states are required to exercise national jurisdiction over their private space actors, their space objects, and activities (Von der Dunk 2020, *Advanced Introduction to Space Law*, 1-41).

Particularly, unlike the strict non-appropriationists, the pragmatic appropriation perspective makes a distinction between the space sphere / territory as terra or res communis versus outer space natural mineral resources deposited therein. The international space territory is absolutely protected under the "non-appropriation" principle of Article II, 1967 OST, while space minerals deposits can be extracted by States or the private space sector, subject to applicable provisions under the 1967 OST and national space policies such as Title IV, U.S. 2015 Space Act (Von der Dunk 2017; IISL 2015, 1-3). The pragmatic theorists argue that states and private actors may conduct space mining if: 1. No sovereign territorial takings occur in any part of space under the guise of space mining; and 2) the national actors and the applicable national space mining laws carry out space mining in conformity with all other international obligations, duties, requirements, and conditions in analogous provisions of the 1967 OST, and general international law, including the 1945 UN Charter (Von der Dunk 2002, 462-481). This reinforces that national sovereignty is absolutely barred in outer space, but states can only employ national jurisdictional routes provided under the 1967 OST, such as Article VI licensing and continuing supervision responsibility. Also as Von der Dunk (2002, 33-37) has averred, states can also

exercise jurisdiction on a quasi-territorial basis to space objects registered by a state, through the detailing of the key elements of such registration under Article VIII, 1967 OST.

In this sense, pragmatic appropriation theorists propose that the emerging national space mining frameworks, such as Title IV should not be dismissed entirely and should be retained as a possible state interpretation of Article II (Von der Dunk 2017; Rapp 2018). The reason is that because space mining activities were not directly addressed in the 1967 OST, and do not appear to be explicitly prohibited within the text and *travaux preparatoires* of international space law and could be implicitly found within interpretive notions of "use" of outer space under Article I, 1967 OST (Von der Dunk 2017; Rapp 2018). Further, as a general legal framework, the provisions of the 1967 OST on space mining activities are mostly vague, imprecise, or very broadly formulated and open to interpretations, such as the "exploration and use" in Article I, and the "non-appropriation" principle of Article II, 1967 OST (Rapp 2018). Thus, given the apparent lack of conclusive guidance in the 1967 OST on space minerals mining, the emerging national frameworks should be interpreted in the light of the new realities of space mining, especially the evolving national level space mining economies and industries seeking regulatory guidance (ibid).

Article VI, 1967 OST imposes an international state responsibility for the undertaking of national activities in outer space (Von der Dunk 2017). Therefore, "resort to domestic lawmaking is a way of crafting a legal framework to ensure compliance of the domestic space activities with the international embedding principles, obligations, and commitments, such [as] safety standards and debris mitigation and prevention (Rapp 2018, 1). Also, since under Article VI, states bear the obligation to authorize, supervise, and control activities of nongovernmental entities in outer space, "national regulation is seen as the plausible devised mechanism to regulate individually

commercial space activities, inherently risky, pursued by private actors" (ibid.). On these grounds, Title IV, U.S. 2015 Space Act is not necessarily at odds with international space law and international law. Moreover, the various States are best positioned to anticipate particular issues that are far removed from the broader focus of the UN world body.

Pragmatist theorists particularly require that national space mining laws comply with all other relevant conditions, obligations, and requirements of international space law and international law, including the 1945 Charter of the United Nations (Von der Dunk 2017). Some even recommend aspects of the 1979 Moon Agreement as necessary cognates in this endeavor. Thus, under the pragmatic approach, Title IV could be upheld without fatal impact on Articles I and II, 1967 OST and vice versa, subject to regimes of international cooperation, collaboration, and coordination in actual implementation of space mining policies (IISL 2015). In addition to notable individual experts like Von der Dunk (2017; 2019; 2020) and Rapp (2018), there are institutional architects of the pragmatic approach.

Some of these include, the 2015 position paper on Space Resource Mining issued by the IISL (IISL 2015, 1-3); the "Draft Building Blocks for the Development of an International Framework on Space Resource Activities" issued by the Hague Space Resources Governance Working Group (The Hague International Space Resources Governance Working Group 2019, ; and the COPUOS report on potential legal models for activities in the exploration, exploitation, and utilization of space resources (COPUOS 2022/2023). The "Draft Building Blocks" (2019) draws from both the established space principles in the 1967 OST and the newer Title IV resources instrument to propose various measures to guide future space resource activities and suggests that this policy domain should be incrementally addressed on the basis of contemporary technology and practices.

The 2015 IISL position paper on Space Resource Mining summarizes the pragmatic position thus: “Therefore, in view of the absence of a clear prohibition of the taking of resources in the Outer Space Treaty one can conclude that the use of space resources is permitted. Viewed from this perspective, the new United States Act is a possible interpretation of the Outer Space Treaty. Whether and to what extent this interpretation is shared by other States remains to be seen…” (IISL 2015, II.2, p.3). This notion of Title IV as “a possible interpretation of the Outer Space Treaty” is a key distinction between pragmatic appropriation theorists and Realist appropriation theorists who unambiguously hold that Title IV is a valid state interpretation. The pragmatic theory recognizes that this is still an open question that would be answered by how other national space policy jurisdictions ultimately responds to Title IV.

Neo-Realist Appropriation / Necessary Compatibility Theory (Dualist)

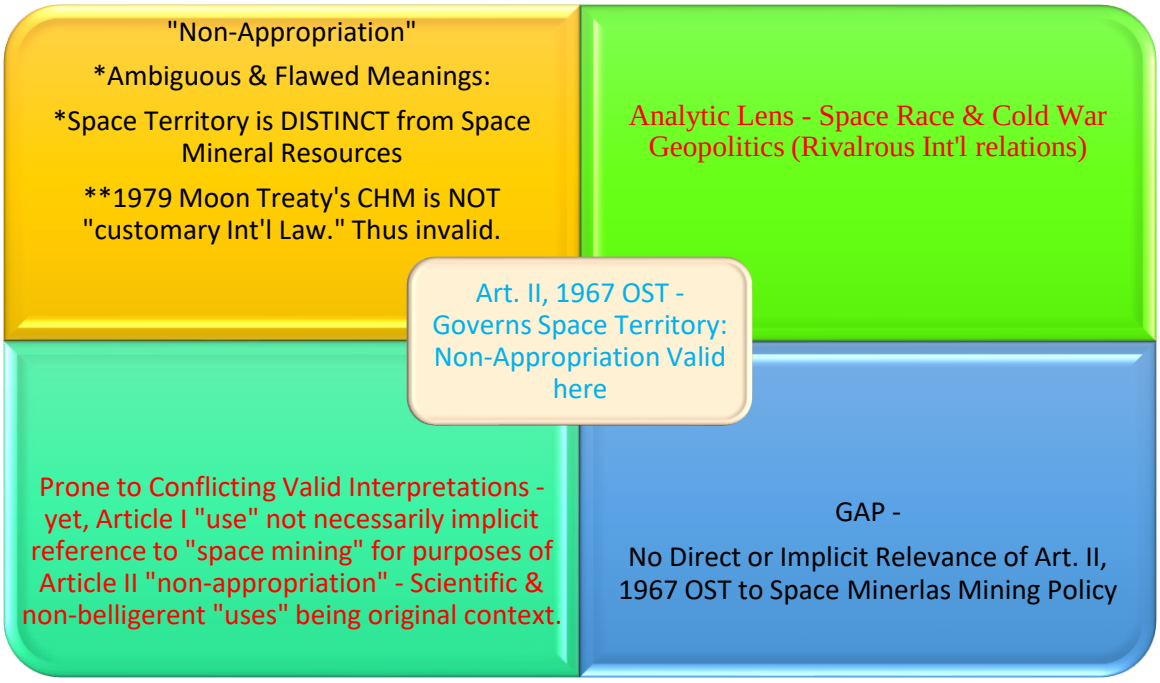


Fig. 10. Perceptions of Article 11, 1967 in NRA / NC Theory

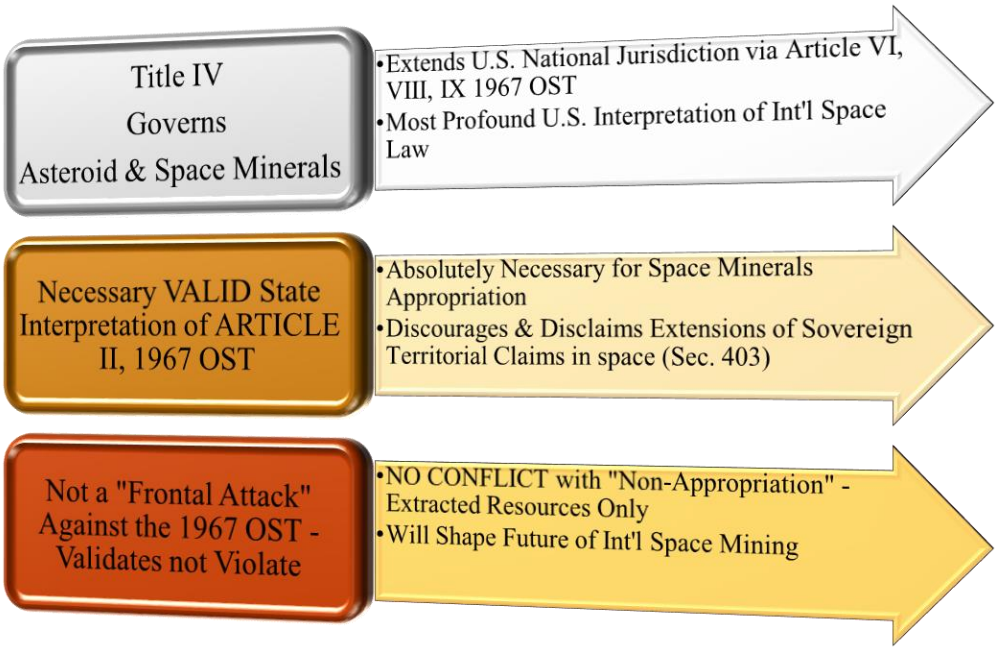


Fig. 11. Perceptions of Title IV in NRA / NC Theory

To the question of whether the rights purportedly granted by the national law of Title IV, Sec. 51303, U.S. 2015 Space Act are with or without solid basis in the existing international legal regime under Articles I and II, 1967, this body of literature unanimously responded with a "yes…absolutely / necessary" affirmation. The Neo-Realist appropriation theory is a variant of the pragmatic appropriation view because they are both unwilling to dismiss national level space mining policies as "frontal attacks" against the 1967 OST (as strict appropriationists do) without adequate rigorous analytic consideration. However, compared to the pragmatic appropriation view of Title IV as a "possible" interpretation of Article II, the neo-realist approach argues that Title IV "is" a valid state interpretation of Article II, 1967 OST (Blount and Robinson 2016). This is because "it is reasonable to interpret Title IV as legislation that represents a step towards defining the content of Article II and the law concerning the specific activity of space mining" (Blount and Robinson 2016, 180-182). In other words, Title IV is necessarily compatible with

the unexpressed vision of space minerals mining policy development in the interpretive scope of the 1967 OST.

Another difference is that the neo-realist theorists are more oriented towards the "Right" of the U.S. national ideological grid and highlight asymmetrical and conflictual perceptions of the international system, including international space law and policy domain. Hence, the neo-realist theorists primarily approach comparative interpretations of the relevant international provisions such as Article II, 1967 through a realist prism of international relations. In short, for Von Der Dunk's (2017; 2019) pragmatic approach to Title IV relative to the 1967 OST, international law is the starting point, whereas for Blount and Robinson (2016), and Gangale (2016) (being, after all, US citizens) national law is the starting point. Yet, both the pragmatic and neo-realist perspectives share common dualist visions of the space realm, distinguishes space resources from space bodies and real estate; stands for the proposition that state and private space mining is legal when guided by settled principles governing that realm; and accepts the validity of Title IV as legally fit to operate within the ambit of 1967 OST principles.

For instance, Blount and Robinson (2016) portrayed Article II, 1967 OST in this manner: "Article II of the Outer Space Treaty is fraught with ambiguity. It not only fails "to anticipate all the realities of our current world," but also seems to purposely use language that allows for multiple conflicting interpretations that are not always reconcilable. Even when confronted with a "plain language" reading using the purpose and scope of the treaty, Article II still defies a universally accepted definition. This is in large part due to the Cold War atmosphere that pervaded negotiations of the Outer Space Treaty" (163). With this negative appraisal of Article II (prior to subsequent 'objective' interpretation) and the apparent highlighting of "Cold War"

foundations of the 1967 OST, the realist appropriationists underscored the conflictual nature of outer space issues and how it could be manipulated against the United States.

Comparatively, Blount and Robinson (2016) employ laudable language in describing Title IV in these terms: “the Title IV of the CSLCA is the most recent, and most profound, American interpretation of the Article II regime. This particular piece of domestic legislation has developed over the course of several years to finally reveal the United States’ position on the exploitation of natural resources by private commercial actors in relation to its Outer Space Treaty obligations….” (173). In this positive frame, the authors proceed to interpret Title IV as a valid state regulation of the special and unique space minerals mining domain.

Consequently, the neo-realist theoretical construct argues that Title IV is forthrightly compatible with Articles I and II, 1967 OST because both legal instruments target different policy domains and are therefore non-conflictual (Blount and Robinson 2016, 182). Moreover, the apparent absence of space minerals policy guidance in the *travaux preparatoires* of international space law was adduced by Gangale (2016) in support of the authority of Title IV as a novel and valid state interpretation of international space law that provides specific legal guidance on the emerging space minerals mining domain. This perspective arrives at this point by mounting a formidable argument against supremacist and strict notions of Article II, 1967 OST to identify gaps that properly fit Title IV. They reject any involuntary, strictly imposed, mandatory, or presumed cooperation, collaboration, or coordination of states on space mining, but welcomes voluntary collaboration and coordination of “allies” on unilateral space mining plans and operations.

According to the 1996 UN Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular

Account the Needs of Developing Countries (Dec. 13, 1996), “States are free to determine all aspects of their participation in international cooperation in the exploration and use of outer space on an equitable and mutually acceptable basis” (UN Gen. Assembly 1996, G.A. Res. 51/122, Annex 2). Thus Title IV represents the “most profound” U.S. interpretation of international space law to provide regulatory guidance on the new domain of space mining through the exercise of national jurisdiction under Article VI of the 1967 OST. Under this theory, it is significant that as the pioneer among contemporary national space mining policies, Title IV will shape the future of international space minerals mining law and policy.

Strict Nationalist Hegemonic Appropriation / Absolute Compatibility Theory (Monist)

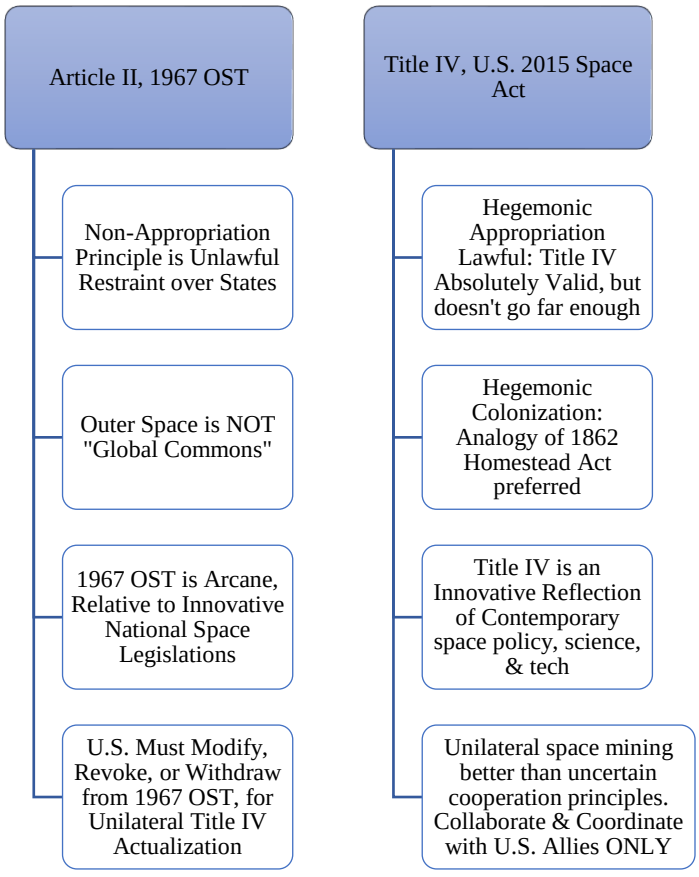


Fig. 12. Summary of SNHA / AC Theory

To the question of whether the rights purportedly granted by the national law of Title IV, Sec. 51303, U.S. 2015 Space Act are with or without solid basis in the existing international legal regime under Articles I and II, 1967, this body of literature unanimously indicated a "yes…absolutely / compatible " outcome. However, it did so with the caveat that Title IV does not require a "solid basis" on an "arcane" 1967 OST regime but should rather be grounded on the 1862 Homestead-style of hegemonic sovereign territorial appropriation (Weichert 2020). Simply put, this theory argues that the U.S. should colonize outer space and its natural resources regardless of the 1967 OST (Weichert 2020). The hegemonic theorists hold a minimalist view of international space law and related international law authority over the national policies of the United States (Baca 1993). Generally, this perspective holds to the populist proposition that outer space and its natural resources are not "global commons," "res communis," or "terra communis" rather they liken that sphere to the colonial era terra nullius that is subject to rivalrous appropriations by the most powerful (Trump 2020; Weichert 2020). And since, in this view, the U.S. is the global "Superpower," the nationalist hegemonic appropriationists proposed that Title IV does not go far enough in providing property rights to U.S. legal entities (ibid.). Therefore, in this view, regardless of Article II, 1967 OST and international law constraints under Article III, 1967 OST, the U.S. must employ the analogy of the 1862 Homestead Act to colonize the space territory, celestial bodies, and mineral resource lodged therein for ultimate rentals to willing and able U.S. legal entities.

Some key characteristics of this theoretical perspective and its variants include populist advocacy for U.S. unilateral invocation of Articles 15 or 16 of the 1967 OST to modify specific unwanted elements or outright U.S. unilateral withdrawal from the treaty obligations entirely (Weichert 2020). This perspective does not consider questions of compatibility between Title IV,

U.S. 2015, and Articles I and II, 1967 OST but instead hold that the entirety of the 1967 OST principles are incompatible with "American traditional values" and free market enterprise (ibid). Some of the key proponents include Weichert (2020), and the pre-2015 nationalist theorists such as Reynolds (1992), Baca (1993), Dinkin (2004), and U.S. politicians like Senator Ted Cruz (2017), and House Speaker, Kevin McCarthy – the author of the 2015 U.S. Space Act. This research study drew from this constellation of strict, pragmatic, realist, and nationalist theoretical constructs to propose a theoretical model that would contribute to the ongoing theoretical discussion while advancing harmonious and effective implementation of Title IV by space minerals mining practitioners.

International Institute of Space Law (2015) – Position Paper (Dualist)

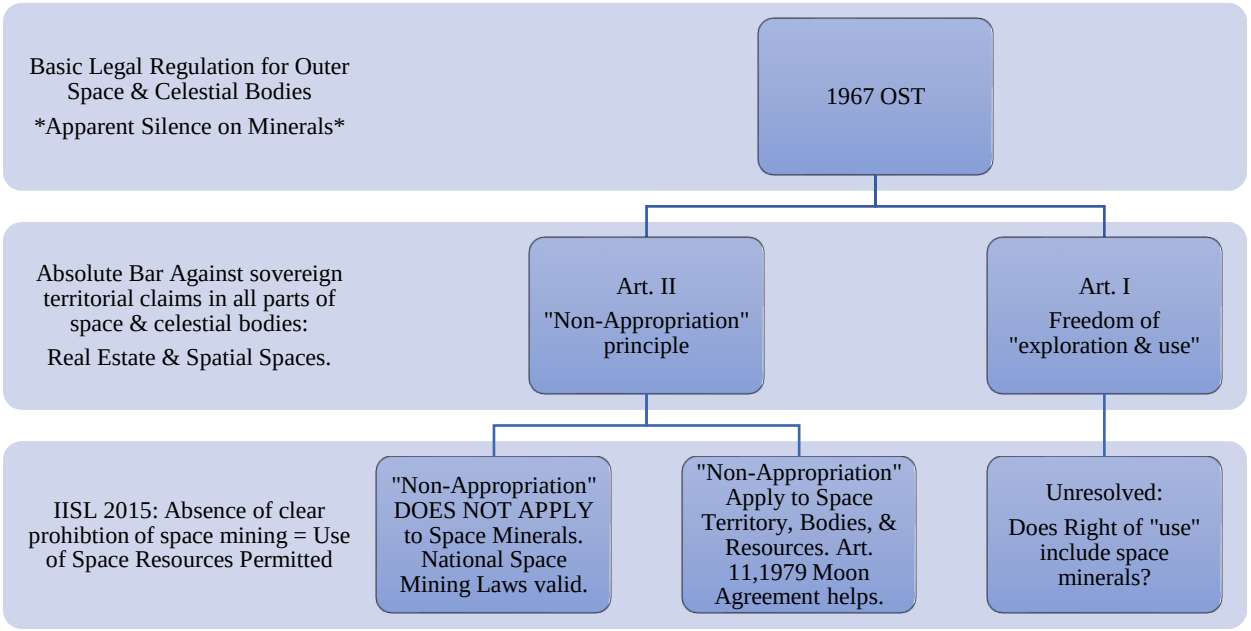


Fig. 13. IISL "Position Paper" (2015) Theory of Article II "Non-Appropriation

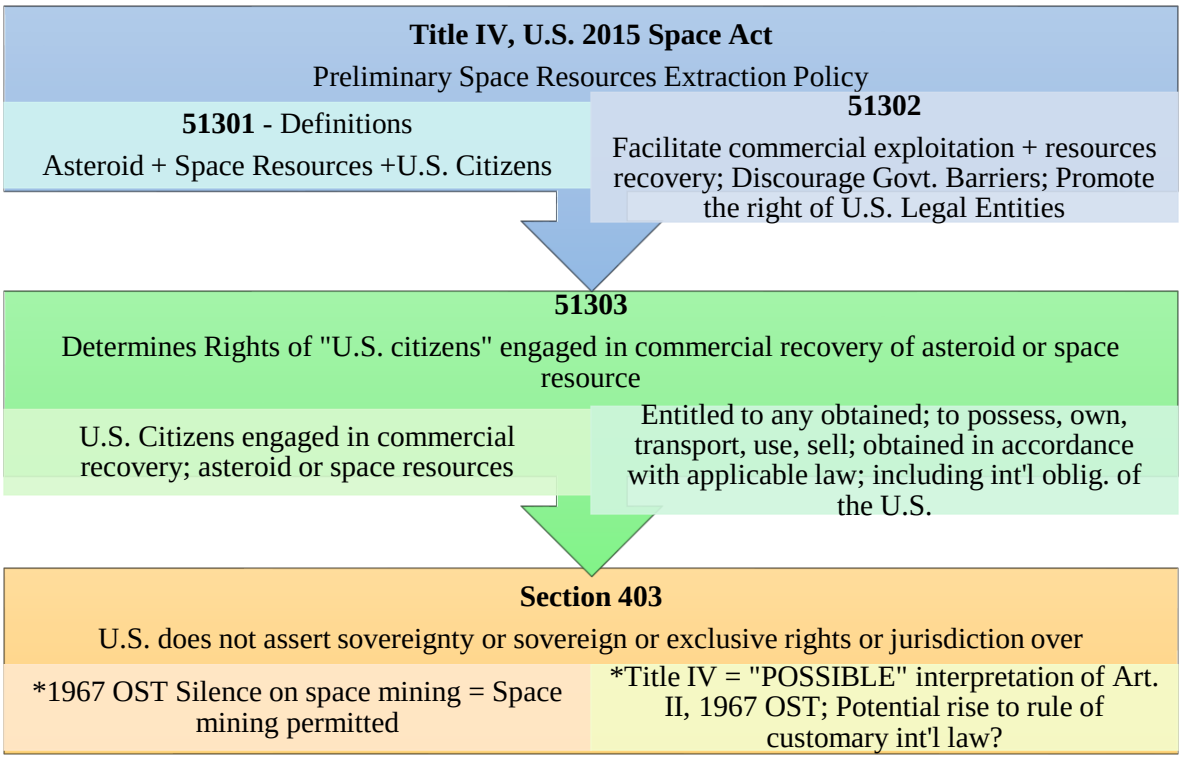


Fig. 14. IISL "Position Paper" (2015) – Theory of Title IV

Following the enactment into law of the U.S. 2015 Commercial Space Launch Competitiveness Act (Public Law 114-90) and its signing by President Barack Obama on November 25, 2015, the International Institute of Space Law (IISL) released an authoritative 3-page "Position Paper" on the most controversial part of the law, Title IV. After a content review of the stipulations of the four sections of Title IV, the IISL stated its position with an evaluation of the implications of Title IV on international space law. First, IISL restated the current legal situation in international space law: Article II, 1967 is the basic legal regulation for outer space and celestial bodies. The Article provides that "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" (UNOOSA 1967, Art. II). On the basis of the "non-appropriation" principle of Article II, "it is uncontested under international law that any appropriation of "territory" even in outer space (e.g. orbital slots) or on celestial bodies is

prohibited…" (IISL 2015, 2). However, "it is less clear whether this Article also prohibits the taking of resources" (ibid.).

Next, Article I protects the rights of free "exploration and use" of outer space and celestial bodies by States on the basis of equality, consistent with international law. However, there is disagreement whether the freedom of free "use" includes the right to take and consume non-renewable natural resources, including minerals and water on celestial bodies as contemplated by Title IV, U.S. 2015 Space Act. Further controversy on the issue emerged from Article 11 of the 1979 Moon Agreement which holds that space natural resources cannot become the "property of any State, international intergovernmental or non-governmental entity or of any natural person" (UNOOSA 1979, Moon Agreement Art. 11(3)). This regime purports to govern the exploitation of mineral resources under a futuristic international regime to ensure equitable sharing (ibid.).

The IISL (2015) argued that the 1979 Moon Agreement has been in decline and does not constitute a universally accepted rule of customary international law – especially given its rejection by major spacefaring States. Thus, its space minerals provision does not resolve the question posed by Title IV. On the foregoing basis, the IISL (2015, II.2 and II.3) concluded as follows: "…in view of the absence of a clear prohibition absence of a clear prohibition of the taking of resources in the Outer Space Treaty one can conclude that the use of space resources is permitted. Viewed from this perspective, the new United States Act is a possible interpretation of the Outer Space Treaty. Whether and to what extent this interpretation is shared by other States remains to be seen" (II.2). Thus Title IV being deemed a "possible" interpretation of the 1967 OST, the extraction of asteroid and/or space resources under Title IV, Sec. 41303, is "permitted" under the IISL (2015) perspective.

Further, Title IV does not violate international law but inherently clarifies it in Sections 51303 and 403. Thus, the IISL (2015 concludes that Title IV assertion of national jurisdiction "….s independent from the claim of sovereign rights over celestial bodies, which the United States explicitly does not make (Section 403). The purpose of the Act is to entitle its citizens to these resources if "obtained in accordance with applicable law, including the international obligations of the United States". The Act thus pays respect to the international legal obligations of the United States and applicable law on which the property rights to space resources will continue to depend" (II.3). With this dualistic approach the IISL endorses the compatibility of Title IV with Articles I and II, 1967 OST.

The Hague International Space Resources Governance Working Group (2019) – Building Blocks (Dualist)

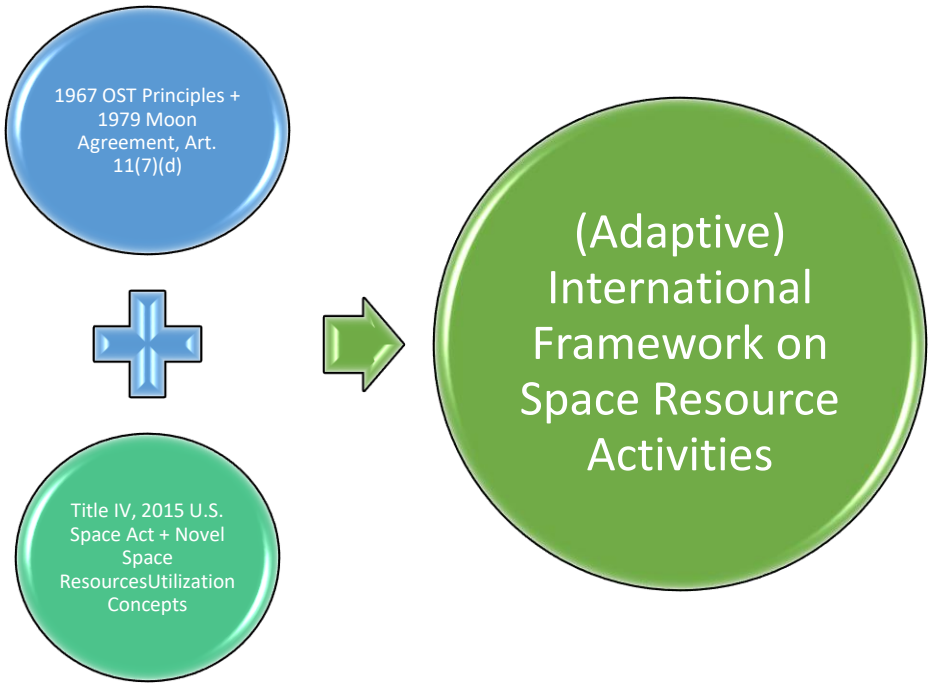


Fig. 15. The Working Group "Building Blocks" (2019) Theory of Space Mining

Another post-2015 theoretical development associated with the emergence of Title IV was The Hague International Space Resources Governance Working Group of 2019 that was

"created to promote international cooperation and multi-stakeholder dialogue" that would create "an enabling environment for space resource activities" (1). On November 12, 2019, this "Working Group" adopted the 7-page "Building Blocks for the Development of an International Framework on Space Resources Activities" that revolves on a so-called "principle of adaptive governance" aimed at adapting Title IV, 1967 OST, and the 1979 Moon Agreement to fit a proposed international framework on space resources activities (Building Blocks 2019, 1).

Among other objectives, this framework aims to "identify and define the relationship of space resource activities with existing international space law, including the provisions of the United Nations treaties on outer space" (1.2(a). Which means a dualist integration of national and international legal frameworks for the common objective of a universally acceptable space minerals mining policy. The hope is that this approach would "promote the identification of best practices by States, international organizations, and non-governmental entities" (1.2(d)). Significantly, the "Building Block" tasks States to continue to develop national space mining frameworks similar to Title IV, while international organizations should design internal frameworks.

Particularly, in Article 2.1, the Building Blocks mirrors the Title IV, Sec. 51301 definition of "space resource" as an "extractable and/or recoverable abiotic resource in situ in outer space" (1). As understood by the Working Group (2019), "….this includes mineral and volatile materials, including water, but excludes (a) satellite orbits; (b) radio spectrum; and (c) energy from the sun except when collected from unique and scarce locations" (1). This document recognized the utilization of space resources as "the recovery of space resources and the extraction of raw mineral or volatile materials therefrom" (2). The Working Group (2019) explains that this "excludes secondary utilization of space resources, i.e. (a) utilization of raw

materials derived from space resources; and (b) marketing and distribution of space resources" (ibid., 2). Also, the Working Group (2019) expands an understanding of "space resource activity" that was inferred from Title IV, Sec. 51303. It means "an activity conducted in outer space for the purpose of searching for space resources, the recovery of those resources and the extraction of raw mineral or volatile materials therefrom, including the construction and operation of associated extraction, recovery, processing and transportation systems" (2.3, 2). Each of these activities will potentially elicit legal issues that experts would struggle to resolve.

In Article 3, the Working Group (2019) proposes an international framework that addresses and integrates national frameworks but with an extension of space resources regulations to cover the solar domain. Article 4 provides a solid basis for both national and international frameworks on the principles of the 1967 OST. Under Article 5, the Working Group proposes an international framework for attributing international responsibility for space resources activities variously to States, non-governmental, and international organization space actors (3). Article 6 proposes an international framework that should "provide that States have jurisdiction and control over any space-made products used in the space resource activities for which they are responsible (ibid., 3). Article 7 puts forward notions of attribution of priority rights to recover space resources; duration; and delimitation of specific area of the rights.

The Working Group, in Article 8, suggested that resource rights be lawfully acquired through domestic legislation, bilateral and/or multilateral agreements. This is a departure from the preceding dualistic approach to a tripartite legal framework of space minerals mining rights. These resource rights are still to be grounded on the non-appropriation principle of Article II, 1967 OST – with regards to the space real estate and spatial spheres. In Articles 9 and 10, the Working Group relates back to the "due regard" and avoidance of harm principles of Article IX,

1967. Technical standards for space resources activity were addressed in Article 11, while Article 12 focuses on monitoring regimes.

Significantly, in its benefits sharing proposals in Article 13, the Working Group partially adopted Article 11, 1979 Moon Agreement on the necessity of benefit sharing. However, it deviated from the Moon Agreement by explicitly rejecting in Article 13.2 any "compulsory monetary benefit-sharing," as well as the need for an international space mining organization. Instead, the Building Block provides in Article 13.1 that, "the international framework should provide that States and international organizations responsible for space resource activities shall provide for benefit-sharing through the promotion of the participation in space resource activities by all countries, in particular developing countries" (5).

In this view, "benefits may include, but not be limited to, enabling, facilitating, promoting, and fostering: a) The development of space science and technology and of its applications; b) The development of relevant and appropriate capabilities in interested States; c) Cooperation and contribution in education and training; d) Access to and exchange of information; e) Incentivization of joint ventures; f) The exchange of expertise and technology among States on a mutually acceptable basis; g) The establishment of an international fund" (Building Block 2019, Art. 13(1), 5). This means that the benefits are not to be passively received by poorer states from richer spacefaring states, but they must be actively taken through active participation in space resources activities.

The Working Group (2019) proposed an international framework for registration and sharing of information among States and international organizations in Article 14 (5-6). These proposals mirrored much of the provisions of Article XI, 1967 OST. Article 15 hearkened back to Article V, 1967 OST regarding provision of assistance; Article 16 on liability was keyed to

Articles VI and VII, 1967 OST liability provisions; Article 17 on space resources-related visits was tied to Article XII, 1967 OST; while Article 18 proposed some novel institutional arrangements for such things as publicly accessible space resources activities registry, database, and international bodies to assure and monitor best practices. The proposed settlement of disputes in Article 19 was for States and international organizations to adopt dispute resolutions through "adjudicatory, non-adjudicatory or hybrid mechanisms" (7). Monitoring and Review in Article 20 proposed a mechanism for monitoring implementation of the international framework through reports by States and international organizations (ibid., 7).

Overall, the Working Group (2019, 1-7) integrated the U.S. Title IV, the 1967 OST, and some aspects of Article 11, of the 1979 Moon Agreement as forming the basis for a novel post-2015 international framework (Building Blocks) for space resources mining activities. Thus the "Building Blocks" is anchored in a tripartite theoretical construct while sustaining a dualist perception of outer space as a prohibited real estate / spatial sphere and a permissible space resources activities policy domain. In 2022, a revised "Building Blocks Commentary" updated some of the terms and concepts without any major deviations from the 2019 version discussed here. It contains the 2019 text, explanation, legal basis, and alternatives considered for each of the 20 "Building Blocks" discussed here as "Articles" that could potentially form part of a future governance framework for evolving space resource activities.

International Institute of Space Law, American Branch (2016/2022) – Contours, Contexts, and Limits of Space Mining (Monist)

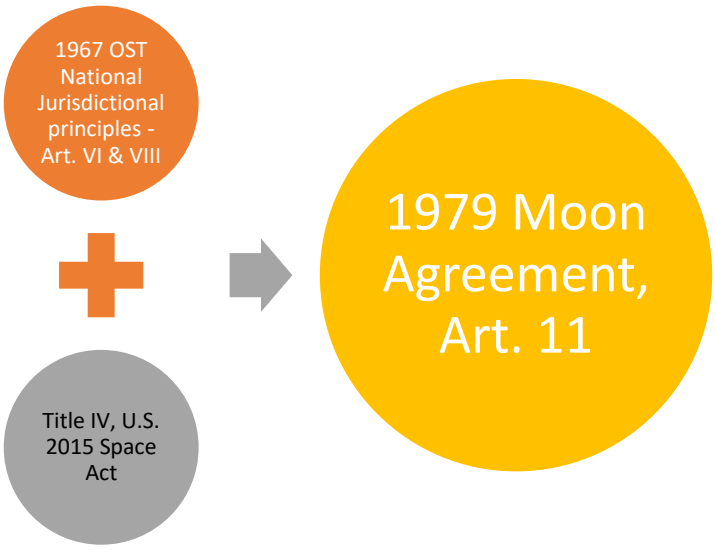


Fig. 16. IISL – American Branch Theory

Yet another position comes from the American Branch of the International Institute of Space Law (AB-IISL), which prepared a "Background Paper" in 2016 (published 2022) setting out to respond to key questions of modern space minerals exploitation law and policy. The Background Paper (2016/2022) asked: "Does international space law either permit or prohibit the taking of resources in outer space and on celestial bodies, and how is this relevant for international actors? What is the context, and what are the contours and limits of this permission or prohibition?" (1-45). The array of experts shared a common dualism of space real estate / spatial spaces that cannot be appropriated versus space mineral resources that could be. However, in terms of a legal framework for space minerals extraction, the Background Paper concluded that Title IV and the relevant principles of the 1967 OST should be merged into the Article 11, 1979 Moon Agreement regime.

The "Background Paper" (2016.2022, 41-46) asserted that space mining could be justified under Article I, 1967 freedom of "use" of the space realm. However, all such uses must

meet the conditions of all other rules of customary international law that the "Background Paper enumerates to include: "the benefit and in the interests of all countries" clause of Article I para. 1, the prohibition of discrimination in Article I para. 2, the requirement in Article III that space activities shall be carried out "in accordance with international law", the principles of due regard and of "cooperation and mutual assistance" contained in Article IX" (41-42). In this view, the "non-appropriation" of Article II, 1967 OST does not operate against Title IV. However, after evaluating states practices with regards to the 1967 OST and the 1979 Moon Agreement, the "Background Paper" concluded as follows, first, that:

> "…both national legislation and the subsequent state practice to Articles I and II of the Outer Space Treaty entailed in the Moon Agreement do not lead to a different result: the legal framework governing activities in space does not prohibit the exploitation of resources as an activity open to States, but it nevertheless requires that such exploitation shall take place under the conditions laid down in the Outer Space Treaty which are to be shaped in an appropriate international legal order multilaterally" (42).

The state practices referred to involves the interpretations of the freedom of use of Article I, 1967 OST, and the non-appropriation principle enshrined in Article II, 1967 OST. The Background Paper (2016/2022) argued that these interpretations "can be found in the Moon Agreement which in its Article 11 paras 5 and 7 allows for the exploitation of natural resources on the Moon and other celestial bodies only after an international regime to govern these activities is established" (42). However, Article 11 (5)/(7), 1979 Moon Agreement has never attained the status of a rule of customary international law and has been experiencing increased rejection among States.

But the "Background Paper" (2016/2022) adduced the controversial international regime as a solid basis for contemporary international space mining policy. The "Background Paper" (2016 / 2022) concluded that, "Taking the fact that outer space law is not particularly outspoken with regard to space mining, the plea of the Moon Agreement to establish an international regime for mineral resource mining should be undertaken only as an effort of the international

community" (42). Thus, the priority of the 1979 Moon Agreement under this theory distinguishes it from the IISL "Position Paper" (2015) and the Working Group "Building Blocks" (2019) both of which share dualist vision of space but proposes different legal frameworks to govern the novel space minerals extractions domain.

The 2020 Artemis Accords (Dualist) – Operationalize Title IV + 1967 OST.

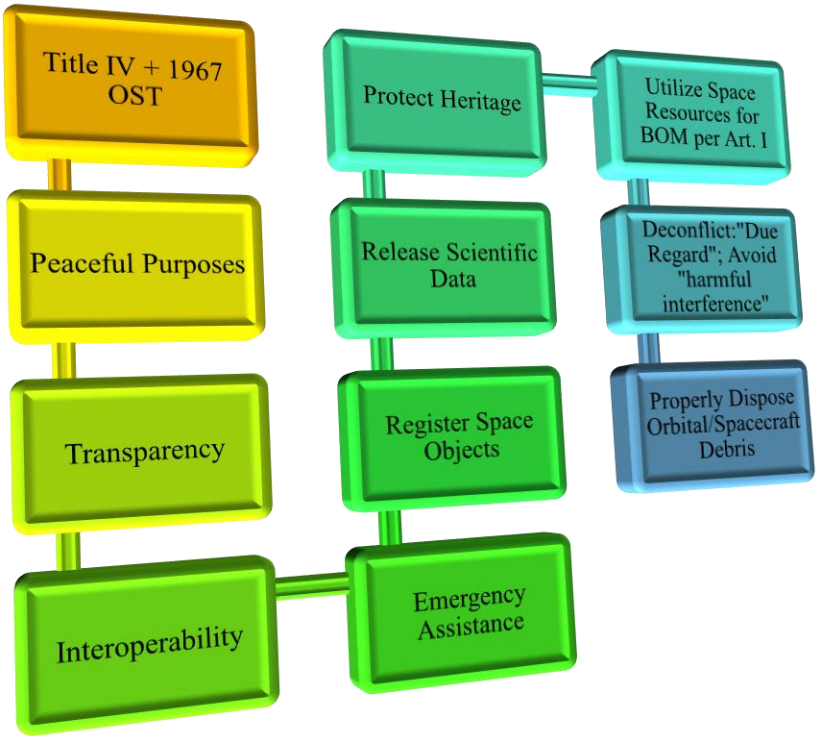


Fig. 17. The 2020 Artemis Accords principles that integrate Title IV space mining policy into the 1967 OST.

To the issue of whether Title IV has a solid basis in international law and justifiably enacted a national level space mining policy to regulate U.S. legal entities – and whether Title IV violates the "non-appropriation" principle of Article II, 1967 OST, the 2020 Artemis Accords takes a dualist approach. According to the Artemis Accords, "….the extraction of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty,

and that contracts and other legal instruments relating to space resources should be consistent with that Treaty" (NASA / Artemis Accords, Section 10.2, p.4). Thus, the 2020 Artemis Accords integrates Title IV space mining policy with the principles of the 1967 OST.

The 2020 Artemis Accords

The Artemis Accords are a series of post-U.S. 2015 Space Act multilateral space resources exploitation agreements entered into by the space agencies of the United States, Canada, the United Kingdom, Italy, Japan, Luxembourg, the United Arab Emirates, and Australia (NASA/Artemis Accords 2020, 1-16). Arguably, coming at the heels of the Res Nullius policy of Title IV, Sec. 51301-03, U.S. 2015 Space Act, this multilateral effort signaled that the U.S. intended to implement the unilateral national space mining policy of Title IV within the international framework of multilateral engagement with likeminded spacefaring states (U.S. Dept. of State 2023). The Artemis Accords were adopted and signed at the 71st International Astronautical Congress, on October 13, 2020, by the aforementioned initial signatories.

However, as at the August 2023 writing of this research project, membership has swelled to a whopping 28 signatory States including Argentina, Australia, Bahrain, Brazil, Canada, Colombia, Czech Republic, Ecuador, France, India, Israel, Italy, Japan, Luxembourg, Mexico, New Zealand, Nigeria, Poland, the Republic of Korea, Romania, Rwanda, Saudi Arabia, Singapore, Spain, Ukraine, the United Arab Emirates, the United Kingdom, and the United States (U.S. Dept. of State 2023 – Artemis Accords, 1). Significantly, States like Saudi Arabia withdrew from the 1979 Moon Agreement in January 2023 (effective January 2024) and hopped on board the Artemis Accords. Notably, competitors like China and Russia have stayed away from endorsing the Artemis Accords. Regardless, this rapid rallying of global States to the Artemis Accords strongly demonstrates the willingness of most spacefaring States to gravitate towards a

space mining regime that comports with preexisting customary rules of international space law under the 1967 OST. In effect, if the current trend of acceptance of the Artemis Accords continue, Title IV may well be on its way to becoming a customary rule of general international law – with wide adoption of its tenets and entrenched practices of the Artemis Accords integrated operation of multilateral cooperation-driven space mining policy.

The Artemis Accords seek to integrate "Principles for cooperation in the civil exploration and use of the Moon, Mars, Comets, and Asteroids for peaceful purposes" (U.S. Dept. of State 2023 – Artemis Accords). According to this framework, these mutually acceptable sets of principles will ensure safe and predictable commercial extraction of space mineral resources – and preservation of the space environment from conflicts, pollutions, and debris (ibid.). The principles that should guide the operation of space mining (Title IV) in the outer space global commons of international relations include the following:

1. Space mining must be for peaceful purposes – consistent with Art. I, 1967 OST
2. Transparency – faithful dissemination of national space-related policies to other states
3. Interoperability – exchanging and using information to ensure safe & robust cooperation in space to ensure "due regard" per Art. IX, 1967 OST
4. Emergency Assistance – subject to obligations to render assistance to/and return of astronauts under Article V, 1967 OST
5. Registration of Space Objects – to ensure proper national personal jurisdiction (Art. VI, 1967 OST), and "quasi" territorial jurisdiction over the space objects (Art. VIII , 1967 OST), mitigate harmful interference (Art. IX), and properly attribute liability (Art. VII).
6. Release of Scientific Data – timely global dissemination of scientific data by space mining actors to share benefits of outer space with the world (per Art. I, 1967 OST).

7. Protecting Heritage – enhancing multilateral extension of terrestrial int'l practices & rules to space – to preserve "historically significant human or robotics landing sites, artifacts, spacecraft, and other evidence of activity on celestial bodies" (ibid.)
8. Utilization of Space resources consistent with Art. I, 1967 OST - peaceful purposes & BOM
9. Deconfliction of activities: Art. IX, 1967 OST "due regard" and avoidance of "harmful interference" are key.
10. Orbital debris and Spacecraft proper disposal – to sustain safe & peaceful operations in space (U.S. Department of State 2023 – Artemis Accords).

As stipulated in Section 1 of the Artemis Accords legal instrument, the accords were designed "to establish a common vision via a practical set of principles, guidelines, and best practices to enhance the governance of the civil exploration and use of outer space with the intention of advancing the Artemis Program" (NASA / Artemis Accords 2020, Section 1, p. 2). The Artemis programs, named after the Greek goddess of the Moon (Artemis) began in 2017, as a series of NASA's efforts to return Astronauts to the surface of the Moon – to stay (NASA 2017). By adherence to a practical set of non-binding principles, guidelines, and best practices in carrying out activities in outer space, the signatory States intended "…to increase the safety of operations, reduce uncertainty, and promote the sustainable and beneficial use of space for all humankind…." (ibid., 2). Thus the Accords intend to integrate and operationalize the written space mining policy of Title IV within the cooperation-driven landscape of international space law.

The Artemis Accords, as explained by the framework, "represent a political commitment to the principles described herein, many of which provide for operational implementation of

important obligations contained in the Outer Space Treaty and other instruments" (NASA / Artemis Accords 2020, Section 1, p. 2). The "other instruments" include the U.S. national space mining policy of Title IV (ibid.). Inferentially, this conveys that the res nullius policy philosophy of Title IV, Sec. 51303, U.S. 2015 Space Act was not legally construed to operate as a unilateral policy measure in the global commons arena of space (Dunk 2017, 93-101). Rather, as Blount and Robison (2016, 185-186) notes, it is implicit that in operational implementation, the U.S. space mining policy would be implemented consistent with preexisting U.S. obligations under the international cooperation theory of Articles I and II, 1967 OST.

As to its scope, the Artemis Accords were intended "to apply to civil space activities conducted by the civil space agencies of each Signatory. These activities may take place on the Moon, Mars, comets, and asteroids, including their surfaces and subsurfaces, as well as in orbit of the Moon or Mars, in the Lagrangian points for the Earth-Moon system, and in transit between these celestial bodies and locations…." (NASA/Artemis Accords 2020, 2). Significantly, the scope did not include considerations of sovereign territorial acquisitions of space, celestial bodies, the Moon, Mars, or other planets, as some influential commentators fear (Tronchetti 2014, 193-195; 2019, 769-816). Those kinds of exclusive sovereign territorial takings of the space real estate, geophysical space, or celestial bodies are prohibited under Articles I and II, 1967 OST (Von der Dunk 2017 / 2019). Significantly, Section 10 of the 2020 Artemis Accords deal with space mineral resources.

The initial eight signatory States underscored that beyond the immediate national interests of each nation, the utilization of space resources can benefit humankind by providing critical support for safe and sustainable operations (NASA / Artemis Accords 2020, Section 10, 1.). They further emphasized that "the extraction and utilization of space resources, including

any recovery from the surface or subsurface of the Moon, Mars, comets, or asteroids, should be executed in a manner that complies with the Outer Space Treaty and in support of safe and sustainable space activities…." (ibid., Section 10.1, p.4). In implicit affirmation of the res nullius policy of Title IV, Sec. 51303, U.S. 2015 Space Act, the signatories affirmed that "the extraction of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty, and that contracts and other legal instruments relating to space resources should be consistent with that Treaty" (NASA / Artemis Accords, Section 10.2, p.4). Thus, the Artemis Accords make a clear legal distinction between space minerals resources that are subject to commercial extractions under Title IV, and the geophysical space, space real estate, and celestial bodies that are protected from sovereign territorial appropriations under Art. II, 1967.

In addition, the Artemis Accords reinforces and endorses the express U.S. disclaimer of any direct or indirect exercise of sovereign territorial acquisitions in Section 403 of Title IV, U.S. 2015 Space Act. Section 403 stipulates that "It is the sense of Congress that the United States does not, by enactment of this Act, assert sovereignty or sovereign or exclusive rights or jurisdiction over, or ownership of, any celestial body" (114th U.S. Congress 2015-2016, Title IV, Sec. 403, U.S. 2015 Space Act). The rationale is that States are required in international law to adopt unique domestic level legal frameworks to maintain proper balance between national interests and the requirement for international peace and security in each "Global Commons" domain such as the high seas, Antarctic, deep seabed, and outer space (Blount and Robison 2016, 172). Yet, such national level frameworks are required to be consistent with all other relevant provisions of general international law under Article II, 1967 OST.

Arguably, the Artemis Accords represent the contemporary trend of integrating unilateral national legal frameworks with multilateral cooperation policy in the evolving space mining

policy field of international relations. Thus, contrary to international level strict prohibitionists of space mining and ultra-nationalist clamor for extensions of colonial logic to space, post-2015 contemporary trends demonstrate that the emergence of national space policies such as Title IV may not necessarily be indicative of the emergence of zero-sum policies in the commercial appropriation of space minerals in the 21st century. Rather, the tradition of multilateral cooperation among States in other policy sectors of space is confronted with the challenge of integrating and collaborating with competitive free market enterprise that necessarily goes with resources extractions such as the emerging space mining policy domain.

Conceptual Reconciliation: Harmonized Approach

Title IV creates the right conditions for interstate co-existence and cooperation because it is a possible interpretation of Article II, 1967 OST as most influential authorities such as Von der Dunk (2017; 2019), attest. Likewise, Title IV is a valid State interpretation of international space law since it unravels the space mining intent of the 1967 OST (Blount and Robinson 2016). Moreover, the lack of an explicit prohibition or express permission in international space law under the 1967 OST or general body of international law justifies U.S. enactment of Title IV under the 1927 "Lotus principle of international law. The "Lotus" principle (as discussed below) "consecrates a freedom to act unless explicitly prohibited by international law" (Hertogen 2016, 901). Both the explicit text and the travaux preparatoires of the 1967 OST does not demonstrate any explicit or implicit prohibition of space mining (Gangale 2016). Therefore, an assumption of permission of space mining is justified under the 1969 Vienna Convention on the Law of Treaties (VCLT).

Thus, Title IV is conceptually compatible with the 1967 OST that permitted freedom of "exploration and use" of outer space as the "province of mankind" (i.e., by all states) under

Article I – in which most authorities have interpreted “use” as extendable to space mining (Von der Dunk 2015, 2-3). In general, both multilevel legal instruments are compatible with the needs of a modern international community that is actively looking to strategically extract space minerals for private benefits on planet Earth. Specifically, the inherent compatibility of both Articles I and II, 1967 and Title IV, U.S. 2015 Space Act inures to the actualization of U.S. foreign policy goal in the prosperity of U.S. legal entities engaged in asteroid or space resources extraction. The public policy analytic tool of original intent and the factual summary of the 1927 “Lotus” principle of international law below converge to reinforce the legitimacy of Title IV as a pivotal, groundbreaking legal guide for the evolving policy field of international space mining.

Brief Comparative Analysis: Title IV; 1967 OST; and 1979 Moon Agreement

So, at this point in 2023, only the U.S. and Luxembourg have very clear unambiguous res nullius space minerals mining policies, while others like the UAE and JAXA have modified their national space agencies laws to reflect the evolving focus on the emerging space minerals mining race. Overall, membership of the 1967 OST has remained consistent, while Title IV is making incremental gains. The Moon Agreement is experiencing incremental losses in membership – most probably indicative of the preferred space minerals mining policy approach favored by a majority of spacefaring states. That approach is that of embracing the inherent compatibility between Title IV, U.S. 2015 Space Act’s unique focus on the extraction of asteroid and space minerals versus the historical protection of the outer space geographical sphere from sovereign territorial jurisdiction or colonial-style takings under Article II, 1967 OST. Therefore, contrary to theories that claim otherwise, as multilevel space policy mechanisms, Title IV and Article II instruments are mutually complementary rather than conflictual.

This study has demonstrated that Articles I and II, 1967 were uniquely designed to address space territory generally, and to prohibit the imperial impulses of states, by removing incentives of states to extend territorial sovereignties to the space realm, while providing freedom of equal access for exploration and use of that sphere (Von der Dunk 2015; 2017; 2019). Hence Articles I and II, 1967 OST does not constitute an absolute bar to space minerals mining (Gangale 2016). On the contrary, these provisions support free exploration and use of outer space and celestial bodies, including the Moon (Von der Dunk 2017). On the other hand, Title IV unambiguously abjures any intent of U.S. sovereign territorial claims in space (Sec. 403) and specifically targets asteroid and space resources mining by U.S. legal entities (Blount and Robinson 2016; Von der Dunk 2015; 2017).

The specific nature of future space mining activities based on the Title IV policy, and the numerous legal nuances surrounding property rights over harvested or residual natural resources; and what kinds of powers states may exert over space minerals fields, are currently speculative notions that fall within the domain of international space law theoretical debates. This policy research study was confined to the examination of the trending theories that hypothesized on the extant U.S. space mining policy texts. Another policy lens that adds a positive layer of support to the compatibility of Title IV with the 1967 OST is the original intent analysis of the travaux preparatoires of international space law. Other commentators such as Gangale (2016) has profusely researched this legal-historical aspect hence only a brief survey is presented below.

Original Intent Analysis

The specific intentions of the original rule makers are vital in ascertaining the actual meanings of constitutional, statutory, and treaty provisions especially where, on its face, the text is ambiguous, vague, or uncertain as to result in competing interpretations or unreasonable

and/or unfair outcomes (Pannier 1992, 696-703). The theory of original intent is therefore a principle of judicial interpretation of legislative, constitutional, or treaty rules to determine the specific intentions of the original drafters or framers (Powell 1985, 885-894). According to St. Thomas Aquinas (1265/1274), "…every law is directed to the common weal of men and derives the force and nature of law accordingly. Hence the jurist says [*Pandect. Justin. lib. i, ff., tit. 3, De Leg. et Senat.]: "By no reason of law, or favor of equity, is it allowable for us to interpret harshly, and render burdensome, those useful measures which have been enacted for the welfare of man" (Summa Theologica, Part 1, Second Part, Question 96, Art. 6, p. 2328). The terms "common weal" means common welfare or common good – and this is the ultimate purpose of every law according to St. Thomas Aquinas (1265/1274).

Aquinas (1265/1274) explains further that: "Now it happens often that the observance of some point of law conduces to the common weal in the majority of instances, and yet, in some cases, is very hurtful. Since then the lawgiver cannot have in view every single case, he shapes the law according to what happens most frequently, by directing his attention to the common good. Wherefore if a case arise wherein the observance of that law would be hurtful to the general welfare, it should not be observed" (ibid., Question 96, Art. 6, p. 2328). This has been understood to mean that where discretionary interpretation and application of an ambiguous, uncertain, and/or vague law would result in unjust or unfair outcomes, further attempts must be made to ascertain from the *travaux preparatoires* of such a law, the original intent of the framers or drafters (Powell 1985, 895-902; Pannier 1992, 697-705). As already discussed prior, with regards to international treaties, the 1969 Vienna Convention on the Law of Treaties provides formal guidelines on the interpretation of international treaties, such as the 1967 OST.

The "Lotus" Principle v. Silence of "Space Minerals" Policy in the 1967 OST

In the international spaces governed by international rules, states are equal and interdependent, therefore "state sovereignty is inherently limited in order to protect the equal sovereignty of other states" (Hertogen 2016, 901). As one of those international spaces, outer space is commonly legally equated with the area of the high seas where there is freedom to act under constraints of rules of public international law (Von der Dunk 2020, 3). Analogous to the high seas global commons domain, outer space allows for the freedom of states to act, which is stipulated in Article I, 1967 OST – unless there are specific prohibitions in public international law that constraints such actions (ibid.). In the preceding synthesis of theoretical categories above, the primary research question is whether Title IV (as a state action with implications for the international space governed by international law) has solid basis in international law.

The pragmatic and neorealist categories discussed prior sees the "Lotus" principle as relevant, however, these authorities validated Title IV on different grounds. First, in sum, Von der Dunk (2015; 2017; 2019; 2020) sees Title IV as a "possible" interpretation of international law because freedom to "use" space in Article I, 1967 OST includes space mining activities; the 1967 OST does not contain any explicit prohibitions of space mining; rather other provisions such as Articles VI, VII, VIII, and IX all seem to anticipate space mining activities by states and non-states. Blount and Robinson (2016) argue that Title IV is a valid interpretation of the "ambiguous" and controversial "non-appropriation" principle of Article II, 1967 OST because Title IV regulates only the extraction of space minerals – and disclaims any intent of U.S. sovereign territorial jurisdiction in space or celestial bodies.

Thus, this view alludes to the freedom of state action in the silence of international law as stipulated by "Lotus", but Blount and Robinson (2016) do not make any explicit claims based on

full-blown reliance on the “Lotus” principle. Gangale (2016) grounded a defense of Title IV on the silence of space minerals or commercial extractions of mineral resources in the travaux preparatoires of the 1967 OST. Hence, the concept of “Lotus” was implicitly present in Gangale (2016), but the perspective was not primarily based on the “Lotus” precedent. This research study argues that Title IV can be based entirely on the “Lotus” decision at its core and that with arguments from travaux preparatoires (Gangale 2016), implicit or inferred presence of space mining in 1967 OST (Von der Dunk 2019/2020), and explicit silence of space minerals in 1967 OST (Blount and Robison 2016), the freedom of states to act under the 1927 “Lotus” principle could then be used as reinforcement for the legal validity of Title IV. On this ground, here is a factual summary of the 1927 “Lotus” case and why the principle from it matters for Title IV.

The Case of the S.S. “Lotus” (PCIJ 1927): Brief Survey

The ”Lotus” principle emerged in international law from a 1927 judgment of the Permanent Court of International Justice (PCIJ) in Geneva. According to Hertogen (2016), questions on the scope and limits of the sovereign territorial reaches of states in international relations, is found in the Lotus principle, “which consecrates a freedom to act unless explicitly prohibited by international law” (901). This principle is still hotly debated on both sides of the argument. The principle emerged from a civil case brought by France against Turkey for exercising jurisdiction over the captain of the French steamship, S.S. Lotus which collided with the Turkish ship, *Boz-Kourt*, in international waters on August 2, 1926 (PCIJ 1927). The Turkish boat had sunk, killing eight of its crew members.

The Turkish government prosecuted the two captains, convicting and fining the French captain under Turkish jurisdictional laws (ibid.). The French government appealed to the international Court arguing that under international maritime law, all states possessed concurrent

jurisdiction. Which meant that since the French steamship flew the French flag, it constituted an extension of France's territorial sovereignty over which Turkey may not encroach to exercise personal jurisdiction and prosecute the French ship captain. However, due to some legal technicality that bordered on the novel criminal law aspect of the deaths in the collision, a majority of the PCIJ decided on September 7, 1927, that Turkey did not contravene the principles of international law with regards to the exercise of personal jurisdiction in the criminal negligence aspect of the case.

The question posed by the Court was whether Turkey violated any rules of international law by criminally prosecuting the French Ship Captain. The PCIJ (1927) answered in the negative – siding with Turkey, that Article 15 of the existing international law allowed Turkey (and all states) to exercise national jurisdiction "whenever such jurisdiction does not come into conflict with a principle of international law" (ibid., 18). Thus states are not allowed to overstep the limits placed upon their jurisdictions in the equal arena of international relations – but states are entitled to exercise jurisdiction within their sovereign borders and where international law is silent or non-existent. The "Lotus" principle held that there was no rule of international law at the time which prohibited Turkey or any state from conducting criminal prosecutions of activities in international waters (ibid., 31). Therefore, Turkey acted consistent with the principles of international law in the criminal prosecution of the French ship captain, Lieutenant Demons (ibid.). The dissenting judges in the case argued that international law was complete and settled on the supremacy of international law authority in international Global Commons zones like the high seas.

Thus, one can see conflicting interpretations exist in international law on the meaning of the "Lotus" decision. Internationalists or the "monists" (discussed above) tend to assume that

international law is complete and supreme in international relations, and therefore ambiguities or gaps in emerging international spaces or Global Commons settings should be construed in favor of international law governance (Handeyside 2007). Others contend that the "Lotus" decision meant that where there is incompleteness, ambiguity, or silence in international law, States are presumed unrestrained by any such non-existent law. According to the PCIJ (1927) dicta, "….Restrictions upon the independence of States therefore cannot be presumed" (Judgment No. 9 – The Case of The S.S. Lotus, III, 18). Therefore, states are within their residual international sovereign authority and freedom of action to enact national legislations to fill such gaps and provide legal guidance and policy certainty to its foreign policy goals and national interest in the specific sectors.

Silence of Space Minerals Policy in the 1967 OST and General Int'l Law

Most authorities concur that there is no explicit treatment or mention of a policy of space mining in the 1967 OST and related body of general international law. In fact, even concepts such as "commercial extraction" or "commercial appropriation" of space minerals are missing from the legal instruments that govern the outer space realm. Further, a 2016 study of the travaux preparatoires of international space law and international law corroborates the silence of space mining as a theme, concept, or full-blown theory in the annals of international space law. However, Von der Dunk (2017; 2020) has pointed to a modern inclination of influential commentators to read "implicit presence" of space mining policy as presumed in the freedom of states to "use" outer space in Article I, and in the space activities referenced in related provisions such as Article IX. But, if one assumes (as is apparent) that on its face, the texts of the 1967 OST does not explicitly mention space mining activities; and neither does the travaux

preparatoires, then how should spacefaring States respond to their legal entities seeking to extract space minerals for private benefits? This is analogous to the “Lotus” situation.

The lingering question drawn from the “Lotus” case above is whether international law is viewed as a system of permissive versus prohibitive rules. In other words, does it mean that whatever is not explicitly permitted by international law is thereby implicitly prohibited or vice versa? The Majority of the PCIJ (1927) addressed this question by focusing on the goals of international law in international relations. As the Judge Max Huber (PCIJ 9127) put it, these goals are “to ensure co-existence between independent communities and to create an environment in which these independent communities can identify and act upon common aims” (ibid., 18). To further these goals of “co-existence and cooperation, the majority recognized the equal sovereignty of other states as a systemic basis for restrictions on the exercise of state sovereignty “ (Hertogen 2016, 903). Following the case of “Lotus” the global states began negotiations (in the spirit of co-existence) on ways to properly allocate jurisdictions over collisions in the high seas. So, it took Turkey’s bold action in a policy domain where international law was silent at the time, to eventually awaken global states to the need to update international law to account for the novel policy domain. This similarity is striking for Title IV.

First, like Turkey’s case, is there a rule in international space law broken by Title IV? The answer is negative. In enacting Title IV, did the U.S. act contrary to the rules of international law? If so, which specific rules? Further, by enacting Title IV, did the U.S. act against any permissive or prohibitive rule of international law with regards to exercising territorial jurisdiction over another state’s sovereign territory restricted international spatial domain? Again the answer is in the negative. For, within Section 403 of Title IV, the U.S. expressly disclaimed any charges of sovereign territorial jurisdiction over outer space, celestial bodies, including the

Moon (Title IV, Sec. 403, U.S. 2015). In addition, Section 51303 the U.S. clearly exercised personal jurisdiction over "U.S. citizens engaged in asteroid or space resources extractions" (Title IV, Sec. 51303).

But the highly significant question is: By 2015 when Title IV was enacted, was international law silent on space mining policy? The answer is a definitive "Yes" – and it does not hurt but enhances the coexistence of states when (as in the "Lotus" case) an apparent void in international law is regulated by a state directly impacted (or potentially to be impacted) by an ongoing void in international law. As Von der Dunk (2020) notes, "It is up to individual States to determine whether and to what extent they would allow non-State entities under their jurisdiction to benefit from this baseline freedom as well, noting that importantly those States themselves will directly be held responsible for such activities of relevant non-State entities" (4). This means that the silence of international law on space mining policies, against the backdrop of willing and technologically savvy U.S. legal entities that are ready to risk space mining ventures, justifies Title IV.

To emphasize, Title IV is consistent with U.S. obligations under Article VI licensing and continuing supervision; Article VIII liability requirements; and Article IX due regard and other relevant provisions of international space law under the 1967 OST. Title IV is also compatible with the full repertoire of general international law, including the 1945 UN Charter under Article III, 1967 OST. And, when combined with the interpretation that Title IV is valid if perceived in combination with all other relevant provisions, rights and duties of the U.S. under the 1967 OST and the body of international law (Von der Dunk 2017; 2020), plus the view that Title IV is a valid State interpretation of the ambiguous Article II subject to general acceptance by the community of States, the "Lotus" principle defense adds another layer to Title IV as outrightly

consistent with the spirit and purpose of general international law because it fills a void and is a pathfinder in the evolving space mining law and policy domain.

Summation from "Original Intent" and "Lotus" Principle

The result of the original intent analysis of the travaux preparatoires of international space law demonstrated that Articles I and II, 1967 OST were not inherently designed to target the space minerals policy domain – though some authorities have interpreted the "use" in Article I, as having implications for space minerals extraction activities as a possible "use" of outer space (Von der Dunk 2017). The comparative foreign policy analysis of the 1927 "Lotus" principle on the rights of states in any "silence" of international law situation conveys that Title IV stands on solid ground as a valid state interpretation / application of international law (Blount and Robinson 2016; Von der Dunk 2017). Together, these reasonings lead to the conclusion that Title IV is solidly inherently grounded in international space law and international law.

Therefore the silence of space minerals in the explicit texts of international space law created a gap which Title IV adequately filled under the 1927 "Lotus" principle of international law. While Article II, 1967 OST provides policy guidance specific to the general international legal space of outer space territory, Title IV addressed the unique and special narrow domain of space minerals mining (a role traditionally left to states under the usual lex specialis of international spaces). Significantly, Title IV Section 51303 addressed only the tangential but unique question of the legal status of extracted asteroid or space resources – even though it provides an implicit right of access to conduct the space mining activity itself in the international Global Commons space (which has been justified under Article VI). Thus, the 1967 OST and Title IV are mutually harmonized with regards to the extraction and legal status of extracted asteroid or space resources minerals – whether by states or non-states. However, all national

space legislations such as Title IV, and space actors operating under them, are subject to conformity with all other conditions, requirements, and obligations of international law.

Title IV, Section 403, U.S. 2015 Space Act explicitly disavows sovereign territorial claims in space under any guises, including any misconstrual of Title IV for that unlawful purpose. Therefore, the principles of international cooperation, collaboration, and coordination, are implicitly necessary for the implementation and actualization of Title IV. Hence, the 1967 OST and Title IV are mutually compatible on space minerals mining policy because they validate and reinforce each other's originally intended policy emphasis area. On this basis, the U.S. does not need to revoke the 1967 OST, modify any of its articles, withdraw from the treaty, or unilaterally colonize the territory and resources of space in order to retain and actualize the space mining policy goals of Title IV.

Further, Title IV also provides precedential value for future national space minerals policies and would help to create the right legal conditions for interstate co-existence and cooperation among likeminded state and private space miners. Therefore, as depicted in the relationship chart below, international cooperation, collaboration, and coordination can work within national unilateral space mining frameworks to advance contemporary practices of international space mining policies. The Artemis Accords, the ISECG, the Building Blocs, the IISL, and COPUOS Legal Sub-Committee Report openness to national space minerals policies, represent ongoing post-2015 collaborative efforts geared towards a harmonious space mining regime.

Together, these national and international adaptive measures aim to integrate the essential elements of Title IV with the governing principles of the 1967 OST for a potential globally acceptable international space minerals mining framework that benefits all humanity. Thus, a

proper interpretation of Articles I and II, 1967 would establish that Title IV is compatible with the principles of international space law and international law. Therefore, to implement and actualize the public policy goals of Title IV, the U.S. does not need to modify the 1967 treaty, withdraw from its tenets under Articles I & II, or indulge in unilateral imperial colonization of outer space under the analogy of the 1862 Homestead Act, and in breach of international norms under Article II, 1967 OST. In Fig. 17 below, the study summarizes the benefits of a harmonized approach akin to the Hague Working Group's "adaptive" framework that draws helpful elements from key theoretical constructs to design an international space mining regime for the benefit of all.

Strict Non-Appropriation / Absolute Incompatibility Theory	Provides the most formidable uncompromising defense against sovereign territorial / colonial impulses in the space sphere under the Non-Appropriation principle of Article II, 1967
• Could become an unintended custodian of the narrow policy focus of Title IV: Even if Title IV attains customary international law status in the future • Strict non-appropriationists logic will stand as a bulwark against any perversions or abuses of Title IV as a subterfuge for sovereign territorial claims of any kind in the space realm. • Strict Non-Appropriation is weakest when applied against Title IV, but strongest when focused predominantly on "non-appropriation" of the sphere, territories, and celestial bodies of outer space, per Article II, 1967 OST.	
Pragmatic Appropriations / Conditional Compatibility Theory	Provides a formidable shield for international space law and international law while nurturing emerging national space mining policies
• Contingent upon ongoing conformity with all applicable international requirements, conditions, and obligations. • Thus, this theory provides both policy levels with fair play in nascent Global Commons policy domains, such as space minerals mining.	
Realist Appropriation / Necessary Compatibility Theory	Corresponds to the Pragmatic but provides a greater weight of support to national legislative frameworks on space minerals mining.
• Does this by finding valid loopholes in international system and law to anchor the validity and viability of the national space mining framework. • Thus, the Realist Appropriation theory does not disparage nether policy levels, but argues through the national spectrum.	
Nationalist Hegemonic Appropriation / Absolute Compatibility Theory	As the polar opposite of strict appropriationists, National Hegemonists provide the most formidable defense for innovative national level space legislations
• Their committed skepticism of the international system and the authority of international space law and international law acts as a check on any international-style imperialism or multilateral dominion over states • Provides strong advocacy for the rights of States to act in the absence or silence of international law in particular narrow domains such space mining. • Also, their inherent populism over the economic advancement of domestic legal entities awakens the broader international law to needs for legal updates and necessary reforms consistent with innovative needs for regulatory guide	

Fig. 18. Summary of the HA / I(M)C Theory

Future Research Recommendations: Persisting Gap

Apparently the gap in Articles I and II, 1967 on the nature and scope of space minerals extractions has not been adequately filled by analogical comparisons with other global commons legal instruments (IISL 2015, 1-3). Likewise, attempts to design an international regime under the 1979 Moon Agreement failed because of disputes over its proposed equitable resources extraction, benefit-sharing, and management schemes under the so-called Common Heritage of Mankind concept (Blount and Robinson 2016). Thus, unresolved questions and issues remain regarding the specific prohibitions under the "non-appropriation" principle of Article II. Perhaps this could be resolved by an interpretive usage of Title IV as a unique national space mining policy that specifically opens up the space mining policy domain for further comprehensive regulatory measures at the international policy level. Given the rudimentary nature of Title IV, future researchers can make contributions to the necessary expansion of Title IV to account for the type of targeted mining regimes that will govern questions such as owning and leasing space mining, occupation issues, duration, and how those arrangements would implicate the freedom of equal access of all states, "due regard" and other protections in the 1967 OST and the body of international law.

CONCLUSION

There is a colossal amount of economic and financial opportunities, with consequence for the balance of economic and military on planet Earth, in the mining of strategic space minerals that amounts to trillions and trillions of dollars (chapter 1). But who will capitalize on it? Without clear legal guidelines in the body of general (public) international law—of which space law is a part of—or a universally acceptable international space mining legal framework made,

and consented to, by spacefaring States, the risk is an escalating arms race, geopolitical conflict that spills over, and potentially, a global war on planet Earth over outer space mineral resources. What legal perceptions of outer space at the international and domestic levels can best avert this looming danger and provide unambiguous, peaceful policy guidelines for space mining that will guarantee and reinforce interstate co-existence, cooperation, and harmony in the 21st century?

Based on analysis drawn from the theoretical constructs articulated above, this research study concluded that the Pragmatic and Realist Appropriation theorists currently dominate ongoing narratives in space minerals mining policy debates. To the question of whether the rights purportedly granted by the national law of Title IV, Sec. 51303, U.S. 2015 Space Act are with or without solid basis in the existing international legal regime under Articles I and II, 1967, this research study answered in the affirmative with the Pragmatic and Realist theories. The study grounded this conviction under a legal-historical investigation of the travaux preparatoires of international space law using the original intent policy analysis approach as well as a comparative foreign policy inquiry hinged on the 1927 "Lotus" principle of international law – regarding the authority of states to act in international spaces via some form of national jurisdiction where international law is ambiguous, absent, or silent .

As the constellation of theories above convey, the freedom of "exploration and use" of outer space is the "province of mankind" under Article I, 1967 OST. Most authorities interpret this phrase as opening space exploration and use to the entire human race – states and non-states. Others also expand the meaning of "use" to impliedly include space mining, while some push back against this reading of the term. Article II, 1967 OST barred the extensions of state sovereign territorial quests in any parts of space and celestial bodies, including the Moon, in the process of exercising the freedom of "exploration and use" of the space sphere. Thus, Article II's

"non-appropriation" principle designated outer space as a legal typology of "Global Commons" and provided a general bar against all forms of sovereign territorial jurisdictions in that space – in the sense of exclusive colonial or imperial takings.

Hence, experts legally equate outer space with the high seas where freedom to act provides the baseline legal regime – and demonstrates that some natural resources could be extracted without commensurate territorial claims of an international space. However, the text of the 1967 OST and its *travaux preparatoires* neither provides a comprehensive policy of space minerals extractions nor explicit bar against space mining policy. As economic interests in outer space minerals and the burgeoning innovative science and technology of the space domain continue to increase, the lack of any specific definitive, universally accepted regulatory guidance for space mining investors becomes a more urgent problem. Hence the national policy of Title IV remains a clear frontrunner for customary international law status as the community of spacefaring states embrace its harmonious tenet of regulated extractions of asteroid and space minerals for private benefits in this age of inevitable space mining.

As the esteemed space law expert and Hugo Grotius' fellow Dutchman and jurist, Professor Dr. Frans G. Von der Dunk (2020, 9-10), forcefully asserts, national space legislations implements, applies, and/or interprets the rules of international space law consistent with international law. In doing so, such national space legislation must operate precisely within the limitations provided by the legal status of outer space and the structure of international space law (ibid.). It is indubitable that the current U.S. space mining policy in Title IV, Sections 51301 – Section 403, U.S. 2015 Space Act, met these criteria. Therefore, it is my hope that the consistency of Title IV with the key tenets of the 1967 OST, as I have demonstrated in this

project, contributes to the evolving prospects of shared commercial prosperity, international cooperation, and global peace.

REFERENCES

Abbey, George, and Neal Lane. 2009. *United States Space Policy: Challenges and Opportunities Gone Astray*. American Academy of Arts and Sciences.

Abbott, Kenneth W. 1989. "Modern International Relations Theory: A Prospectus for International Lawyers." *Yale Journal of International Law*, Vol. 14, Iss. 2: 335-408. https://digitalcommons.law.yale.edu/yjil/vol14/iss2/3

Abdelal, Rawi, Herrera, Yoshiko M., Johnston, Alastair Lain, and Rose McDermott. 2012. "Identity as a Variable," in *Measuring Identity: A Guide for Social Scientists* .2012. Edited by Rawi Abdelal, Yoshiko M. Herrera, Alastair Lain Johnston, and Rose McDermott. Cambridge University Press. Pp. 17-32. https://doi.org/10.1017/CBO9780511810909.002

Abrahamian, Atossa Araxia. 2019. "How the Asteroid-Mining Bubble Burst: A Short History of the Space Industry's Failed (for now) Gold Rush." *MIT Technology Review*. https://www.technologyreview.com/2019/06/26/134510/asteroid-mining-bubble-burst-history/

Acemoglu, Daron and James A. Robinson. 2012. *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*. Crown Publishers. https://edisciplinas.usp.br/pluginfile.php/3954893/mod_resource/content/0/Why-Nations-Fail-Daron-Acemoglu.pdf

Aerospace Technology. 2015. "The 10 Countries Most Active in Space." Features-Analysis. https://www.aerospace-technology.com/features/featurethe-10-countries-most-active-in-space-4744018/

Allen, Craig. 2016. "Selected Scholarly Writings of William T. Burke." *Berkeley Law School*. https://www.law.berkeley.edu/wp-content/uploads/2016/09/Allen-_-Burke-Bibliography-2016.pdf

Alvesson, M., and Skoldberg, K. 2000. *Reflexive Methodology: New Vistas for Qualitative Research*. SAGE.

American Bar Foundation. 1959. "The American Bar Foundation: Annual Report 1959-1960." 1-47. American Bar Center. https://www.americanbarfoundation.org/uploads/cms/documents/1959_-_1960_abf_annual_report.pdf

Andem, Maurice N. 2004. "The Outer Space Treaty as the Magna Carta of Contemporary Space Law: A Reflection." In, *Proceedings of the Forty-Seventh Colloquium on the Law of Outer Space*. Vol. 47, no.IAC-04-IISL.3.10: 292-307. International Astronautical Federation. http://iafastro.directory/iac/archive/browse/IAC-04/IISL/3/508/

Anderson, Scot W., LaManna, Julia, Segal, Randy, and Steven Kaufman. 2021. "Innovations in Space: Space Mining." *JD Supra*, 1-6. Hogan Lovells. https://www.jdsupra.com/legalnews/innovations-in-space-space-mining-9603506/

Anderson, Scott W., Christensen, Korey, and Julia LaManna. 2019. "The Development of Natural Resources in Outer Space." *Journal of Energy & Natural Resources Law*, Vol. 37, Iss. 2: 227-258. Taylor & Francis Online. https://doi.org/10.1080/02646811.2018.1507343

Apple, James G., and Christine E. White. 2007. "Leading Figures in International Law: Hugo Grotius." *International Judicial Monitor*, Vol. 2, Iss. 3: 1. Published by the American Society of International Law and the International Judicial Academy. http://www.judicialmonitor.org/archive_1007/leadingfigures.html

Aquinas, St. Thomas. 1265/1274. Summa Theologica. Christian Classics Ethereal Library. https://www.ccel.org/ccel/a/aquinas/summa/cache/summa.pdf

Ashworth, Lucian, M. 2010 / 2011. "Realism and the Spirit of 1919: Halford Mackinder, Geopolitics and the Reality of the League of Nations." *European Journal of International Relations*, Vol. 17, no.2: 279-301. https://doi.org/10.1177%2F1354066110363501

Asterank Asteroid Database and Mining. 2021. "Asteroid Mass, Composition, and Value." https://www.asterank.com/

Austin, Zubin, and Jane Sutton. 2015. "Qualitative Research: Data Collection, Analysis, and Management." *The Canadian Journal of Hospital Pharmacy*, Vol. 68, no. 3: 226-231. DOI: 10.4212/cjhp.v68i3.1456

Authenticated U.S. Government Information / GPO 2014. "H.R. 5063: A Bill." 113th Congress, 2nd Session. https://www.govinfo.gov/content/pkg/BILLS-113hr5063ih/pdf/BILLS-113hr5063ih.pdf

Avalon Project / Lillian Goldman Law Library, Yale Law School. 2008. "Treaty of Westphalia." *The Avalon Project*. https://avalon.law.yale.edu/17th_century/westphal.asp

Avgerinopoulou, Dionysia – Theodora and Katerina Stolis. 2017. "Current Trends and Challenges in Space Law." *European Space Sciences Committee Plenary Meeting, Athens*, July 01, 2017. https://www.essc.esf.org/fileadmin/user_upload/essc/Article_Current_Trends_and_Challenges_in_Space_Law.pdf

Axelrod, Robert. 1980. "Effective Choice in the Prisoner's Dilemma." *Journal of Conflict Resolution*, Vol. 24, no. 1: 3-25. SAGE Publications, Inc. JSTOR. http://www.jstor.org/stable/173932?origin=JSTOR-pdf

Axelrod, Robert. 1981. "The Emergence of Cooperation Among Egoists." *The American Political Science Review*, Vol. 75, no. 2: 306–318. https://doi.org/10.2307/1961366

Axelrod, Robert, and William Hamilton. 1981. "The Evolution of Cooperation." *Science*, Vol. 211, no. 4489: 1390–1396. JSTOR. https://www.jstor.org/stable/1685895

Axelrod, Robert. 1984. *The Evolution of Cooperation*. Basic Books.

Axelrod, Robert, and Douglas Dion. 1988. "The Further Evolution of Cooperation." *Science*, Vol. 242, Iss. 4884: 1385-1390. JSTOR. http://www.jstor.org/stable/1702320?origin=JSTOR-pdf

Babcock, Hope M. 2019. “The Public Trust Doctrine, Outer Space, and the Global Commons: Time to Call Home ET.” *Syracuse Law Review*, Vol. 69, no.2: 191-261. *Georgetown Law Faculty Publications and Other Works*. https://scholarship.law.georgetown.edu/facpub/2201

Baca, Kurt Anderson. 1993. “Property Rights in Outer Space.” *Journal of Air Law and Commerce*, Vol. 58, Iss. 4, Art. 4: 1041-1085. https://core.ac.uk/download/pdf/147638351.pdf

Barber, Chris. 2015. “The Nixon Space Doctrine.” *The Richard Nixon Foundation*. https://www.nixonfoundation.org/2015/03/the-nixon-space-doctrine/

Barton, David. 2019. *Original Intent: The Courts, The Constitution, and Religion*. Wallbuilders.

Batsanov, Sergey. 2007. “The Outer Space Treaty: Then and Now.” In, “Celebrating the Space Age: 50 Years of Space Technology, 40 Years of the Outer Space Treaty.” Conference Report, April 2-3, 2007, 4-5. United Nations Institute for Disarmament Research, UNIDIR. https://unidir.org/sites/default/files/conferences/pdfs/conference-report-eng-0-103.pdf

Bazeley, P. 2007. *Qualitative Data and Analysis with NVivo*. SAGE.

Bean, Barbara. 2015. “Law of the Sea.” *Electronic Source Guide – American Society of International Law*. https://www.asil.org/sites/default/files/ERG_LOS.pdf

Beasley, Ryan K., Kaarbo, Juliet, Lantis, Jeffrey S., and Michael T. Snarr, eds. 2013. *Foreign Policy in Comparative Perspective: Domestic and International Influences on State Behavior*. Second Edition. CQ Press / SAGE.

Beaulac, Stephane. 2004. “The Westphalian Model in Defining International Law: Challenging the Myth.” *Australian Journal of Legal History*, Vol., 8: 181-213. https://ssrn.com/abstract=672241

Becker, Saul, and Alan Bryman, eds. 2004. *Understanding Research for Social Policy and Practice: Themes, Methods, and Approaches*. Policy Press.

Bederman, David J., Borgen, Christopher J., and David A. Martin, eds. 2003. *International Law: A Handbook for Judges*. American Society of International Law.

Behrens, Carl. 2009. “The International Space Station and the Space Shuttle.” *Congressional Research Service*, March 2009. http://www.fas.org/sgp/crs/space/RL33568.pdf.

Behrens, Carl. 2006. “Space Launch Vehicles: Government Activities, Commercial Competition, and Satellite Exports.” *Congressional Research Service*, March 20, 2006. http://www.fas.org/sgp/crs/space/IB93062.pdf.

Bell, Duncan, ed. 2007. *Victorian Visions of Global Order*. Cambridge University Press.

Bell, Golden W. 1937. “The President’s Power in the Field of Foreign Relations.” *Supplemental Opinions of the Office of Legal Counsel in Volume 1*, Memo 20661: 49-77. https://www.justice.gov/file/20661/download

Bensaid, Adam. 2021. “The Race for Space Colonization and Limitless Wealth is Already Here.” TRT World. https://www.trtworld.com/magazine/the-race-for-space-colonisation-and-limitless-wealth-is-already-here-45430

Biden, President Joseph R., Jr. 2021. “Interim National Security Strategic Guidance.” The White House. https://www.whitehouse.gov/wp-content/uploads/2021/03/NSC-1v2.pdf

Birks, M., and Mills J. 2015. *Grounded Theory: A Practical Guide*. 2nd Edition. SAGE.

Birks, M. 2014. “Practical Philosophy.” In, Mills, J., and M. Birks, eds. 2014. *Qualitative Methodology: A Practical Guide*. SAGE.

Black’s Law Dictionary Online. 2023. *Dominium*. https://thelawdictionary.org/dominium/#:~:text=Ownership%3B%20property%20in%20the%20largestsense,Dig.

Blackstone, Sir William. 1765-1769. *Commentaries on the Laws of England: Sir William Blackstone*. 4 Volumes, 2 Genealogical Tables. First Edition. Printed at the Clarendon Press. Lillian Goldman Law Library, Yale Law School. https://avalon.law.yale.edu/subject_menus/blackstone.asp

Blackstone, Sir William. 1770/1979. *Commentaries on the Laws of England*. Volume 2. The University of Chicago Press.

Block, Walter E., and Ivan Jankovic. 2016. “Tragedy of the Partnership: A Critique of Elinor Ostrom.” *American Journal of Economics and Sociology*, Vol. 75, no. 2: 289-318. https://doi.org/10.1111/ajes.12141

Blount, P. J. 2009. “Aviation and Space Law: Relevant Publications.” In Gabrynowicz, Professor Joanne Irene and Jacqueline Etil Serrao, eds. 2008. “Air and Space Law.” *Journal of Space Law*, Vol. 34, no.2: 525-542. https://airandspacelaw.olemiss.edu/pdfs/jsl-34-2.pdf

Blount, P. J., and Christian J. Robinson. 2016. “One Small Step: The Impact of the U.S. Commercial Space Launch Competitiveness Act of 2015 on the Exploitation of Resources in Outer Space.” *North Carolina Journal of Law & Technology*, Vol. 18, Iss. 2: 160-186. https://scholarship.law.unc.edu/cgi/viewcontent.cgi?article=1324&context=ncjolt

Bogue, Stuart H. 1963. “Trends in Water Use.” *Journal of American Water Works Association (AWWA)*, Vol. 55, Iss. 5: 548-554. https://doi.org/10.1002/j.1551-8833.1963.tb01047.x

Bolden, Charles, and John Holdren. 2010. “Joint Statement on Launching a New Era in Space Exploration.” The White House, February 1, 2010. http://www.whitehouse.gov/files/documents/ostp/press_release_files/Joint%20Statement%202.pdf.

Boli, John. 2001. “Sovereignty from a World Polity Perspective.” In *Problematic Sovereignty: Contested Rules and Political Possibilities*, edited by Stephen D. Krasner. Columbia University Press.

Bosselmann, Klaus. 2015. “Earth Governance: Trusteeship of the Global Commons.” *New Horizons in Environmental and Energy Law Series*. Pp 71-112. https://www.elgaronline.com/view/9781783477814.xml

Boucher, David. 1998. *Political Theories of International Relations: From Thucydides to the Present*. Oxford University Press.

Bouvet, Isabelle. 2012. “An International Legal Framework to Govern Space Natural Resources Exploitation.” Doctor of Civil Law Thesis. *Institute of Air and Space Law, Faculty of Law, McGill University Montreal*. https://escholarship.mcgill.ca/downloads/f1881q51f?locale=en

Bowe, Alexander. 2019. “China’s Pursuit of Space Power Status and Implications for the United States.” *Staff Research Report – U.S.-China Economic and Security Review Commission*, 1-26. https://www.uscc.gov/files/000797

Boyle, Michael J. / The Investopedia Team. 2020. “Tragedy of the Commons.” Investopedia – Economics – Microeconomics. https://www.investopedia.com/terms/t/tragedy-of-the-commons.asp

Brands, Hal, and Charles Edel. 2019. *The Lessons of Tragedy: Statecraft and World Order*. Yale University Press.

Brehm, Andrew R. 2015. “Private Property in Outer Space: Establishing a Foundation for Future Exploration.” *Wisconsin International Law Journal*, Vol. 33, no. 2: 353-379. https://repository.law.wisc.edu/s/uwlaw/media/77012

Brewer, Justice. 1892. *Church of the Holy Trinity v. United States*. 143 U.S. 457 (1892). Argued and Submitted January 7, 1892. Decided February 29, 1892. Justia. U.S. Supreme Court. https://supreme.justia.com/cases/federal/us/143/457/

Brierly, J. L. 1928. *The Law of Nations*. pp. 20-21.

Bringer, Joy D., Johnston, Lynne H., and Celia H. Brackenridge 2007. “Maximizing Transparency in a Doctoral Thesis: The Complexities of Writing about the Use of QSR*NVIVO Within a Grounded Theory Study.” *SAGE Journals-Qualitative Research*, Vol. 4, Iss. 2. : 247-265. https://doi.org/10.1177%2F1468794104044434

Bringer, Joy D., Johnston, Lynne H., and Celia H. Brackenridge. 2006. “Using Computer Assisted Qualitative Data Analysis Software to Develop a Grounded Theory Project.” *SAGE Journals - Field Methods*, Vol. 18, Iss. 3: 245-266. https://doi.org/10.1177%2F1525822X06287602

Brint, Michael, and William Weaver. 1991. *Pragmatism in Law and Society*. Westview Press.

Broniatowski, D.A., Faith, G. Ryan, and Vincent G. Sabathier. 2006. “The Case for Managed International Cooperation in Space Exploration.” *International Space Exploration Update*, 1-7. Center for

Strategic and International Studies, Washington, D.C. https://web.mit.edu/adamross/www/BRONIATOWSKI_ISU07.pdf

Brown, Chris. 2012. "The 'Practice Turn,' Phronesis and Classical Realism: Towards a Phronetic International Political Theory?" *Millennium*: *Journal of International Studies*, Vol. 40, no.3: 439-456. Sage Journals. https://doi.org/10.1177%2F0305829812441893

Brown, Chris, and Kirsten Ainley. 2009. *Understanding International Relations*. Fourth Edition. Palgrave Macmillan.

Brown, Chris, Nardin, Terry, and Nicholas Rengger. 2002. *International Relations in Political Thought: Texts from the Ancient Greeks to the First World War*. Cambridge Core. Published by Cambridge University Press. https://doi.org/10.1017/CBO9780511808784

Brown, Scott C., Stevens, Richard A., Jr., Troiano, Peter F., and Mary Kay Schneider. 2002. "Exploring Complex Phenomenon: Grounded Theory in Student Affairs Research." *Journal of College Student Development*, Vol. 43, no. 2: 173 - 183. https://www.cedu.niu.edu/~walker/research/Grounded%20Theory.pdf

Brownlie, Ian. 1970. *Principles of Public International Law*. Fifth Edition. Oxford University Press.

Brunner, Christian and Alexander Soucek, eds. 2011. *Outer Space in Society, Politics, and Law. Studies in Space Policy*. Volume Eight. European Space Policy Institute (ESPI). Springer Wien. https://espi.or.at/?view=article&id=99:outer-space-in-society-politics-and-law&catid=17

Bryant, A., and Kathy Charmaz. 2011/2012. "Grounded Theory and Psychological Research." In, *APA Handbook of Research Methods in Psychology*, Vol. 2. 2012. Edited by H. Cooper, et al. American Psychological Association. https://psycnet.apa.org/fulltext/2011-23864-003.pdf

Bryant, A., and Charmaz, Kathy, eds. 2007. *The Sage Handbook of Grounded Theory*. Thousand Oaks.

Bryant, A., and Kathy Charmaz. 2007. "Grounded Theory in Historical Perspective: An Epistemological Account." In, Bryant, A., and Kathy Charmaz, eds *The Sage handbook of grounded theory*. SAGE.

Bryce, James. 1904. *The Holy Roman Empire*. 5th Edition. P.436.

Buckland, William Warwick. 1921/1963. *A Textbook of Roman Law from Augustus to Justinian*. 3rd Edition. Revised by Peter Stein. Cambridge University Press.

Bull, Hedley. 1981. "Hobbes and International Anarchy." *Social Research*, Vol 48, no. 4:717-738. Politics: The Work of Hans Morgenthau (Winter 1981). Published by The New School. JSTOR. http://www.jstor.org/stable/40970843

Bull, Hedley. 1977. *The Anarchical Society: A Study of Order in World Politics*. Columbia University Press.

Burchill, S., Linklater, A., Devetak, R., Donnelly, J., Paterson, M., Reus-Smit, C., and Jacqui True. 2005. *Theories of International Relations*. Third Edition. Palgrave Macmillan.

Bureau of Public Affairs / U.S. Department of State / Bureau of Arms Control, Verification, and Compliance. 2009-2017. "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies: Entered into Force October 10, 1967." *Archive of Current Treaties and Agreements*. https://2009-2017.state.gov/t/isn/5181.htm

Burley, Anne-Marie Slaughter. 1993. "International Law and International Relations Theory: A Dual Agenda." *The American Journal of International Law*, Vol. 87, no. 2: 205-239). Published by Cambridge University Press. JSTOR. https://www.jstor.org/stable/2203817

Bush, President George W. 2006. "National Space Policy of the United States of America." Unclassified – USGS, Eros History Project – Records. https://d9-wret.s3.us-west-2.amazonaws.com/assets/palladium/production/s3fs-public/atoms/files/2006%20National%20Space%20Policy.pdf

Bush, President George W. 2004. "A Journey to Inspire, Innovate, and Discover." Report of the President's Aldridge Commission on the Implementation of United States Space Exploration Policy, 1-61. *Space Policy Archive*. https://aerospace.org/sites/default/files/policy_archives/Aldridge%20Commission%20Report%20Jun04.pdf

Bush, President George H.W. 1992. "A Post-Cold War Assessment of U.S. Space Policy: A Task Group Report." *Vice President's Space Policy Advisory Board*, 1-76. Space Policy Archive. https://aerospace.org/sites/default/files/policy_archives/Post-Cold%20War%20Assessment%20of%20U.S.%20Space%20Policy%20Dec92.pdf

Bush, President George H.W. 1991. "National Space Council 1990 Report to the President." 1-33. *Space Policy Archives*. https://aerospace.org/sites/default/files/policy_archives/National%20Space%20Council%201990%20Report%20Jan91.pdf

Buxton, Carol R. 2004. "Property in Outer Space: The Common Heritage of Mankind Principle vs. the "First in Time, First in Right" Rule of Property Law." *Journal of Air Law and Commerce*, Vol. 69, Iss.4: 689-703. https://scholar.smu.edu/jalc/vol69/iss4/3

Buzan, Barry and George Lawson. 2013. "The Global Transformation: The 19th Century and the Making of Modern International Relations." *International Studies Quarterly*, Vol. 57, no.1: 620-634. Oxford Academic. https://doi.org/10.1111/isqu.12011

Buzan, Barry and Richard Little. 2000. *International Systems in World History*. Oxford University Press.

Callahan, Jason. 2014. "How Richard Nixon Changed NASA." *Planetary Society*. https://www.planetary.org/articles/20141003-how-richard-nixon-changed-nasa

Campbell, Richmond, and Lanning Snowden. 1985. *Paradoxes of Rationality and Cooperation*. University of British Columbia Press.

Canada Space Agency. 1990. “Canadian Space Agency Act.” *Space Policy Archive*. https://aerospace.org/sites/default/files/policy_archives/Canadian%20Space%20Agency%20Act%201990.pdf

Canada Space Agency. 2014. “Canada’s Space Policy Framework: Launching the Next Generation.” 1-13. *Space Policy Archive*. https://aerospace.org/sites/default/files/policy_archives/Canada%20Space%20Policy%20Framework%20Feb14.pdf

Carcary, Marian. 2020. "The Research Audit Trial - Enhancing Trustworthiness in Qualitative Inquiry." *The Electronic Journal of Business Research Methods*, Vol. 18, no.2: 166-177. https://doi.org/10.34190/JBRM.18.2.008

Carlsnaes, Walter, Risse, Thomas and Beth Simmons, eds. 2004. *Handbook of International Relations*. SAGE.

Carnegie Endowment for International Peace National Commission. 1992. *Changing Our Ways: America and the New world*. Carnegie Endowment for International Peace.

Carr, E. H. 2016. *The Twenty Years’ Crisis, 1919-1939: An Introduction to the Study of International Relations*. Reissued with a New Preface from Michael Cox, ed. Palgrave Macmillan.

Cassese, Antonio. 2004/2013. *International Law*. Second Edition. Oxford University Press. Oxford Law Trove. https://www.oxfordlawtrove.com/view/10.1093/he/9780199259397.001.0001/he-9780199259397

Casey, J. P. 2019. “The History of Space Mining: Five Key Events for Mineral Exploration in Space.” Mining Technology. https://www.mining-technology.com/features/history-of-space-mining/

CBC News. 2015. “U.S. Space-Mining Law Seen Leading to Possible Treaty Violations.” Citing Professor Ram Jakhu. CBC Science News. https://www.cbc.ca/news/science/space-mining-us-treaty-1.3339104

Center for International Law. 1959. “The 1959 Antarctic Treaty.” *CIL University of Singapore*, 1-8. http://www.cil.nus.edu.sg/

Center for Strategic & International Studies – CSIS. 2022. “What’s Next for the China-Russia Relationship?” Events – CSIS. https://www.csis.org/events/whats-next-china-russia-relationship

Center for Space Policy and Strategy. 2021. *Space Policy Archive*. Aerospace. https://aerospace.org/space-policy-resources

Center for the Study of the Presidency and Congress Space Policy Project. 2021. “Space Policy Summary: Harnessing Commercial Innovation to Secure the Highest Ground.” *CSPCSPP*, 20-21. https://static1.squarespace.com/static/5cb0a1b1d86cc932778ab82b/t/5d02b0ad95e7570001cf5bc4/1560457389416/Space+Policy+2+Pager.pdf

Cepelka, Cestmir, and Jamie H. C. Gilmour. 1970. "The Application of General International Law in Outer Space." *Journal of Air Law and Commerce*, Vol. 36, Iss. 1, Art. 3: 30-49. SMU Scholar. https://scholar.smu.edu/jalc/vol36/iss1/3

Chaturvedi, S. 2009. "Antarctic as a Continent of Science and Peace: 1950s and 1960s." *International Encyclopedia of Human Geography*. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/antarctic-treaty

Charmaz, Kathy. 2007. *Constructing Grounded Theory: A Practical Guide Through Qualitative Research*. SAGE. *Nurse Res*, Vol. 13, no. 4: 1-86. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6318722/

Charmaz, Kathy and A. Bryant. 2011. "Grounded Theory and Credibility." In, Silverman D., ed. *Qualitative Research*. 3rd ed. SAGE.

Charmaz, Kathy. 2012. "The Power and Potential of Grounded Theory." *A Journal of the BSA MedSoc Group*, Vol.6, Iss. 3: 2–15. Medical Sociology Online. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1062.8596&rep=rep1&type=pdf

Charmaz, Kathy. 2005. "Grounded Theory in the 21st Century: Application for Advancing Social Justice Studies." In, Denzin, N. K. and Y. S. Lincoln, eds. 2005. *The Sage handbook of qualitative research*. SAGE.

Chen, Janet, Lu, Su-I, and Dan Vekhter. 1998/1999. "Game Theory." https://cs.stanford.edu/people/eroberts/courses/soco/projects/1998-99/game-theory/index.html

Cheng, Bin. 1983. "The Legal Status of Outer Space and Relevant Issues: Delimitation of Outer Space and Definition of Peaceful Use." *Journal of Space Law*, Vol. 11, nos.1&2:89-105. HeinOnline / Biddle Law Library, University of Pennsylvania. https://www.law.upenn.edu/live/files/7834-chengdftissspclawjrnlspclawpdf

Cheng, Bin. 1997. "From Air Law to Space Law." In, *Studies in International Space Law*, by Bin Cheng. Published to Oxford Scholarship Online by Oxford University Press. DOI:10.1093/acprof:oso/9780198257301.003.0003

Cheng, Bin. 1997. "The Commercial Development of Space: The Need for New Treaties." In, *Studies in International Space Law*, by Bin Cheng. Published to Oxford Scholarship Online by Oxford University Press. DOI:10.1093/acprof:oso/9780198257301.003.0025

Cheng, Bin. 2000. "Properly Speaking, Only Celestial Bodies have been Reserved for Use Exclusively for Peaceful (Non-Military) Purposes, but Not Outer Void." International Studies, Vol, 75: 81-117. *International Law Across the Spectrum of Conflict. Essays in Honor of Professor L.C. Green: On the Occasion of His Eightieth Birthday*. Chapter III. Edited by Michael N. Smith. U.S. Naval War College. https://digital-commons.usnwc.edu/ils/vol75/iss1/21/

Cheng, Bin. 1953 / 2006. *General Principles of Law as Applied by International Courts and Tribunals*. University College, London. P.29.

China National Space Administration / The State Council Information Office of the People's Republic of China. 2022. "China's Space Program: A 2021 Perspective." White Paper, 1-22. CSA - English. http://www.cnsa.gov.cn/english/n6465652/n6465653/c6813088/content.html

China National Space Administration. 2021. "Chang'e 4 Lunar Probe and Sample Return." Lunar Probe. https://www.spacetv.net/change-4-cnsa-lunar-probe/

Choi, Charles Q. 2020. "Mars Colonists Could Get Fuel and Oxygen from Water on the Red Planet." Space.com News / Science & Astronomy, December 02, 2020. https://www.space.com/mars-colonists-fuel-oxygen-production

Christol, Carl Q. 1990. "Outer Space Exploitability: International Law and Developing Nations." *Space Policy*, Vol. 6, Iss.2:146-160. https://doi.org/10.1016/0265-9646(90)90050-8

Christol, Carl Q. 1991. *Space Law: Past, Present and Future*. Kluwer Law and Taxation Publishers.

Christol, Carl Q. 1994. "Judge Manfred Lachs and the Principle of Jus Cogens." *Journal of Space Law*, Vol. 22, nos.1 & 2: 33-46. https://heinonline.org/HOL/Page?handle=hein.journals/jrlsl22&collection=journals&id=37&startid=&endid=50

Christol Carl Q. 2008. *Space Law: Past, Present, and Future*. Kluwer and Taxation Publishers.

CIA / Mildred Benton. 1958. "The Literature of Space Science and Exploration." *Library Branch, Technical Information Division*. Bibliography No. 13. Declassified 2014. https://www.cia.gov/library/readingroom/docs/CIA-RDP81-01043R002700120002-3.pdf

Clarke, A. 2005. *Situational Analysis: Grounded Theory After the Postmodern Turn*. SAGE.

Clarke, Chris. 2009. "Parts Between Positivism and Interpretivism: An Appraisal of Hay's Via Media." *Journal of Politics*, Vol. 29, Iss. 1: 28-36. Political Studies Association. Wiley. https://doi.org/10.1111/j.1467-9256.2008.01335.x

Cobb, Kurt. 2021. "Another Extraordinary Delusion: Mining Helium from the Moon." Resource Insights / Resilience – Energy. https://www.resilience.org/stories/2021-11-14/another-extraordinary-delusion-mining-helium-from-the-moon/

Cochran, Clarke E., Mayer, Lawrence C., Carr, T.R., Cayer, N. Joseph, McKenzie, Mark J., and Laura R. Peck. 2016. *American Public Policy: An Introduction.* Eleventh Edition. CENGAGE Learning.

Coffey, Sarah. 2009. "Establishing a Legal Framework for Property Rights to Natural Resources in Outer Space." *Case Western Reserve Journal of International Law*, Vol. 41, Iss. 1, Art. 6: 120-148. https://scholarlycommons.law.case.edu/jil/vol41/iss1/6

Cogolati, C., and R. Vanstappen. 2016. "Global Commons and Global Public Goods: Two Sides of the Same Coin?" International Conference on Global Commons, Global Public Goods, and Global Democracy. Leuven. https://ghum.kuleuven.be/ggs/events/2016/international-conference-

global-commons-global-public-goods-and-global-democracy-leuven/c-cogolati-and-vanstappen-global-commons-and.pdf

Cohen, Aaron. 1992. *Variables to be Considered for Further Human Exploration of Space*. *National Aeronautics and Space Administration*. 30th Aerospace Sciences Meeting and Exhibit – American Institute of Aeronautics and Astronautics (AIAA) Meeting Research. https://doi.org/10.2514/6.1992-620

Cohen, Ariel. 2021. "China's Space Mining Industry is Prepping for Launch – But what about the U.S.?" *Forbes – Energy*. https://www.forbes.com/sites/arielcohen/2021/10/26/chinas-space-mining-industry-is-prepping-for-launch--but-what-about-the-us/?sh=6fd9ce462ae0

Cohen, Benjamin J. 1982. "Balance-of-Payment Financing: Evolution of a Regime." *International Organization*, Vol. 36, no. 2: 457-478. Published by The MIT Press. JSTOR. https://www.jstor.org/stable/2706529

Cohen, D. J., and B. F. Crabtree. 2008. "Evaluative Criteria for Qualitative Research in Health Care: Controversies and Recommendations." *Annals of Family Medicine*, Vol. 6, no. 4: 331-339. DOI: 10.1370/afm.818

Cohen, Eliot A. 2016. *The Big Stick: The Limits of Soft Power and the Necessity of Military Force*. Basic Books.

Coleman, J. 1988. "Property and Poverty." In, *The Cambridge History of Medieval Political Thought c.350–c.1450,* edited by J. Burns. The Cambridge History of Political Thought, 1988, 607-648. Cambridge University Press. doi:10.1017/CHOL9780521243247.023

Committee on Science, Space, and Technology, U.S. House of Representatives. 2019. "Compilation of Space Law, Documents, and Agreements: Prepared at the Request of Hon. Eddie Bernice Johnson, Chairwoman." 116th Congress, 1st Session. (CP: 116-9) 38-136. U.S. Government Publishing Office. https://www.govinfo.gov/content/pkg/CPRT-116HPRT38136/pdf/CPRT-116HPRT38136.pdf

Committee on International Space Programs. 1998. *U.S.–European Collaboration in Space Science*. National Academies Press. https://doi.org/10.17226/5981

Committee on the Peaceful Uses of Outer Space / Legal Subcommittee. 2018. "The Hague International Space Resources Governance Working Group: Information Provided by the Netherlands." *UNOOSA*. A/AC.105/C.2/2018/CRP.18 https://www.unoosa.org/res/oosadoc/data/documents/2018/aac_105c_22018crp/aac_105c_22018crp_18_0_html/AC105_C2_2018_CRP18E.pdf

Congressional Research Service (CRS). 2022. "Understanding Federal Legislation: A Section-by-Section Guide to Key Legal Considerations." *Congressional Research Service*, R46484. https://crsreports.congress.gov/product/pdf/R/R46484

Congressional Research Service (CRS). 2018. "Statutory Interpretation: Theories, Tools, and Trends." *CRS. No. R45153*. https://crsreports.congress.gov/product/pdf/R/R45153

Conkling, Alfred. 1866. *The Powers of the Executive Department of the Government of the United States*. Published by Weare C. Little. Originally from Harvard University. Digitized by Google. https://babel.hathitrust.org/cgi/pt?id=hvd.hx4ihw&view=1up&seq=7

Cooney, Adeline. 2011. "Rigor and Grounded Theory." *Nurse Researcher*, Vol. 18, no. 4: 17-22. NIH / National Library of Medicine. DOI: 10.7748/nr2011.07.18.4.17.c8631

Cooper, John Cobb. 1952. "Roman Law and the Maxim *Cujus Est Solum* in International Air Law." *McGill Journal of International Air Law*, Vol. 1, no.1: 23-65. https://lawjournal.mcgill.ca/wp-content/uploads/pdf/39679-1.1.Cooper.pdf

COPUOS Legal Subcommittee. 2021. "Report of the Legal Subcommittee on its Sixty-First Session Held in Vienna from 28 March to 8 April 2022." COPUOS, Sixty-Fifth Session, Vienna, 1 – 10 June 2022. UNGA. https://documents-dds-ny.un.org/doc/UNDOC/GEN/V22/022/49/PDF/V2202249.pdf?OpenElement

COPUOS Legal Subcommittee. 2021. "Report of the Legal Subcommittee on its Sixtieth Session, Held in Vienna from 31 May to 11 June 2021." COPUOS Sixty-Fourth Session, Vienna, 25 Augus-3September 2021. https://documents-dds-ny.un.org/doc/UNDOC/GEN/V21/047/17/PDF/V2104717.pdf?OpenElement

COPUOS Legal Subcommittee. 2019. "Report of the Legal Subcommittee on its Fifty-Eighth Session, Held in Vienna from 1 to 12 April 2019." COPUOS Sixty-Second Session. Vienna, 12-21 June 2019. UNGA. https://documents-dds-ny.un.org/doc/UNDOC/GEN/V19/025/95/PDF/V1902595.pdf?OpenElement

Cobb, Kurt. 2021. "Another Extraordinary Delusion: Mining Helium from the Moon." Resource Insights – Independent Commentary on Environmental and Natural Resource News, Sunday November 14, 2021. http://www.resourceinsights.blogspot.com.2021/11/another-extraordinary-delusion-mining.html

Corbin, Juliet M, and Anselm Strauss. 1990. "Grounded Theory (GT) Research: Procedures, Canons, and Evaluative Criteria." *Qualitative Sociology*, Vol. 13, no.1: 3-21. https://med-fom-familymed-research.sites.olt.ubc.ca/files/2012/03/W10-Corbin-and-Strauss-grounded-theory.pdf

Corbin, Juliet M., and Anselm Strauss. 1998. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. SAGE Publications, Inc.

Corbin, Juliet M., and N.L. Holt. 2004. "Grounded Theory." In B. Somekh and C. Lewin, eds. 2004. *Research Methods in the Social Sciences*. Pp. 50-57. SAGE.

Corbin, Juliet M., and Anselm Strauss. 2008. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. Third Edition. SAGE.

Cornell Law School / Legal Information Institute. 2023. "Nullum Crimen Sine Lege." Nullum crimen sine lege | Wex | US Law | LII / Legal Information Institute (cornell.edu)

Cornell Law School. 2021. “The Conduct of Foreign Relations: Scope of Presidential Power (U.S. Constitution Annotated; Article II. Executive Department; Section III- The Conduct of Foreign Relations).” *Legal Information Institute*. https://www.law.cornell.edu/constitution-conan/article-2/section-3/the-conduct-of-foreign-relations

Cotter, Thomas F. 2011. “Legal Pragmatism and Intellectual Property Law.” In *Intellectual Property and the Common Law*, edited by Shyam Balganesh. Cambridge University Press. *Minnesota Legal Studies Research.* No. 11-22. https://researchs.ssrn.com/sol3/researchs.cfm?abstract_id=1845915

Cotter, Thomas F. 1996. “Legal Pragmatism and the Law and Economics Movement.” *Georgetown Law Journal*, Vol. 84, Iss. 6: 2071-2142. HeinOnline. https://heinonline.org/HOL/AuthorProfile?search_name=Cotter%2C+Thomas+F.&collection=journals&base=js

Craven, Matt. 2019. “Other Spaces: Constructing the Legal Architecture of a Cold War Commons and the Scientific-Technical Imaginary of Outer Space.” *European Journal of International Law*, Vol. 30, Iss.2:547-572. https://doi.org/10.1093/ejil/chz024

Crawford, James. 2012. *Brownlie’s Principles of Public International Law*. Eighth Edition. Oxford University Press.

Creswell, J. W. 2013. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 4th ed. SAGE.

Crotty, M. 1998. *The Foundation of Social Research: Meaning and Perspective in the Research Process*. SAGE.

Crowe, Beryl L. 1969. “The Tragedy of the Commons Revisited.” *Science*, Vol. 166, no.3909: 1103-1109. https://science.sciencemag.org/content/166/3909/1103

Darwin, Charles. 1859. *On the Origin of Species*. https://www.vliz.be/docs/Zeecijfers/Origin_of_Species.pdf

Davis, Lawrence H. 1977. “Prisoners, Paradox and Rationality.” *American Philosophical Quarterly*, Vol. 14, no. 4: 319–327. Published by University of Illinois Press on behalf of the North American Philosophical Publications. JSTOR. https://www.jstor.org/stable/20009684

Davis-Floyd, Robbie, Cox, Kenneth J., and Frank White. 2012. “Space Stories: Oral Histories from the Pioneers of America’s Space Program.” An Oral History Project. The Institute for Advanced Interdisciplinary Research / The Houston Chapter, AIAA, Honeywell Corporation. 1-185. http://www.davis-floyd.com/wp-content/uploads/2018/10/Spacestories-for-online-publication-2012.pdf

Daya, Puja / IAEA. 2022. “What are Isotopes?” International Atomic Energy Agency. News Center. https://www.iaea.org/newscenter/news/what-are-isotopes

Defense Intelligence Agency (DIA). 2019. “Challenges to Security in Space.” *Military Power Publications*. https://www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/Space_Threat_V14_020119_sm.pdf

Degrange, Valentin. 2018. “Into the Twenty-First Century: Integration of Principles of Global Governance in Space Law.” In, *A Fresh View on the Outer Space Treaty*, 2018, by Annette Froelich, ed. Pp. 75-87. European Space Policy Institute / Studies in Space Policy. Springer.

De Man, Philip. 2017. “Luxembourg Law on Space Resources Rests on Contentious Relationship with International Framework.” *Working Research*, no. 189 - July 2017. KU Leuven Center for Global Governance Studies / Institute for International Law. https://ghum.kuleuven.be/ggs/publications/working_researchs/2017/189De Man

De Man, Philip. 2015. “The Exploitation of Asteroids and the Non-Appropriation Principle: Reflections on the Nature of Property Rights in Light of the U.S. Space Resource Act of 2015.” *Journal of Space Law* 2016-2016, Vol, 40, no. 1-2: 1-56. University of Mississippi School of Law. https://airandspace.confit.dev/wp-content/uploads/2020/07/JSL-40.12.pdf

Dembling, Paul G. and Daniel M. Arons. 1966. “Space Law and the United Nations: The Work of the Legal Subcommittee of the United Nations COPUOS. *The Journal of Air Law and Commerce*, Vol. 32: 329-386. ProQuest. https://www.proquest.com/docview/1296625508/fulltextPDF/2B93A474DA0B425DPQ/1?accountid=12085

Dembling, Paul G. and Daniel M. Arons. 1967 / 2007. “The Evolution of the Outer Space Treaty.” *Journal of Air Law and Commerce*, Vol. 33, 1967: 419-456. Reprinted in *Space Law*, by F. Lyall and P. B. Larsen, eds., pp. 151-188. Ashgate. University of Nebraska, Digital Commons. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1002&context=spacelawdocs

Dembling, Paul G. 1979. “Treaty on Principles Governing the Activities of States in the Exploration and Use of Outerspace, Including the Moon and Other Celestial Bodies.” In, *Manual on Space Law*. 1979. Volume I. Compiled and Edited by Nandasiri Jasentuliyana and R.S.K. Lee. Oceana Publications.

Denzin, Norman K., and Yvonne S. Lincoln. 1998. *The Landscape of Qualitative Research: Theories and Issues*. SAGE Publications.

Denzin, Norman K. 1970. *The Research Act: A Theoretical Introduction to Sociological Methods*. Aldine Publishing Co.

Derian, Der James. 2013. “A Review of Righteous Realists: Political Realism, Responsible Power, and American culture in the Nuclear Age. By Joel H. Rosenthal. Baton Rouge: Louisiana State University Press, 1991. 191p. $24.95.” *American Political Science Review*, Vol. 86, Iss.3: 848-849. American Political Science Association (APSA). Published Online by Cambridge University Press. https://doi.org/10.2307/1964213

Devlen, Balkan. 2015. “Book Review: The Politics of American Foreign Policy: How Ideology Divides Liberals and Conservatives Over Foreign Affairs. By Peter Hays Gries.” *International Affairs*, Vol. 91, no.3: 679-680. https://doi.org/10.1111/1468-2346.12326

Dey, Ian. 1999. *Grounding Grounded Theory: Guidelines for Qualitative Inquiry*. Academic Press.

Di Gregorio, S. 2003 / 2017. “Teaching Grounded Theory with QSR NVivo.” *Qualitative Research Journal*, Special Issue 2003: 79-95. https://search.informit.org/doi/abs/10.3316/aeipt.150147

Dictionary of Greek and Roman Antiquities. 1870. Edited by Sir William Smith (1813 – 1893). University of Michigan Library. http://name.umdl.umich.edu/ACL4256.0001.001

Diederiks-Verschoor, I. H. Philepina and Vladimir Kopal. 2008. *An Introduction to Space Law*. Third Revised Edition. Kluwer Law International. Wolters Kluwer.

Dinar, Shlomi, Dinar, Ariel, and Pradeep Kurukulasuriya. 2011. “Scarcity and Cooperation Along International Rivers: An Empirical Assessment of Bilateral Treaties.” *International Studies Quarterly*, Vol. 55, No. 3: 809-833. Published by Wiley on behalf of The International Studies Association. JSTOR. https://www.jstor.org/stable/23020068

Dinkin, Sam. 2004. “Property Rights and Space Commercialization.” *The Space Review* – Essays and Commentary about the Final Frontier. Monday, May 10, 2004. 1-3. https://www.thespacereview.com/article/141/1

Distefano, Giovanni. 2010. “Theories on Territorial Sovereignty: A Reappraisal.” *Journal of Sharia & Law*, Issue No. 41-Muharram1431 H: 25-47. http://ssrn.com/abstract=1688967

Dixit, Avinash K., and Barry J. Nalebuff. 1999/2019. “Prisoners’ Dilemma.” The Library of Economics and Liberty. https://www.econlib.org/library/Enc/PrisonersDilemma.html

Dobbins, James. 2017. “In Its Relations with Russia, Can the U.S. Walk and Chew Gum at the Same Time?” U.S. News & World Report, Commentary. The RAND Corporation. https://www.rand.org/blog/2017/08/in-its-relations-with-russia-can-the-us-walk-and-chew.html

Dodge, Michael. 2016. “The U.S. Commercial Space Launch Competitiveness Act of 2015: Moving U.S. Space Activities Forward.” *The Air & Space Lawyer*, Vol. 29, no.3: 1-5. American Bar Association. https://www.sarahnilsson.org/app/download/966144643/Space+law+act+2015.pdf

Donohue, Laura K. 2021. “Who Owns the Skies?: A Coelum, Property Rights, and State Sovereignty.” Georgetown University Law Center. https://scholarship.law.georgetown.edu/facpub/2369

Drmola, Jakub and Tomas Hubik. 2018. “Kessler Syndrome: System Dynamics Model.” *Space Policy - Elsevier*, Vols. 44-45: 29-39. ScienceDirect. https://doi.org/10.1016/j.spacepol.2018.03.003

Dryden, Hugh L., and National Academy of Sciences. 1965. “Theodore Von Karman 1881-1963: A Biographical Memoir by Hugh L. Dryden.” *National Academy of Sciences Biographical Memoirs*, 345-384. http://www.nasonline.org/publications/biographical-memoirs/memoir-pdfs/von-karman-theodore.pdf

Duke, Michael B. 2020. “Space Resources.” NASA – Technology Priorities Recommendations. Microsoft PowerPoint 1-40. https://history.nasa.gov/DPT/Technology%20Priorities%20Recommendations/Space%20Resources%20DPT%20Boulder%2000.pdf

Dumbauld, Edward. 1954. “Hugo Grotius: The Father of International Law.” *Journal of Public Law*, Vol. 1: 117-127. HeinOnline. https://heinonline.org/HOL/Page?handle=hein.journals/emlj1&div=10&g_sent=1&casa_token=&collection=journals

Dumbauld, Edward. 1952. “Grotius on the Law of Prize.” *Journal of Public Law*, Vol. 1: 370-389. HeinOnline. https://heinonline.org/HOL/Page?collection=journals&handle=hein.journals/emlj1&id=372&men_tab=srchresults

Dunne, Tim, Kurki, Milja and Steve Smith, eds. 2010. *International Relations Theories: Discipline and Diversity*. Second Edition. Oxford University Press.

Dunietz, Jesse. 2017. “Floating Treasure: Space Law Needs to Catch Up with Asteroid Mining.” *Scientific American*, 1-6. https://www.scientificamerican.com/article/floating-treasure-space-law-needs-to-catch-up-with-asteroid-mining/?print=true

Education for the Information Age. 1999. “What is Helium-3?” EDinformatics. https://www.edinformatics.com/math_science/what-is-helium-3.html

Edwards, Jim. 2017. “Goldman Sachs: Space-Mining for Platinum is “More Realistic than Perceived.”” *Business Insider*. https://www.businessinsider.com/goldman-sachs-space-mining-asteroid-platinum-2017-4?r=UK%26IR=T

Egan, Brian J. 2016. “The Next Fifty Years of the Outer Space Treaty.” Galloway Symposium on Critical Issues in Space Law, December 7, 2016. Office of the Legal Adviser, U.S. Department of State. https://2009-2017.state.gov/s/l/releases/remarks/264963.htm

Eig, Larry M. 2014. “Statutory Interpretation: General Principles and Recent Trends.” *Congressional Research Service, CRS Report* 97-589: 1-55. https://sgp.fas.org/crs/misc/97-589.pdf

Eisenhower, President Dwight D. 1957. “A National Space Program: Report.” *Space Policy Archive*. https://aerospace.org/sites/default/files/policy_archives/National%20Space%20Program%20report%201957.pdf

Eisenhower, President Dwight D. 1959. “The Antarctic Treaty: Message from the President of the United States.” *86th Congress, 2d Session, Executive B*., 1-13. https://www.gc.noaa.gov/documents/1959-Antarctic-treaty.pdf

Eisenhower, President Dwight D. 1960. “Address by President Dwight Eisenhower to the UN General Assembly: September 22, 1960.” *U.S. Department of State*. https://2009-2017.state.gov/p/io/potusunga/207330.htm

Elden, Stuart. 2009. *Terror and Territory: The Spatial Extent of Sovereignty*. New Edition. University of Minnesota Press. JSTOR. https://www.jstor.org/stable/10.5749/j.cttts6bw

Elden, Stuart. 2007. "Terror and Territory." *ANTIPODE – A Radical Journal of Geography*, Vol. 39, Iss. 5: 821-845. WILEY. https://doi.org/10.1111/j.1467-8330.2007.00554.x

Elferink, Alex G. Oude. 2012. "Governance Principles for Areas Beyond National Jurisdiction." *The International Journal of Marine and Coastal Law*, Vol. 27, no. 2: 205-260. Martinus Nijhoff Publishers. HeinOnline. https://heinonline.org/HOL/Page?handle=hein.journals/ljmc27&collection=journals&id=213&startid=213&endid=268

Erskine, Toni and Ned Lebow, eds. 2012. *Tragedy and International Relations*. Palgrave Studies in International Relations. Palgrave Macmillan.

European Space Policy Institute. 2021. "Emerging Spacefaring Nations – Full Report." *ESPI Public Reports*. https://espi.or.at/publications/espi-public-reports/send/2-public-espi-reports/577-emerging-spacefaring-nations-full-report

European Space Agency (ESA). 2020. "ESA Space Resources Strategy." *ESA Unclassified – Releasable to the Public*, 1-19. https://sci.esa.int/documents/34161/35992/1567260390250-ESA_Space_Resources_Strategy.pdf

European Space Agency. 2014. "Philae Probe Lands on Comet." ESA-Science & Exploration / Rosetta. 12/11/2014. https://www.esa.int/Science_Exploration/Space_Science/Rosetta/Touchdown!_Rosetta_s_Philae_probe_lands_on_comet

European Space Agency (ESA). 2007. "Resolution on the European Space Policy: ESA Director General's Proposal for the European Space Policy." ESA Multimedia Publications, ESA BR-269, June 2007. https://esamultimedia.esa.int/multimedia/publications/BR-269/offline/download.pdf

European Space Agency (ESA). 2005. "Convention of the European Space Agency." *ESA SP*-1300 (English), 1-87. https://aerospace.org/sites/default/files/policy_archives/ESA%20Convention%20Sep05.pdf

Evans, Graham, and Jeffrey Newnham. 1998. *The Penguin Dictionary of International Relations. Penguin Books*. https://pdfs.semanticscholar.org/67d3/cd29da8f8026a98800ad6a123b1c7fc25d52.pdf?_ga=2.254814273.838036289.1602874132-1403948819.1598273172

Factories in Space Database. 2021. "Factories in Space." https://www.factoriesinspace.com/

Fasan, E. 1996. "Dominium Lunae, Proprietas Lunae: In Proceedings of the Thirty-Ninth Colloquium on the Law of Outer Space." p.1. http://www.iislweb.org/docs/1996%20IISL%20REPORT%20BEIJING.pdf

Fassbender, Bardo. 1992. “International Law and International Relations Theory: Building Bridges.” *The American Society of International Law – Proceedings of the 86th Annual Meeting*, pp. 167-187. Martinus Nijhoff Publishers. https://www.alexandria.unisg.ch/publications/235196

Feenstra, Robert. 2009. *Hugo Grotius: Mare Liberum 1609-2009*. Original Latin Text (Facsimile of the First Edition, 1609) and Modern English Translation. Edited and Annotated by Robert Feenstra, with a General Introduction by Jeroen Vervliet. Brill.

Feldman, George .J. 1959. “An American View of Jurisdiction in Outer Space.” In: Haley, A.G., and W. Heinrich, eds. *First Colloquium on the Law of Outer Space*. Springer. https://doi.org/10.1007/978-3-7091-4414-5_8

Fenwick, C.G. 1958/2017. “How High is the Sky?” *American Journal of International Law*, Vol. 52, Iss. 1: 96-99. American Society of International Law. Published online by the Cambridge University Press. https://doi.org/10.2307/2195673

Fenwick, Mark D., Kaal, Wulf A., and Erik P. M. Vermeulen. 2017. “Regulation Tomorrow: What Happens When Technology is Faster than the Law.” *American University Business Law Review*, Vol. 6, Iss. 3, Art. 1: 562-593. https://digitalcommons.wcl.american.edu/cgi/viewcontent.cgi?article=1028&context=aublr

Feuerbacher, Berndt and Heinz Stoewer, eds. 2012. *Utilization of Space: Today and Tomorrow*. Springer.

Fidler, David P. 2020. “The Artemis Accords and the Next Generation of Outer Space Governance.” Council on Foreign Relations. https://www.cfr.org/blog/artemis-accords-and-next-generation-outer-space-governance

Figliola, Patricia Maloney, Behrens, Carl E., and Daniel Morgan. 2006. “U.S. Space Programs: Civilian, Military, and Commercial.” CRS Issue Brief for Congress. *Congressional Research Service – Library of Congress*. IB92011: 1-17. https://fas.org/sgp/crs/space/IB92011.pdf

Finch, M. J. 1986. “Limited Space: Allocating the Geostationary Orbit.” *Northwestern Journal of International Law & Business*, Vol. 7, Iss.4:788-802. https://scholarlycommons.law.northwestern.edu/cgi/viewcontent.cgi?article=1216&context=njilb

Finlayson, Jock A., and Mark W. Zacher. 1983. “The GATT and the Regulation of Trade Barriers: Regime Dynamics and Functions.” In, *International Regimes*, 1983, edited by Stephen D. Krasner. Cornell University Press. pp., 273-314.

Fischer, Kahlib. 2021. “Biblical Principles of Government and Criminal Justice.” *Spring 2021 PLCY 861-B01 LUO – Reading & Study*. Helms School of Government, Liberty University. https://learn.liberty.edu/webapps/blackboard/execute/content/file?cmd=view&content_id=_44801595_1&course_id=_710135_1

Fischhoff, Baruch and Cherie Chauvin, eds. 2017. *Intelligence Analysis: Behavioral and Social Scientific Foundations.* National Academies Press. https://www.nap.edu/catalog/13062/intelligence-analysis-behavioral-and-social-scientific-foundations

Fisk, L. A. 2019. “Space as a Global Commons.” *UNOOSA*. https://www.unoosa.org/documents/pdf/hlf/1st_hlf_Dubai/Presentations/26.pdf

Flick, Uwe. 2009. *An Introduction to Qualitative Research Fourth Edition Sage: The Episodic Interview*. Sage Publications Ltd. https://introcomunicareinterpersonala.files.wordpress.com/2016/03/uwe-flick-2009_an-introduction-to-qualitative-research-the-episodic-interview.pdf

Foreign Policy Bureau, Ministry of Foreign Affairs of Japan. 2020. “Japan’s Space Diplomatic Policy.” https://www.mofa.go.jp/policy/outer_space/pdfs/space_diplomatic_policy.pdf

Fountain, L. M. 2003. “Creating Momentum in Space: Ending the Paralysis Produced by the Common Heritage of Mankind Doctrine.” *Connecticut Law Review*, Vol. 35, no.1753.

Foust, Jeff. 2017. “Luxembourg Adopts Space Resources Law.” *Space News*. https://spacenews.com/luxembourg-adopts-space-resources-law/

Fox, Nick J. 2008 / 2012. “Induction.” In: *The SAGE Encyclopedia of Qualitative Research Methods*. Edited by Lisa M. Given. SAGE Publications, Inc. SAGE Research Methods. http://dx.doi.org/10.4135/9781412963909.n212

Franck, Thomas M. 1990. *The Power of Legitimacy among Nations*. 1st ed. Oxford University Press.

Freeland, S., and R. Jakhu. 2010. “Article II of the Outer Space Treaty.” In, *Cologne Commentary on Space Law*, Vol. 1, edited by S. Hobe, B. Schmidt-Tedd, and K. U. Schrogl. Carl Heymanns Verlag.

Frei, Christoph. 2001. *Hans J. Morgenthau*: *An Intellectual Biography (Political Traditions in Foreign Policy Series)*. Illustrated Edition. LSU Press.

Froehlich, Annette, ed. 2018. *A Fresh View on the Outer Space Treaty*. Studies in Space Policy - European Space Policy Institute. Springer.

Froehlich, Annette, and Vincent Seffinga, eds. 2018. *National Space Legislation: A Comparative and Evaluative Analysis*. Studies in Space Policy, Vol. 15. European Space Policy Institute. Springer.

Gabrynowicz, Professor Joanne Irene and Jacqueline Etil Serrao, eds. 2008. “Air and Space Law.” *Journal of Space Law*, Vol. 34, no.2: 203-542. https://airandspacelaw.olemiss.edu/pdfs/jsl-34-2.pdf

Gal, G. 1996. “Acquisition of Property in the Legal Regime of Celestial Bodies.” In, *Proceedings of the Thirty-Ninth Colloquium on the Law of Outer Space*, Vol. 39: 20-45. http://www.gbv.de/dms/spk/sbb/toc/279616007.pdf

Galloway, Eileen M. 2010. Preface. In, *Cologne Commentary on Space Law, Volume 1: Outer Space Treaty*, by S. Hobe, B. Schmidt-Tedd, K.U. Schrogl, eds. Carl Heymanns Verlag.

Galloway, Eileen M. 2008. “Sputnik and the Creation of NASA: A Personal Perspective.” In, *NASA’s 50 Years of Exploration and Discovery*, pp. 48-49. NASA.

Galloway, Eileen M. 1997. “The United States and the 1967 Treaty on Outer Space.” In, *Proceedings of the Fortieth Colloquium on the Law of Outer Space*.” p.18. https://airandspacelaw.olemiss.edu/team/resources/eilene-m-galloway/

Galloway, Eileen M. 1998. “Guidelines for the Review of Outer Space Treaties: In Proceedings of the Forty-First Colloquium on the Law of Outer Space.” *Journal of Air and Space Law*, Vol. 26, no.1: 187-192. https://airandspacelaw.olemiss.edu/team/resources/eilene-m-galloway/

Galloway, Eileen M. 1999. “Globalization, Sovereignty and the Common Heritage of Mankind: In Proceedings of the Forty-Second Colloquium on the Law of Outer Space.” p.308. https://airandspacelaw.olemiss.edu/team/resources/eilene-m-galloway/

Galloway, Eileen M. 1980. “Agreement Governing the Activities of States on the Moon and Other Celestial Bodies.” https://airandspacelaw.olemiss.edu/team/resources/eilene-m-galloway/

Galton, Francis. 1883. *Inquiries into Human Faculty and its Development*. Macmillan. https://galton.org/books/human-faculty/text/galton-1883-human-faculty-v4.pdf

Ganatra, Devanshu, and Neil Modi. 2016. “Asteroid Mining and its Legal Implications.” *Journal of Space Law*, Vol. 40, no. 1 & 2: 81-104. University of Mississippi School of Law. https://airandspace.confit.dev/wp-content/uploads/2020/07/JSL-40.12.pdf

Gangale, Thomas. 2016. “The Legality of Mining Celestial Bodies.” *Journal of Space Law*, Vol. 40, no. 1-2: 187-213. University of Mississippi School of Law. https://airandspace.confit.dev/wp-content/uploads/2020/07/JSL-40.12.pdf

Gangale, Thomas. 2009. *The Development of Outer Space: Sovereignty and Property Rights in International Space Law*. Praeger.

Garner, Bryan A., ed. 2019. *Black’s Law Dictionary*. Deluxe 11th Edition. Thomson Reuters.

Garside, M. 2021. “Space Mining – Statistics & Facts.” Statista. https://www.statista.com/topics/3279/space-mining/#dossierKeyfigures

Gasson, Susan. 2004. “Rigor in Grounded Theory Research: An Interpretive Perspective on Generating Theory from Qualitative Field Studies.” In, *The Handbook of Information Systems Research*, edited by Michael E. Whitman and Amy B. Woszczynski, 2004. Chapter VI, 79-102. http://www.bwgriffin.com/gsu/courses/edur7130/qualitative/9_Qual_Grounded_Explained_4.pdf

Gauthier, David P. 1986. *Morals by Agreement*. Clarendon Press.

Gauthier, David P. 1969. *The Logic of Leviathan*. Clarendon Press.

Gayen, Pralay, Sankarasubramanian, Shrihari, and Vijay K. Ramani. 2020. “Fuel and Oxygen Harvesting from Martian Regolithic Brine.” Edited by Alexis T. Bell. *PNAS Engineering*, Vol. 117, no. 50: 31685 – 31689. https://www.pnas.org/doi/epdf/10.1073/pnas.2008613117

Gentles, Stephen J., Jack, Susan M., Nicholas, David B., and K. Ann McKibbon. 2014. “A Critical Approach to Reflexivity in Grounded Theory.” *The Qualitative Report*, Vol. 19, no. 25: 1-14. http://jbposgrado.org/icuali/Reflexivity%20in%20Grounded%20Theory.pdf

Georgeson, Caitlyn and Matthew T. Stubbs. 2020. “Targeting in Outer Space: An Exploration of Regime Interactions in the Final Frontier.” *Journal of Air Law and Commerce*, Vol. 85, Iss. 4, Art. 3: 609-731. Scholar, Southern Methodist University. https://scholar.smu.edu/cgi/viewcontent.cgi?article=4161&context=jalc

Ghervas, Stella and David Armitage. 2020. “From Westphalia to Enlightened Peace, 1648-1815: A Cultural History of Peace in the Age of Enlightenment.” *Harvard Scholar*. https://scholar.harvard.edu/files/armitage/files/introduction.pdf

Given, Lisa M. 2008. “The SAGE Encyclopedia of Qualitative Research Methods.” SAGE Publications, Inc. DOI: https://dx.doi.org/10.4135/9781412963909

Glaser, Barney G. 2007. *Doing Formal Grounded Theory: A Proposal*. Sociology Press.

Glaser, Barney G., and Anselm L. Strauss. 1967/2006. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Aldine Transaction. http://www.sxf.uevora.pt/wp-content/uploads/2013/03/Glaser_1967.pdf

Glaser, Barney G. 2004. “”Naturalist Inquiry” and Grounded Theory.” *Forum for Qualitative Social Research*, Vol. 5, Iss. 1: 1-20. ProQuest. https://www.proquest.com/docview/869221245/fulltextPDF/9AD49BA53DC24491PQ/1?accountid=12085

Glaser, Barney G., and Judith Holton. 2004. “Remodeling Grounded Theory.” *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, Vol. 5, no. 2: 1-22. https://doi.org/10.17169/fqs-5.2.607

Glaser, Barney. G. 1998. *Doing Grounded Theory: Issues and Discussions*. Sociology Press.

Glaser, Barney G. 1992. *Basics of Grounded Theory: Emergence vs. Forcing*. Sociology Press.

Glaser, Barney G. 1978. *Theoretical Sensitivity: Advances in the Methodology of Grounded Theory*. Sociology Press.

Gleeson, Patrick K. 2005. “Legal Aspects of the Use of Force in Space.” Thesis, McGill University. *Institute of Air and Space Law*, McGill University, Montreal Quebec. https://www.collectionscanada.gc.ca/obj/thesescanada/vol2/QMM/TC-QMM-99137.pdf

Glester, Andrew. 2020. “The Asteroid Trillionaires.” *Physics World*. IOP Publishing. https://physicsworld.com/a/the-asteroid-trillionaires/

Globus, Al. 2010. “Asteroid Mining Project.” San Jose State University, NASA Ames Research Center, Human Systems Integration Division, ISU2010: 1-26. http://space.alglobus.net/presentations/ISUasteroidMining/ISU2010AsteroidMining.pdf

Goedhuis, D. 1978. "The Changing Legal Regime of Air and Outer Space." *International and Comparative Law Quarterly*, Vol. 27, Iss.3: 576-595. HeinOnline. https://heinonline.org/HOL/Page?handle=hein.journals/incolq27&collection=journals&id=582&startid=&endid=601

Goedhuis, D. 1981. "Some Recent Trends in the Interpretation and the Implementation of the Rules of International Space Law." *Columbia Journal of Transnational Law*, Vol. 19, Iss.2:213-234. HeinOnline. https://heinonline.org/HOL/Page?handle=hein.journals/cjtl19&collection=journals&id=217&startid=&endid=238

Gohd, Chelsea. 2020. "Scientists Think this may be the Farthest Galaxy in the Universe." *Scientific American*. Future Space. https://www.scientificamerican.com/article/scientists-think-this-may-be-the-farthest-galaxy-in-the-universe/

Goldberg, Ambassador Arthur J. 1966. "Statement by Ambassador Arthur J. Goldberg before the General Assembly Committee I (Political and Security)." December 17, 1966. Reprinted in Department of State Bulletin Vol. 56, April 3, 1967 (Classic Reprint), Forgotten Books. 78-81.

Goldman, N.C., and D.J. O'Donnell. 1997. "Revisiting the Outer Space Treaty: A Re-examination of the Sovereignty-Jurisdiction Compromise, in Proceedings of the Fortieth Colloquium on the Law of Outer Space." In the 40th Colloquium on the Law of Outer Space, Turin Italy, Session 4, no. 5-6. International Institute of Space Law. https://iislweb.org/docs/1997%20IISL%20REPORT%20TURIN.pdf

Goldstein, Judith, and Robert O. Keohane, eds. 1993. "Ideas and Foreign Policy: An Analytical Framework," in *Ideas and Foreign Policy: Beliefs, Institutions, and Political Change*, by Goldstein, Judith, and Robert O. Keohane, eds. 1993, pp. 3-30. Cornell Studies in Political Economy. Cornell University Press. JSTOR. https://www.jstor.org/stable/pdf/10.7591/j.ctvv4147z.5.pdf?refreqid=excelsior%3A361043f6d24a5f4294aca7b5383f59bb

Golrounia, A. A. and Bahrami, M. 1997 / 1998. "Outer Space Treaty in 21st Century: A Change of Concept, in Proceedings of the Fortieth Colloquium on the Law of Outer Space." *International Institute of Space Law*, Issue 4: 303.

Golrounia, A. A. and Bahrami, M. 2003. "Legal Principles of Exploration and Use of Outer Space: Past Achievements and Future Challenges, in Proceedings of the Forty-Sixth Colloquium on the Law of Outer Space." *International Institute of Space Law*, Iss. 2: 159.

Good, Andrew and Alana Johnson. 2019. "NASA's Treasure Map for Water Ice on Mars." *NASA Jet Propulsion Laboratory Feature*. https://www.nasa.gov/feature/jpl/nasas-treasure-map-for-water-ice-on-mars

Gorn, Michael H. 1988. *Harnessing the Genie: Science and Technology Forecasting for the Air Force 1944-1986*. Office of Air Force History, United States Air Force, Washington, D.C. https://media.defense.gov/2010/May/26/2001330294/-1/-1/0/AFD-100526-038.pdf

Gorove, Stephen. 1969. “Interpreting Article II of the Outer Space Treaty.” *Fordham Law Review*, Vol. 37, Iss. 3, Art. 2: 349-354. https://ir.lawnet.fordham.edu/cgi/viewcontent.cgi?article=1966&context=flr

Goswami, Namrata. 2018. “China in Space: Ambitions and Possible Conflict.” *Strategic Studies Quarterly*, Vol. 12, no.1: 74-97). Published by Air University Press. JSTOR. https://www.jstor.org/stable/26333878

Goswami, Namrata. 2019. “China’s Future Space Ambitions: What’s Ahead?” *The Diplomat – Features*. https://thediplomat.com/2019/11/chinas-future-space-ambitions-whats-ahead/

Goswami, Namrata. 2019. “A Space Service is Essential to U.S. Primacy.” *Gulf News* – Op-ed. https://gulfnews.com/opinion/op-eds/a-space-service-is-essential-to-us-primacy-1.66122449

Goswami, Namrata. 2020. “Explaining China’s Space Ambitions and Goals Through the Lens of Strategic Culture.” *The Space Review*. https://www.thespacereview.com/article/3944/1

Goswami, Namrata, and Peter A. Garretson. 2020. *Scramble for the Skies: The Great Power Competition to Control the Resources of Outer Space*. Illustrated Edition. Lexington Books.

Goswami, Namrata. 2021. “Watch This Space: Asia in the Final Frontier.” *Asia and The Pacific Policy Society – Policy Forum*. https://www.policyforum.net/watch-this-space/

Government Accountability Office. 2009. “International Space Station: Significant Challenges May Limit Onboard Research.” GAO. http://www.gao.gov/products/GAO-10-9.

Government Accountability Office. 2014. “NASA: Actions Needed to Improve Transparency and Assess Long-Term Affordability of Human Exploration Programs.” GAO. http://www.gao.gov/products/GAO-14-385.

Government of Luxembourg. 2016/2017. “Draft Law on the Exploration and Use of Outer Space Resources.” English Interpretation of the French Document, 1-17. https://gouvernement.lu/dam-assets/fr/actualites/communiques/2016/11-novembre/11-presentation-spaceresources/Draft-law-space_press.pdf

Graham, Jesse, Haidt, Jonathan, and Brian A. Nosek. 2009. “Liberals and Conservatives Rely on Different Sets of Moral Foundations.” *Journal of Personality and Social Psychology*, Vol. 96, no.5: 1029-1046. https://fbaum.unc.edu/teaching/articles/JPSP-2009-Moral-Foundations.pdf

Gramlich, John. 2016. “America’s Political Divisions in 5 Charts.” *Pew Research Fact-tank*. https://www.pewresearch.org/fact-tank/2016/11/07/americas-political-divisions-in-5-charts/

Grant, C. K. 1955/1956. “Polar Concepts and Metaphysical Arguments.” *Proceedings of the Aristotelian Society*, New Series, Vol. 56: 83-108. JSTOR. https://www.jstor.org/stable/4544558

Graps, Amara L. and 43 C-Authors. 2018. “ASIME 2018 White Research In-Space Utilization of Asteroids: Asteroid Composition – Answers to Questions from the Asteroid Miners.” *Asteroid Science*

Intersections with In-Space Mine Engineering, Universite Du Luxembourg. https://arxiv.org/ftp/arxiv/researchs/1904/1904.11831.pdf

Gries, Peter Hays. 2014. *Politics of American Foreign Policy: How Ideology Divides Liberals and Conservatives Over Foreign Affairs*. Stanford University Press.

Griffin, E. 1997. *A First Look at Communication Theory*. McGraw-Hill.

Griffiths, Martin, ed. 2007. *Encyclopedia of International Relations and Global Politics*. Routledge.

Grotius, Hugo. 1625/2012. *Hugo Grotius: On the Law of War and Peace*. Student Edition. Edited and Annotated by Stephen C. Neff. Cambridge University Press.

Grotius, Hugo. 1625/2005. *The Rights of War and Peace: Book I*. Edited and with an Introduction by Richard Tuck. From the Edition by Jean Barbeyrac. Natural Law and Enlightenment Classics. Liberty Fund.

Grotius, Hugo. 1625/2005. *The Rights of War and Peace: Book II*. Edited and with an Introduction by Richard Tuck. From the Edition by Jean Barbeyrac. Natural Law and Enlightenment Classics. Liberty Fund.

Grotius, Hugo. 1625/2005. *The Rights of War and Peace: Book III*. Edited and with an Introduction by Richard Tuck. From the Edition by Jean Barbeyrac. Natural Law and Enlightenment Classics. Liberty Fund.

Grotius, Hugo. 1957. *Prolegomena to the Law of War and Peace*. Translated by Francis W. Kelsey. With an Introduction by Edward Dumbauld. The Bobbs-Merrill Company, Inc.

Grotius, Hugo. 1625 / 2008. *On The Law of War and Peace: Book I, Book II, Book III*. Natural Law and Enlightenment Classics. Edited by Knud Haakonssen. Edited and with an Introduction by Richard Tuck. From the Edition by Jean Barbeyrac. Liberty Fund. http://files.libertyfund.org/files/1425/1032-01_LFeBk.pdf

Grotius, Hugo. 1609 / 2004. *Mare Liberum - The Free Sea: Major Legal and Political Works of Hugo Grotius*. Translated by Richard Hakluyt with William Welwod's Critique and Grotius' Reply. Edited and with an Introduction by David Armitage. Natural Law and Enlightenment Classics. Liberty Fund. https://oll.libertyfund.org/page/grotius-the-freedom-of-the-seas

Grotius, Hugo. 1604-1606 / 2006. *Commentary on the Law of Prize and Booty* (*De Jure Praedae*). Edited and with an Introduction by Martine Julia van Ittersum. Natural Law and Enlightenment Classics. Liberty Fund. http://files.libertyfund.org/files/1718/1350_LFeBk.pdf

Grotius, Hugo. 1633/2001. *The Freedom of the Seas Or The Right Which Belongs to the Dutch to Take Part in the East Indian Trade: A Dissertation by Hugo Grotius*. Translated with a Revision of the Latin Text of 1633 by Ralph Van De Man Magoffin. Edited with an Introductory Note by James Brown Scott. Carnegie Endowment for International Peace, Division of International Law. The Lawbook Exchange, Ltd.

Guba, Egon G., and Yvonna S. Lincoln. 1994. "Competing Paradigms in Qualitative Research." In N. K. Denzin and Y. S. Lincoln, eds. 1994. *Handbook of Qualitative Research*, pp. 105-117. SAGE. https://eclass.uoa.gr/modules/document/file.php/PPP356/Guba%20&%20Lincoln%201994.pdf

Guilhot, Nicolas, ed. 2011. *The Invention of International Relations Theory: Realism, the Rockefeller Foundation, and the 1954 Conference on Theory*. Columbia university Press.

Guion, Lisa A. 2002. "Triangulation: Establishing the Validity of Qualitative Studies." University of Florida, Institute of Food and Agricultural Sciences, *Extension FCS6014*, 1-3. https://sites.duke.edu/niou/files/2014/07/W13-Guion-2002-Triangulation-Establishing-the-Validity-of-Qualitative-Research.pdf

Haas, Ernst B. 1983. "Words Can Hurt You; Or, Who Said What to Whom about Regimes." In, *International Regimes*, edited by Stephen D. Krasner, 1983. Cornell University Press. Pp., 23-60.

Haas, Ernst B. 1964. *Beyond the Nation-State: Functionalism and International Organization*. Revised ed. Stanford University Press.

Hagan, Joe D. 2008. "Domestic Political Conflict, Issue Areas, and Some Dimensions of Foreign Policy Behavior Other than Conflict." *International Interactions – Empirical and Theoretical Research in International Relations*, Vol. 12, Iss. 4: 291-313. Taylor & Francis Online. https://doi.org/10.1080/03050628608434661

Haggard, Stephan, and Beth A. Simmons. 1987. "Theories of International Regimes." *International Organization*, Vol. 41, no. 3: 491-517. Harvard Scholarship Library. Office for Scholarly Communication. http://dx.doi.org/10.1017/S0020818300027569

Haley, Andrew Gallagher. 1956. "Space Law and Metalaw: A Synoptic View." Presented at the 7th Annual Congress of the International Astronautical Federation, Rome Italy, September 19, 1956. Air Law Pamphlet Series, Vol. 1, no. 4. Publisher Unknown.

Haley, Andrew Gallagher. 1957. "Space Law and Metalaw – Jurisdiction Defined." *Journal of Air Law and Commerce*, Vol. 24, Iss. 3, Art. 3: 286-303. https://scholar.smu.edu/cgi/viewcontent.cgi?article=3018&context=jalc

Hall, R. Cargill. 1992. "The Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space." *Defense Technical Information Center* 19980513 059, 1-28. https://apps.dtic.mil/dtic/tr/fulltext/u2/a344697.pdf

Halperin, Morton H. and Priscilla A. Clapp. 2006. *Bureaucratic Politics and Foreign Policy*. Brookings Institution Press.

Hamburger, Henry. 1979. *Games as Models of Social Phenomena*. W. H. Freeman & Co.

Handeyside, Hugh. 2007. "The *Lotus* Principle in ICJ Jurisprudence: Was the Ship Ever Afloat?" *Michigan Journal of International Law*, Vol. 29, Iss. 1: 71-93. University of Michigan Law School. https://repository.law.umich.edu/mjil/vol29/iss1/3

Hardin, Garrett. 1968. “The Tragedy of the Commons.” *Science*, *New Series*, Vol. 162, no. 3859: 1243-1248. Published by American Association for the Advancement of Science. https://www.sciencemag.org/site/feature/misc/webfeat/sotp/pdfs/162-3859-1243.pdf

Harding, Sandra. 1987. “The Method Question.” *Hypatia*, Vol. 2, no. 3: 19-35. *Feminism and Science*, Vol. 1. Published by Wiley on behalf of Hypatia, Inc. JSTOR. https://www.jstor.org/stable/3810120

Hardt, Michael, and Antonio Negri. 2009. *Commonwealth*. Belknap Press of Harvard University Press.

Hart, A.C. 1983. “Hugo de Groot and Giambattista Vico.” *Netherlands International Law Review*, Vol. 30, Iss. 1: 5-41. Published online by Cambridge University Press. https://doi.org/10.1017/S0165070X00011876

Hartle, R. T., Baviskar, S., & R. Smith. 2012. “A Field Guide to Constructivism in the College Science Classroom: Four Essential Criteria and a Guide to their Usage.” *Bioscene*, Vol. 38, no.2: 31-35. https://files.eric.ed.gov/fulltext/EJ1002158.pdf

Hasenclever, Andreas, Mayer, Peter, and Volker Rittberger. 2000. “Integrating Theories of International Regimes.” *Review of International Studies*, Vol. 26, no. 1: 3-33. Published by Cambridge University Press. JSTOR. https://www.jstor.org/stable/20097653

Haslam, Jonathan. 2002. *No Virtue Like Necessity: Realist Thought in International Relations Since Machiavelli*. Yale University Press.

Hautaluoma, Grey, Kraft, Rachel, and Karen Northon. 2019. “New Companies Join Growing Ranks of NASA Partners for Artemis Program.” *NASA Moon to Mars Press Release* 19-090. https://www.nasa.gov/press-release/new-companies-join-growing-ranks-of-nasa-partners-for-artemis-program

Hautaluoma, Grey, Kraft, Rachel and Leejay Lockhart. 2020. “NASA Selects Intuitive Machines to Land Water-Measuring Payload on the Moon.” *NASA Moon to Mars Press Release* 20-100. https://www.nasa.gov/press-release/nasa-selects-intuitive-machines-to-land-water-measuring-payload-on-the-moon

Heale, Roberta, and Dorothy Forbes. 2013. “Understanding Triangulation in Research.” Evidence-Based Nursing. *BMJ Journals*, Vol. 16, Iss. 4: 98. http://dx.doi.org/10.1136/eb-2013-101494

Heffington, Stephen, Oler, Adam, and David Tretler, eds. 2020. “A National Security Strategy Primer.” National War College. National Defense University Press. https://nwc.ndu.edu/Portals/71/Documents/Publications/NWC%20Primer%202020%20Final.pdf?ver=NKiGA4Ocm119DU5GveImYw%3D%3D

Heller, Thomas C., and Abraham D. Sofaer. 2001. “Sovereignty: The Practitioners’ Perspective.” In *Problematic Sovereignty: Contested Rules and Political Possibilities*, edited by Stephen D. Krasner. Columbia University Press. pp., 24-52.

Herbert, Anne L. 1996. “Cooperation in International Relations: A Comparison of Keohane, Haas and Franck.” *Berkeley Journal of International Law*, Vol. 14, Iss. 1: 222-238. https://lawcat.berkeley.edu/record/1115586/files/fulltext.pdf

Hertogen, An. 2015/2016. “Letting Lotus Bloom.” *European Journal of International Law*, Vol. 26, Iss. 4: 901-926. Oxford University Press Online – Academic. https://doi.org/10.1093/ejil/chv072

Hertzfeld, Henry. 2009. “Current and Future Issues in International Space Law.” *ILSA Journal of International & Comparative Law*, Vol. 15, no. 2: 325-335. NSUWORKS.. https://nsuworks.nova.edu/cgi/viewcontent.cgi?article=1640&context=ilsajournal

Hertzfeld, Henry R. and Frans G. von der Dunk. 2005. “Bringing Space Law into the Commercial World: Property Rights Without Sovereignty.” *Chicago Journal of International Law*, Vol. 6, no.1, Art. 8: 81-99. https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=1273&context=cjil

Herz, John H. 1950. “Idealist Internationalism and the Security Dilemma.” *World Politics*, Vol. 2, no. 2: 157-180. Published by Cambridge University Press. JSTOR. https://www.jstor.org/stable/2009187

Heshusius, L., and K. Ballard, eds. 1996*. From Positivism to Interpretivism and Beyond: Tales of Transformation in Educational and Social Research (the Mind-Body Connection)*. Teachers College Press.

Hesse-Biber, Sharlene. 2010. “Qualitative Approaches to Mixed Methods Practice.” *SAGE Journals*, Vol. 16, Iss. 6: 455-468. https://doi.org/10.1177%2F1077800410364611

Heydte, Friedrich August Freiherr von der. 1935. “Discovery, Symbolic Annexation and Virtual Effectiveness in International Law.” *The American Journal of International Law*, Vol. 29, no.3: 448-471. Published by Cambridge University Press. JSTOR. https://doi.org/10.2307/2190420

Heywood, Andrew. 2011. *Global Politics*. Palgrave.

Hickman, John. 2007. “Still Crazy After Four Decades: The Case for Withdrawing from the 1967 Outer Space Treaty.” *The Space Review*. Monday, September 24, 2007. https://www.thespacereview.com/article/960/1

History. 2019. “Glorious Revolution 1688-1689.” https://www.history.com/topics/british-history/glorious-revolution#:~:text=The%20Glorious%20Revolution%2C%20also%20called,Dutch%20husband%2C%20William%20of%20Orange.

Hobbes, Thomas. 1640 / 1999. *The Elements of Law, Natural, and Politic: Part I, Human Nature, Part II, De Corpore Politico; with Three Lives*. Edited by John Aubrey (1626-1697), and John Charles Addison Gaskin. Oxford World’s Classics. Oxford University Press.

Hobbes, Thomas. 1642 / 1949. *De Cive; or The Citizen*. Created by Thomas Hobbes, 1588-1679. Edited by Sterling Power Lamprecht, 1890-1973. Appleton-Century-Crofts.

Hobbes, Thomas. 1651 / 2008. *Thomas Hobbes: Leviathan* (Longman Library of Primary Sources in Philosophy). Routledge. Taylor and Francis Group. https://doi.org/10.4324/9781315507613

Hobbes, Thomas. 1651 / 1981. *Leviathan, or The Matter, Forme, & Power of a Commonwealth, Ecclesiasticall and Civill*. Edited by C. B. Macpherson. Penguin.

Hobbes, Thomas. 1681 / 1971. *A Dialogue Between a Philosopher and a Student of the Common Laws of England*. Edited and with an Introduction by Joseph Cropsey. The University of Chicago Press.

Hobe, Stephan, and Kuan-Wei Chen. 2017. "Legal Status of Outer Space and Celestial." In, *Rutledge Handbook of Space Law*. 2017. Edited by Jakhu, Ram S., and Paul Stephen Dempsey. Routledge, Taylor & Francis Group. Pp. 25-41

Hofmann, Mahulena and Federico Bergamasco. 2020. "Space Resources Activities from the Perspective of Sustainability: Legal Aspects." *Global Sustainability*, Vol. 3, e4: 1-7. Cambridge Core. https://doi.org/10.1017/sus.2019.27

Holland, Dora, and Jack O. Burns. 2018. "The American Space Exploration Narrative from the Cold War Through the Obama Administration." *Space Policy*, Vol. 46: 9-17. *Science Direct* – State Policy, 1-19. https://doi.org/10.1016/j.spacepol.2018.03.007

Horsford, Cyril E. 1964. "Current Aspects of Space." *The Modern Law Review*, Vol. 27, no.1: 50-54. Published by Wiley on behalf of the Modern Law Review. JSTOR. https://www.jstor.org/stable/1092256

Hudgins, Edward. 2002. *Space: The Free-Market Frontier*. Cato Institute.

Hudson, Valerie M., and Benjamin S. Day. 2019. *Foreign Policy Analysis: Classic and Contemporary Theory*. Third Edition. 1-288. Rowman & Littlefield Publishers.

Hudson, Valerie M. 2005. "Foreign Policy Analysis: Actor-Specific Theory and the Ground of International Relations." *Foreign Policy Analysis*, Vol. 1, Iss. 1: 1-30. Oxford Academic. https://doi.org/10.1111/j.1743-8594.2005.00001.x

Hugo, Adam. 2019. "Propelling De Man d for Space Water." *The Space Resource – News*. https://www.thespaceresource.com/news/2019/2/propelling-De Man d-for-space-water

Hunter, William A. 1934. *Introduction to Roman Law*. 9th Edition. Revised by F.H. Lawson. William Maxwell & Son.

Hutchison, Andrew John, Johnston, Lynne Halley, and Jeff David Breckon. 2010. "Using QSR-NVivo to Facilitate the Development of a Grounded Theory Project: An Account of a Worked Example." *International Journal of Social Research Methodology*, Vol. 13, no. 4: 283-302. https://doi.org/10.1080/13645570902996301

Hyman, William A. 1962. "Wanted – A Policeman for Outer Space 2." In Cooper, 1961, "Outer Space and the Law." *Astronautics* 65. New York.

IFRI and SWF Space Policy Program. 2012. “International Relations and Space: The European Approach.” A conference organized by IFRI and the Secure World Foundation Brussels, September 13, 2012. *E-space Conference Report* 2012: 1-7. https://swfound.org/media/95945/espace_conference_report_2012_sans_logos.pdf

Ikenberry, G. John. 2010. “The Liberal International Order and its Discontents.” Millennium: *The Journal of International Studies*, Vol. 38, no.3: 509-521. Sagepub. https://journals.sagepub.com/doi/pdf/10.1177/0305829810366477

Ikenberry, G. John. 2006. *Liberal Order and Imperial Ambition: Essays on American Power and International Orde*r. First Edition. Polity.

Inclan, Bettina and Matthew Rydin. 2020. “NASA Exploration Mission Integral to 2020 National Space Policy.” *NASA Moon to Mars Release* 20-123.

Indian Space Research Organization (ISRO). 2019. “Chandrayaan2.” Government of India – Department of Space. Missions. https://www.isro.gov.in/Spacecraft/chandrayaan2

Ingimundarson, Valur. 2010. “The Geopolitics of Arctic Natural Resources.” Standard Briefing. The European Parliament. Directorate-General for External Policies, Directorate B – Policy Department. EXPO/B/AFET/FWC/2009-01/Lot 2/02, 1-24. https://www.europarl.europa.eu/RegData/etudes/divers/join/2010/433791/EXPO-AFET_DV(2010)433791_EN.pdf

International Academy of Astronautics. 2015. “Space Mineral Resources: A Global Assessment of the Challenges and Opportunities.” IAA. https://iaaspace.org/product/space-mineral-resources-a-global-assessment-of-the-challenges-and-opportunities/

International Academy of Aeronautics (IAA). 2004. “The Next Steps in Exploring Deep Space: A Cosmic Study by the International Academy of Astronautics.” *Acta Astronautica*, Vol. 58, Iss. 6-7: 304-377. Science Direct. https://doi.org/10.1016/j.actaastro.2006.01.004

International Court of Justice. 2017-2023. “Statute of the International Court Of Justice.” Chapters I – V, 2-70. https://www.icj-cij.org/statute#CHAPTER_II

International Court of Justice. 2008. *Sovereignty over Pedra Branca/Pulau Batu Puteh, Middle Rocks, and South Ledge (Malaysia/Singapore).* https://www.icj-cij.org/en/case/130

International Institute of Space Law/Directorate of Studies. 2022. “Does International Space Law Either Permit or Prohibit the Taking of Resources in Outer Space and on Celestial Bodies? What is the Context, and What are the Contours and Limits of this Permission or Prohibition?” Background Paper, 1-46. https://www.ila-americanbranch.org/wp-content/uploads/2022/10/IISL_Space_Mining_Study.pdf

International Institute of Space Law. 2015. “Position Paper on Space Resource Mining: Adopted by Consensus by the Board of Directors on 20 December 2015.” IISL 2015, 1-3. https://iislweb.space/wp-content/uploads/2020/01/SpaceResourceMining.pdf

International Institute of Space Law. 2004. “Statement by the Board of Directors of the International Institute of Space Law on Claims of Property Rights Regarding the Moon and Other Celestial Bodies.” http://www.iafastro-iisl.com/additional%20pages/Statement_Moon.htm

International Judicial Monitor. 2006. “General Principles of International Law: Treaty Interpretation.” Excerpted and Adapted from *International Law: A Handbook for Judges*, 2003, edited by Bederman, David J., Borgen, Christopher J., and David A. Martin. American Society of International Law. http://www.judicialmonitor.org/archive_0906/generalprinciples.html

International Relations and Security Network / Primary Resources in International Affairs (PRIA). 2008. “Treaty of Westphalia; October 24, 1648: Peace Treaty between the Holy Roman Emperor and the King of France and their Respective Allies.” ISN run by CSS. https://is.muni.cz/el/1423/podzim2008/MVZ430/um/Treaty-of-Westphalia.pdf

International Space Exploration Coordination Group (ISECG). 2022. “International Space Agencies Meet in Montreal, Canada, to Advance Coordination in Space Exploration of Moon and Mars.” ISECG News, November 16, 2022. https://www.globalspaceexploration.org/?p=1194

International Space Exploration Coordination Group (ISECG). 2022. “The Global Exploration Roadmap Supplement.” October 2022 – Lunar Surface Exploration Scenario Update. https://www.globalspaceexploration.org/wp-content/isecg/GER_Supplement_Update_2022.pdf

International Union for Conservation of Nature (IUCN). 1980. *World Conservation Strategy: Living Resource Conservation for Sustainable Development*. IUCN Library System. DOI: https://doi.org/10.2305/IUCN.CH.1980.9.en

IP Access International. 2023. “How Do LEO, GEO, and MEO Satellites Differ?” https://www.ipinternational.net/how-do-leo-geo-and-meo-satellites-differ/

Jackson, John H. 2003. “Sovereignty – Modern: A New Approach to an Outdated Concept.” *American Journal of International Law*, Vol. 97, no. 3: 782-802. Georgetown University Law Center. https://scholarship.law.georgetown.edu/cgi/viewcontent.cgi?article=1108&context=facpub

Jackson, Patrick. 2010. *The Conduct of Inquiry in International Relations*. Routledge.

Jahn, Beate. 2006. *Classical Theory in International Relations*. Cambridge University Press.

Jakhu, Ram S., Pelton, Joseph N., and Yaw Out Mankata Nyampong. 2017. *Space Mining and Its Regulation*. New Space Ventures. Praxis Publishing. Springer. https://link.springer.com/content/pdf/10.1007%2F978-3-319-39246-2.pdf

Jakhu, Ram S., and Paul Stephen Dempsey, eds. 2017. *Routledge Handbook of Space Law*. Routledge / Taylor & Francis Group. https://doi.org/10.4324/9781315750965

Janos, Brett M. 2009. “The Final Frontier: Incorporating Aspects of Culture and History in the Formation of a Workable, Legal Framework for Outerspace.” *Selected Works of Brett Janos*, 2009. http://works.bepress.com/brett_janos/1/

Janowitz, Morris. 1961. “Mass Persuasion and International Relations.” *The Public Opinion Quarterly*, Vol. 25, no. 4: 560-570. Published by Oxford University Press on behalf of the American Association for Public Opinion Research. JSTOR. https://www.jstor.org/stable/2746291

Japan Aerospace Exploration Agency (JAXA). 2021. “JAXA Hayabusa2 Project.” http://www.hayabusa2.jaxa.jp/en/

Japan Aerospace Exploration Agency (JAXA). 2020. “About Asteroid Explorer “Hayabusa” (MUSES-C): Hayabusa’s Mission to Bring Back Samples from an Asteroid and Investigate the Mysteries of the Birth of the Solar System.” Projects. https://global.jaxa.jp/projects/sas/muses_c/

Japan Aerospace Exploration Agency (JAXA). 2018. Hayabusa-2 Information Fact Sheet. Ver. 2.3., 2018.07.05. Hayabusa2 Project Team. sat33_fs_23_en.pdf (jaxa.jp)

Japanese Aerospace Exploration Agency (JAXA). 2010. “Asteroid Explorer “Hayabusa” (MUSES-C): Particles Brought Back by Hayabusa Identified as from Itokawa.” Press Release, November 16, 2010. https://global.jaxa.jp/projects/sas/muses_c/topics.html#topics8524

Japan Official Gazette. 2021. “Act on Promotion of Business Activities Related to the Exploration and Development of Space Resources (83).” June 23, Reiwa 3, (Extra No. 141), Law. Internet Official Gazette (npb.go.jp)

Jasentuliyana, Nandasiri. 1994. “Ensuring Equal Access to the Benefits of Space Technologies for All Countries.” *Space Policy*, Vol. 10, Iss.1:7-18. https://pdf.sciencedirectassets.com/271460

Jasentuliyana, Nandasiri. 1995. “A Survey of Space Law as Developed by the United Nations.” In, *Perspectives on International Law*. 1995. Edited by Nandasiri Jasentuliyana. Kluwer Law International.

Jasentuliyana, Nandasiri. 1995. “The Role of Developing Countries in the Formation of Space Law.” *Annals of Air and Space Law*, Vol. XX: 95.

Jasentuliyana, Nandasiri. 1999. “Strengthening International Space Law: The Role of the United Nations.” *International Organizations and Space Law Proceedings of the Third ECSL Colloquium*, Perugia, Italy, 6-7 May 1999. Edited by R.A. Harris. ESA SP-442.ESA/ESTEC, 1999. 87-95. Harvard University. http://articles.adsabs.harvard.edu/cgi-bin/nph-iarticle_query?1999ESASP.442...87J&defaultprint=YES&filetype=.pdf

Jenks, Wilfred C. 1956. “International Law and Activities in Space.” *The International and Comparative Law Quarterly*, Vol. 5, no. 1: 99-114. Published by Cambridge University Press on behalf of the British Institute of International and Comparative Law. JSTOR. https://www.jstor.org/stable/755301

Jenks, Wilfred C. 1960. “The International Control of Outer Space.” Research presented to the IIIrd Colloquium on the Law of Outer Space during the XIth Ann. Cong. of the Int'l Astronautical Federation, Stockholm, 1960.

Jennings, R. Y. 1963. *The Acquisition of Territory in International Law*. Melland Schill Lectures Series. Pp. 19-35. Manchester University Press.

Jervis, Robert. 1983. "Security Regimes." In, *International Regimes*, 1983, edited by Stephen D. Krasner. Cornell University Press. pp. 173-194.

Jervis, Robert. 1982. "Security Regimes." *International Organization*, Vol. 36, no. 2: 357-378. Published by The MIT Press. JSTOR. https:///www.jstor.org/stable/2706526

Jet Propulsion Laboratory / NASA / California Institute of Technology. 2021. "Hayabusa." https://www.jpl.nasa.gov/missions/hayabusa

Jiang, Linhua, Kashikawa, Nobunari, Wang, Shu, Walth, Gregory, Ho, Luis C., Cai, Zheng, Egami, Eiichi, Fan, Xiaohui, Ito, Kei, Liang, Yongming, Schaerer, and Daniel P. Stark. 2020. "Evidence for GN-z11 as a Luminous Galaxy at Redshift 10.957." *Nature Astronomy*, December 14, 2020. DOI: https://doi.org/10.1038/s41550-020-01275-y

Johnson, D.H.N. 1965. "Reviewed Work: Space Law by C. Wilfred Jenks." *The International and Comparative Law Quarterly*, Vol. 14, no. 4: 1428-1430. Published by Cambridge University Press on behalf of the British Institute of International and Comparative Law. JSTOR. https://www.jstor.org/stable/757353

Johnson, Loch K. 2015. *American Foreign Policy and the Challenges of World Leadership: Power, Principle, and the Constitution*. Oxford University Press.

Johnson, President Lyndon B. 1968. "A Comparison of the American and Soviet Space Programs." PL Web Document / PSM 1-3. LBJ Library. *Space Policy Archive*. https://aerospace.org/sites/default/files/policy_archives/US-USSR%20comparison%201968.pdf

Johnson, President Lyndon B. 1967. "Remarks at the Signing of the Treaty on Outer Space." Gerhard Peters and John T. Woolley. The American Presidency Project https://www.presidency.ucsb.edu/node/237562

Jones, Andrew. 2021. "China Launches Space Mining Test Spacecraft on Commercial Rideshare Mission." SpaceNews, April 27, 2021, 1-3. https://spacenews.com/china-launches-space-mining-test-spacecraft-on-commercial-rideshare-mission/

Joyner, Christopher C., and Elizabeth Martell. 1996 / 2009. "Looking Back to See Ahead: UNCLOS III and Lessons for Global Commons Law." *Ocean Development and International Law Journal*, Vol. 27, Iss. 1-2: 73-95. Taylor & Francis Online. https://doi.org/10.1080/00908329609546076

Justia, U.S. Law. 2021. "Acts of Congress Held Unconstitutional in Whole or in Part by the Supreme Court of the United States." *U.S. Constitution Annotated*. https://law.justia.com/constitution/us/acts-of-congress-held-unconstitutional.html

Justinian. 2011. *Justinian, Institutes*. *Translated by J.B. Moyle*. Oxford / Harvard Law. https://amesfoundation.law.harvard.edu/digital/CJCiv/JInst.pdf

Kant, Immanuel. 1795 / 1917. *Perpetual Peace: A Philosophical Essay*. 1917 Edition. Translated with Introduction and Notes by Mary Campbell Smith. George Allen & Unwin Ltd. Liberty Fund. https://oll.libertyfund.org/title/latta-perpetual-peace-a-philosophical-essay-1917-ed

Kant, Immanuel. 1909. *Critique of Practical Reason and Other Works on the Theory of Ethics*. Translated by T. K. Abbott. Longman, Green, and Co. Liberty Fund. http://files.libertyfund.org/files/1442/0330_Bk.pdf

Kant, Immanuel. 1881 / 1922. *The Critique of Pure Reason*. Second Edition, Revised. In Commemoration of the Centenary of its First Publication. Translated into English by F. Max Muller. The Macmillan Company. Liberty Fund. http://files.libertyfund.org/files/1442/0330_Bk.pdf

Kant, Immanuel. 1795. *Perpetual Peace: A Philosophical Essay*. Translated with Introduction and Notes by M. Campbell Smith. George Allen & Unwin Ltd.

Kaplan, Morton. 1979. *Towards Professionalism in International Theory*. Free Press. pp., 66-69, 73-75.

Kaplan, Morton. 1957. *Systems and Process in International Politics*. Wiley. Pp., 23-25.

Kauffman, James L. 2009. *Selling Outer Space: Kennedy, the Media, and Funding for Project Apollo, 1961-1963*. University of Alabama Press.

Kealotswe-Matlou, Icho. 2018. "The Rule of Law in Outer Space: A Call for International Cooperation." https://www.law.upenn.edu/live/files/7811-kealotswethe-rule-of-law-in-outer-spacepdf

Keating, Kenneth B. 1958. "The Law and the Conquest of Space." *Journal of Air Law and Comm*erce, Vol. 25, Iss.2: 182-192 https://scholar.smu.edu/jalc/vol25/iss2/3?utm_source=scholar.smu.edu%2Fjalc%2Fvol25%2Fiss2%2F3&utm_medium=PDF&utm_campaign=PDFCoverPages

Keefe, Heidi. 1995. "Making the Final Frontier Feasible: A Critical Look at the Current Body of Outer Space Law." *Santa Clara High Tech Law Journal*, Vol. 11, Iss.2:345-371. http://digitalcommons.law.scu.edu/chtlj/vol11/iss2/7

Keene, Edward. 2002. *Beyond the Anarchical Society: Grotius, Colonialism, and Order in World Politics*. Cambridge University Press.

Keller, Arthur Schopenhauer., Lissitzyn, Oliver James, and Frederick J. Mann. 1938. *Creation of Rights of Sovereignty Through Symbolic Acts, 1400-1800*. Columbia University Press

Kennan, George F. 1954/1966. *Realities of American Foreign Policy*. W.W. Norton & Company.

Keohane, Robert O. 1984. *After Hegemony: Cooperation and Discord in the World Political Economy. Princeton University Press*. https://www.jstor.org/stable/j.ctt7sq9s

Keohane, Robert O. 1982. "The De Man d for International Regimes." *International Organization*, Vol. 36, no. 2: 325-355. Published by MIT Press. Also, in *International Regimes*, 1983, edited by Stephen D. Krasner, pp., 141-172. JSTOR. https://www.jstor.org/stable/2706525

Keohane, Robert O., and Joseph S. Nye. 1977. *Power and Interdependence*. Little Brown. Pp., 19-20.

Kertzer, Joshua D. and Dustin Tingley. 2018. "Political Psychology in International Relations: Beyond the Paradigms." *Harvard Scholar / Annual Reviews*, 1-23. https://scholar.harvard.edu/files/dtingley/files/psyir.pdf

Keszthelyi, Laszio, Hagerty, Justin, Bowers, Amanda, Ellefsen, Karl, Ridley, Ian, King, Trude, Trilling, David, Moskovitz, Nicholas, and Will Grundy. 2017. "Feasibility Study for the Quantitative Assessment of Mineral Resources in Asteroids." *U.S. Geological Service (USGS) – Open File Report 2017-1041*. https://pubs.usgs.gov/of/2017/1041/ofr20171041.pdf

Kish, John. 1973 / 2017. *The Law of International Spaces*. Cambridge University Press.

Kleinschneider, Andreas, Van Overstraeten, Dmitry, Van der Reijnst, Roy, Van Hoorn, Niels, Lamers, Marvin, Hubert, Laurent, Dijk, Bert, Blangé, Joey, Hogeveen, Joel, De Boer, Lennaert, and Ron Noomen. 2014. "Feasibility of Lunar Helium-3 Mining." The ADS, Harvard. The Smithsonian Astrophysical Observatory / NASA Cooperative Agreement. https://ui.adsabs.harvard.edu/abs/2014cosp...40E1515K/abstract

Kluge, Eike-Henner W. 2005. "Res Nullius, Res Communis, and Res Propria: Patenting Genes and Patenting Life-Forms." *Jahrbuch fur Recht und Ethik / Annual Review of Law and Ethics*, Vol. 13, no. 70: 543-563. Published by Duncker & Humblot GmbH. https://www.jstor.org/stable/43593718

Kody, George. 2021. "Analysis of Current Law Governing Water in Space." American Bar Association, Environment / Energy Resources Publications Online, September 24, 2021. https://www.americanbar.org/groups/environment_energy_resources/publications/wr/20210924-analysis-of-current-law-governing-water-in-space/

Kopal, Vladimir. 1966 / 2008. "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies." United Nations Audiovisual Library of International Law. https://legal.un.org/avl/pdf/ha/tos/tos_e.pdf

Kopal, Vladimir. 1996. "United Nations and the Progressive Development of International Space Law." In, *The Finnish Yearbook of International Law*, Volume VII. 1996. Edited by M. Koskenniemi and K. Takamaa. Martinus Nijhoff Publishers / Kluwer Law International.

Krasner, Stephen D., ed. 2001. *Problematic Sovereignty: Contested Rules and Political Possibilities*. Columbia University Press. pp., 1-82.

Krasner, Stephen D. 1999. *Sovereignty: Organized Hypocrisy*. Princeton University Press

Krasner, Stephen D. 1995-1996. "Compromising Westphalia." *International Security*, Vol., 20, no.3: 115-151. https://www.jstor.org/stable/pdf/2539141.pdf

Krasner, Stephen D. 1993. “Westphalia and All That.” In, *Ideas and foreign Policy: Beliefs, Institutions, and Political Change*, by Judith Goldstein and Robert O. Keohane, eds. 1993, 235-264. Cornell University Press. JSTOR. https://www.jstor.org/stable/10.7591/j.ctvv4147z.13

Krasner, Stephen D. 1983. “Structural Causes and Regime Consequences: Regimes as Intervening Variables.” In *International Regimes,* edited by Stephen D Krasner. Cornell University Press.

Krasner, Stephen D., ed. 1983. *International Regimes*. Cornell University Press.

Krasner, Stephen D. 1982. “Regimes and the Limits of Realism: Regimes as Autonomous Variables.” *International Organization*, Vol. 36, no.2: 497-510. Published by The MIT Press. JSTOR. https://www.jstor.org/stable/2706531

Kratochwil, Friedrich V. 1992. “International Order and Individual Liberty: A Critical Examination of “Realism” as a Theory of International Politics.” *Constitutional Political Economy*, Vol. 3: 29-50. https://doi.org/10.1007/BF02393231

Krige, John. 2007. “NASA as an Instrument of U.S. Foreign Policy.” In, *Societal Impact of Spaceflight*, edited by Roger D. Launius and Andrew Fraknoi, pp. 207-218. NASA History Division. https://history.nasa.gov/sp4801-chapter11.pdf

Krutz, Glen and Sylvie Waskiewicz. 2021. “American Government 3e: Chapter 16 – Public Policy.” OpenStax – Rice University. https://openstax.org/details/books/american-government-3e

Kuhn, Steven. 1997. “Prisoner’s Dilemma.” Stanford Encyclopedia of Philosophy. https://plato.stanford.edu/entries/prisoner-dilemma/

Kuhn, Steven, and Serge Moresi. 1995. “Pure and Utilitarian Prisoner's Dilemmas.” *Economics and Philosophy*, Vol. 11, Iss. 2: 123–133. https://doi.org/10.1017/S0266267100003424

Kuhn, Thomas S. 1962. *The Structure of Scientific Revolutions*. University of Chicago Press.

Kulu, Erik. 2021. “In-Space Economy in 2021 – Statistical Overview and Classification of Commercial Entities." 72nd International Aeronautical Congress (IAC 2021), Dubai, United Arab Emirates. Factories in Space Database. https://www.factoriesinspace.com/graphs/In-Space-Economy-2021_Erik-Kulu_IAC2021.pdf

Lachs, Judge Manfred. 2010. *The Law of Outer Space: An Experience in Contemporary Law-Making*. Reissued on the Occasion of the 50th Anniversary of the International Institute of Space Law. Edited by Tanja Masson-Zwaan and Stephan Hobe. Martinus Nijhoff Publishers. https://brill.com/view/title/18848

Lachs, Judge Manfred. 1972. *The Law of Outer Space: An Experience in Contemporary Law-Making*. Sijthoff.

Larschan, Bradley and Bonnie C. Brennan. 1983. “The Common Heritage of Mankind Principle in International Law.” *Columbia Journal of Transnational Law*, Vol. 21, no. 2: 305-338. HeinOnline. https://heinonline.org/HOL/P?h=hein.journals/cjtl21&i=309

Lasswell, Harold D. 1950/1986. *World Politics and Personal Insecurity*. The Free Press.

Launius, Roger D. 2009. "United States Space Cooperation and Competition: Historical Reflections." *Astropolitics – The International Journal of Space Politics and Policy*, Vol. 7, Iss. 2: 89-100. Tandonline. https://doi.org/10.1080/14777620903073853

Law Insider. 2022. "Mineral Exploitation." https://www.lawinsider.com/dictionary/mineral-exploitation

Lebow, Richard Ned. 2009. *The Tragic Vision of Politics: Ethics, Interests and Orders*. Cambridge University Press. https://doi.org/10.1017/CBO9780511491504

Lechner, Silviya. 2017. "Anarchy in International Relations." International Studies Association and Oxford University Press. https://doi.org/10.1093/acrefore/9780190846626.013.79

Lee, Daniel. 2008. "Private Law Models for Public Law Concepts: The Roman Law Theory of *Dominium* in the Monarchomach Doctrine of Popular Sovereignty." *The Review of Politics*, Vol. 70, no. 3: 370-399. Published by Cambridge University Press for the University of Notre Dame du lac on behalf of Review Politics. http://www.jstor.com/stable/20453014

Lee, R.W. 1956. *The Elements of Roman Law with Translation of the Institutes of Justinian*. 4th Edition. Sweet & Maxwell Limited.

Lee, Ricky J. 2012. *Law and Regulation of Commercial Mining of Minerals in Outer Space*. Space Regulations Library Book Series, Vol. 7. Springer. DOI 10.1007/978-94-007-2039-8_1

Legal Information Institute (LII). 2022. "Ripeness Doctrine: Overview." Art III, Sec.2, Clause 1.2.6.1., U.S. Constitution Annotated. Cornell Law School. https://www.law.cornell.edu/constitution-conan/article-3/section-2/clause-1/ripeness-doctrine-overview

Leon, Amanda M. 2018. "Mining for Meaning: An Examination of the Legality of Property Rights in Space Resources." *Virginia Law Review*, Vol. 104, no.3: 497-546. JSTOR. https://www.jstor.org/stable/44864188

Levit, Janet K. 2007. "Bottom-Up International Lawmaking: Reflections on the New Haven School of International Law." *Yale Journal of International Law*, Vol. 32: 393-420. https://digitalcommons.law.yale.edu/cgi/viewcontent.cgi?article=1301&context=yjil

Lewis, James Andrew. 2014. *Space Exploration in a Changing International Environment: A Report of the CSIS Technologies Program*. Center for Strategic and International Studies, July 2014. Rowman & Littlefield.

Lewis, John S. 1997. *Mining the Sky: Untold Riches from the Asteroid, Comets, and Planets*. Basic Books. Center for Near Earth Object Studies (CNEOS), NASA Jet Propulsion Laboratory. https://cneos.jpl.nasa.gov/about/nea_resource.html

Library of Congress. 2020. "American State Research, 1789-1838: Thirty-Eight Volumes." *The Library of Congress*. https://memory.loc.gov/ammem/amlaw/lwsplink.html

Licht, Amir N. 1999. “Games Commissions Play: 2x2 Games of International Securities Regulation.” *The Yale Journal of International Law*, Vol. 24: 61-125. https://faculty.idc.ac.il/licht/GCP.pdf

Lim, Jonathan. 2018. “The Future of the Outer Space Treaty – Peace and Security in the 21st Century.” *Global Politics Review*, Vol. 4, no. 2: 72-112. ISSN 2464-9929. GPR. https://www.globalpoliticsreview.com/publications/2464-9929_v04_i02_p072.pdf

Lincoln, Yvonna S., and Egon G. Guba. 1985. *Naturalistic Inquiry*. SAGE Publications.

Lindley, M. F. 1926. *The Acquisition and Government of Backward Territory in International Law: Being a Treatise on the Law and Practice Relating to Colonial Expansion*. Pp., 12-65. Longmans, Green and Co.

Lindsay, James M. 2018. “Invitation to Struggle: Congress, the President, and U.S. Foreign Policy.” *Trans-Atlantic Relations*, 145-161. https://archive.transatlanticrelations.org/wp-content/uploads/2018/01/ch07_Lindsay.pdf

Lipson, Charles. 1983. “The Transformation of Trade: The Sources and Effects of Regime Change.” In, *International Regimes*, 1983, edited by Stephen D. Krasner. Cornell University Press.

Lipson, Leon, and Nicholas de Belleville Katzenbach. 1960. “Report to the National Aeronautics and Space Administration on the Law of Outer Space.” October 1960. American Bar Foundation. https://play.google.com/books/reader?id=McE3AAAAIAAJ&pg=GBS.PP1&hl=en

Listner, Michael J. 2017. “The Outer Space Treaty: Implications of Amendment and Withdrawal.” In, 2017 U.S. Senate Hearing. Subcommittee on Space, Science, and Competitiveness. https://www.govinfo.gov/content/pkg/CHRG-115shrg29998/html/CHRG-115shrg29998.htm

Lloyd, The Rev. W.F. 1833. *Two Lectures on the Checks to Population: Delivered Before the University of Oxford, in Michaelmas Term 1832*. Printed by S. Collingwood, Printer to the University of Oxford.

Locke, John. 1689 / 1975. *An Essay Concerning Human Understanding*. Edited with a Foreword by Peter H. Nidditch. Clarendon Press.

Locke, John. 1689. *Second Treatise: Of Property*, Sections 25-51, 123-126. https://press-pubs.uchicago.edu/founders/documents/v1ch16s3.html

Locke, John. 1823. *Two Treatises of Government: The Works of John Locke*. A New Edition, Corrected. In Ten Volumes. Volume V. Thomas Tegg; W. Sharpe and Son. https://www.yorku.ca/comninel/courses/3025pdf/Locke.pdf

Lodge, Henry Cabot, ed. 1904. *The Works of Alexander Hamilton: in Twelve Volumes*. Federal Edition. Vol., 7. G. P. Putnam’s Sons. OLL – Part of the Liberty Fund Network. https://oll.libertyfund.org/title/lodge-the-works-of-alexander-hamilton-federal-edition-vol-7

Lodico, M. G., Spaulding, D. T., and K. H. Voegtle. 2010. *Methods in Educational Research: From Theory to Practice*. John Wiley and Sons.

Logsdon, John M. 2008. “Ten Presidents and NASA.” NASA 50th Magazine. https://www.nasa.gov/50th/50th_magazine/10presidents.html

Logsdon, John M. 2004. “A Sustainable Rationale for Human Spaceflight.” *Issues in Science and Technology*, Vol. 20, Iss. 2: 31-34. https://www.proquest.com/docview/195919496?accountid=12085

Luce, R. Duncan, and Howard Raiffa. 1957/1989. *Games and Decisions: Introduction and Critical Survey*. John Wiley & Sons, Inc. / Dover Publications, Inc.

Lumen Learning / Open Education Resources. 2020. Western Education: The Rise of Nation-States, The Peace of Westphalia and Sovereignty.” *OER Services*. https://courses.lumenlearning.com/suny-hccc-worldhistory/chapter/the-peace-of-westphalia-and-sovereignty/

Lunar and Planetary Institute. 2020. “Lunar Samples.” *Lunar Science and Exploration*. https://www.lpi.usra.edu/lunar/samples/

Lunar Exploration Analysis Group (LEAG). 2017. “2017 Annual Meeting of the Lunar Exploration Analysis Group: Science Enabled by Getting to the Surface.” *Meeting Program / Contribution Documents, LPI Contrib*. no. 2041: 5091-5006. https://www.lpi.usra.edu/lpi/contribution_docs/LPI-002041.pdf

Luscombe, Richard / The Guardian Online. 2022. “NASA Successfully Crashes Space Craft into Asteroid in Planetary Defense Test.” September 26, 2022. Science. https://www.theguardian.com/science/2022/sep/26/nasa-spacecraft-asteroid-crash-planetary-defense-test

Luxembourg Space Agency. 2017. “Law of July 20th, 2017, on the Exploration and Use of Space Resources: English Translation.” *LSA Public*. https://space-agency.public.lu/en/agency/legal-framework/law_space_resources_english_translation.html

Luxembourg Space Agency. 2020. “Resources in Space: A Universe of Potential.” https://space-agency.public.lu/en/space-resources/ressources-in-space.html

Lyall, Francis and Paul B. Larsen. 2018. *Space Law: A Treatise. Second Edition*. Routledge. Taylor and Francis Group. https://doi.org/10.4324/9781315610139

Machiavelli, Niccolò. 2014. *The Prince: Penguin Classic Edition*. Penguin Random House UK. https://apeiron.iulm.it/retrieve/handle/10808/4129/46589/Machiavelli%2C%20The%20Prince.pdf

Mackinder, Halford J. 1904. “The Geographical Pivot of History.” *The Geographical Journal*, Vol. 23, no.4: 421-437. Published by The Royal Geographical Society (with the Institute of British Geographers). JSTOR. https://www.jstor.org/stable/1775498

MacWhorter, Kevin. 2016. “Sustainable Mining: Incentivizing Asteroid Mining in the Name of Environmentalism.” *William and Mary Environmental Law and Policy Review*, Vol. 40, Iss.2: 645-676. https://scholarship.law.wm.edu/wmelpr/vol40/iss2/11

Maine, Sir Henry Sumner. 1908. *Ancient Law: It’s Connection with the Early History of Society and its Relation to Modern Ideas*. Cheap Edition. John Murray.

Makichuk, Dave. 2021. “Helium-3: The Secret ‘Mini War’ in Space.” Asia Times – Aerospace, November 6, 2021. https://asiatimes.com/2021/11/helium-3-the-secret-mining-war-in-space/

Mallick, Senjuti, and Rajeswari Pillai Rajagopalan. 2019. “If Space is ‘the Province of Mankind’, Who Owns its Resources?: The Potential of Space Mining and its Legal Implications.” *ORF Occasional Research*, No. 182. *Observer Research Foundation (ORF)*. https://www.orfonline.org/research/if-space-is-the-province-of-mankind-who-owns-its-resources-47561/

Malthus, Thomas Robert. 1798. *An Essay on the Principle of Population*. 6th Edition. John Murray. Library of Economics. https://www.econlib.org/library/Malthus/malPlong.html

Marcus, Alfred A. 1981. “Policy Uncertainty and Technological Innovation.” *Academy of Management Review*, Vol. 6, no. 3: 443-448. JSTOR. https://doi.org/10.2307/257379

Markovich, Steven J., Chatzky, Andrew, and Anshu Siripurapu. 2020. “Space Exploration and U.S. Competitiveness.” *Backgrounder - Council on Foreign Relations*. https://www.cfr.org/backgrounder/space-exploration-and-us-competitiveness

Marshall, Justice John. 1803. *Marbury v. Madison*, 5 U.S. (1 Cranch) 137 (1803). *U.S. Reports*. Library of Congress. https://www.loc.gov/item/usrep005137/

Martin, Lisa. 1992. “Interests, Power, and Multilateralism.” *International Organization*, Vol. 46, Iss. 4: 765-792. https://doi.org/10.1017/S0020818300033245

Massachusetts Institute of Technology (MIT). 2016. “Mission 2016: The Future of Strategic Natural Resources – The Solution.” https://web.mit.edu/12.000/www/m2016/finalwebsite/solutions/asteroids.html

Matte, Nicolas Mateesco. 1978. “The Draft Treaty on the Moon: Eight Years Later.” *Annals of Air and Space Law*, Vol. III: 511.

Matthews, Jeff. 2021. “The Decline of Commercial Space Launch Costs: Insights to Action.” Deloitte – Space Industry Perspectives. https://www2.deloitte.com/us/en/pages/public-sector/articles/commercial-space-launch-cost.html

Mayer, Joseph. 1935. “Znaniecki, Florian. The Method of Sociology. Pp. xii, 338. New York: Farrar & Rinehart, 1934.” *The Annals of the American Academy of Political and Social Science*, Vol. 177, Iss. 1: 284-285. SAGE Journals. https://doi.org/10.1177%2F000271623517700161

Mayhew, David R. 1974. *Congress: The Electoral Connection*. Yale University Press.

McDougal, Myres S., and Leon Lipson. 1958 / 2017 “Perspectives for a Law of Outer Space.” *The American Journal of International Law*, Vol. 52, Iss. 3: 407-431. DOI: https://doi.org/10.2307/2195459

McDougal, Myres S. 1947. “The Law School of the Future: From Legal Realism to Policy Science in the World Community.” *Yale Law School Legal Scholarship Repository / Faculty Scholarship Series*. *The Yale Law Journal*, Vol. 56: 1345-1355. HeinOnline. https://digitalcommons.law.yale.edu/cgi/viewcontent.cgi?article=3474&context=fss_researchs

McDougal, Myres S., and David Haber. 1948. *Property, Wealth, Land: Allocation, Planning and Development: Selected Cases and Other Materials on the Law of Real Property: An Introduction*. Michie Casebook Corporation.

McDougal, Myres S., and William T. Burke. 1962. *The Public Order of the Oceans: A Contemporary International Law of the Sea*. Yale University Press.

McDougal, Myres S., Lasswell, Harold D., and Ivan A. Vlasic. 1963. *Law and Public Order in Space*. Yale University Press.

McDougal, Myres S., Lasswell, Harold D., and Lung-chu Chen. 1980. *Human Rights and World Public Order: The Basic Policies of an International Law of Human Dignity*. Yale University Press. http://digitalcommons.nyls.edu/fac_books/29

McDougal, Myres S. 1993. “Legal Bases for Securing the Integrity of the Earth-Space Environment.” *Journal of Natural Resources and Environmental Law*, Vol. 8, no.2: 177-207. HeinOnline. https://heinonline.org/HOL/Page?handle=hein.journals/jnatrenvl8&collection=journals&id=189&startid=&endid=220

McDougal, Myres S., and Florentino P. Feliciano. 1994. *The International Law of War: Transnational Coercion and World Public Order*. Yale University Press.

McDougall, Walter A. 1997. *The Heavens and the Earth: A Political History of the Space Age*. JHUP.

McGill University / Institute of Air & Space Law. 2021. *Annals of Air and Space Law: 1976-2017 Volumes*. https://www.mcgill.ca/iasl/annals/contents/1984

McGlinchey, Stephen, Walters, Rosie and Christian Scheinpflug, eds. 2017. *International Relations Theory*. E-International Relations Publishing. https://www.e-ir.info/publication/international-relations-theory/

McKenzie, Baker and Tajiro Suzuki. 2021. “Japan: Legal Issues in Space Business in Japan – Volume 2.” *Lexology*, 1-2. https://www.lexology.com/library/detail.aspx?g=5e3f8d2b-1022-4583-9b98-a88943ba7dac

McTague, Tom and Peter Nicholas. 2020. “How ‘America First’ Became America Alone: In His Desperation to Restore and Showcase American Strength, Donald Trump has Made the Country Weaker.” *The Atlantic*, October 29, 2020. https://www.theatlantic.com/international/archive/2020/10/donald-trump-foreign-policy-america-first/616872/

Mearsheimer, John J. 1994/1995. “The False Promise of International Institutions.” *International Security*, Vol. 19, No. 3: 5-49. Published by The MIT Press. JSTOR. http://www.jstor.org/stable/2539078?origin=JSTOR-pdf

Mearsheimer, John J. 2011. “Imperial by Design.” *The National Interest*, no.111: 16-34. JSTOR. https://www.jstor.org/stable/42897726

Mearsheimer, John J. 2014. *The Tragedy of Great Power Politics*. Updated Edition. W.W. Norton & Company.

Messier, Doug. 2014. “U.S. Space Lead Continues to Decline in Futron Space Competitiveness Index.” *Parabolic ARC*. http://www.parabolicarc.com/2014/05/08/space-lead-continues-decline-futron-space-competitiveness-index/

Mickelson, Karin. 2014. “The Maps of International Law: Perceptions of Nature in the Classification of Territory.” *Leiden Journal of International Law*, Vol. 27, Iss. 3: 621-639. Published Online by Cambridge University Press. Cambridge Core. https://doi.org/10.1017/S0922156514000235

Miles, Matthew B., and A. M. Huberman. 1984. *Qualitative Data Analysis: A Sourcebook of New Methods*. SAGE Publications.

Mills, J., Birks, M., and K.J. Hoare. 2014. Grounded Theory. In: Mills J and M. Birks, eds. *Qualitative methodology: a practical guide*. SAGE.

Mills, Albert J., Durepos, Gabrielle, and Elden Wiebe, eds. 2010. “Iterative.” Encyclopedia of Case Study Research. SAGE Research Methods. https://dx.%3Cwbr%3Edoi.%3Cwbr%3Eorg/10.4135/9781412957397.n185

Milner, Helen. 1992. “Review: International Theories of Cooperation Among Nations: Strengths and Weaknesses. Reviewed Works – Cooperation Among Nations by Joseph Grieco; Saving the Mediterranean by Peter Haas.” *World Politics*, Vol. 44, no. 3: 466-496. Published by Cambridge University Press. JSTOR. https://www.jstor.org/stable/2010546

Milner, Helen. 1991. “The Assumption of Anarchy in International Relations Theory: A Critique.” *Review of International Studies*, Vol. 17, no. 1: 67-85. Cambridge University Press. JSTOR. https://www.jstor.org/stable/20097244

Milun, Kathryn. 2011. *The Political Uncommons: The Cross-Cultural Logic of the Global Commons*. Ashgate Publishing Ltd.

Minet, Mathilde. 2020. “Astronationalism or Nationalism in Outer Space.” *Space Legal Issues*. https://www.spacelegalissues.com/astronationalism-or-nationalism-in-outer-space/

Mitchell, Rachel. 2018. “Into the Final Frontier: The Expanse of Space Commercialization.” *Missouri Law Review*, Vol. 83, Iss.2, Art. 9: 1-26. https://scholarship.law.missouri.edu/cgi/viewcontent.cgi?article=4328&context=mlr

Mitrany, David. 1946. *A Working Peace System: An Argument for the Further Development of International Organization*. 4th ed. The Royal Institute of International Affairs / Oxford University Press.

Molesworth, Sr. William, ed. 1841. *The English Works of Thomas Hobbes of Malmesbury*. John Bohn.

Morgan, Edmund S. 2009. "Columbus' Confusion About the New World." Smithsonian Magazine, October 2009. https://www.smithsonianmag.com/travel/columbus-confusion-about-the-new-world-140132422/

Morgenthau, Hans J. 1956. *Politics Among Nations: The Struggle for Power and Peace*. Fifth Edition, Revised. Alfred A. Knopf.

Morgenthau, Hans J. 1948. "The Problem of Sovereignty Reconsidered." *Columbia Law Review*, Vol. 48, no.3: 341-365. Published by Columbia Law Review Association, Inc. https://doi.org/10.2307/1118308.

Morgenthau, Hans J. 1946. *Scientific Man vs. Power Politics*. The University of Chicago Press.

Morgera, Elisa. 2016. "The Need for an International Legal Concept of Fair and Equitable Benefit Sharing." *European Journal of International Law*, Vol. 27, Iss. 2: 353-383. Oxford Academic. https://doi.org/10.1093/ejil/chw014

Morrison, Fred L. 1981. Review of "Human Rights and World Public Order. By Myres S. McDougal, Harold D. Lasswell, & Lung-Chu Chen." *Hofstra Law Review*, Vol. 9, Iss.2: 725-731. https://scholarlycommons.law.hofstra.edu/cgi/viewcontent.cgi?article=1391&context=hlr

Morrow, James D. 1994. "Modeling the Forms of International Cooperation: Distribution Versus Information." *International Organization*, Vol. 48, no.3: 387-423. The MIT Press. https://www.jstor.org/stable/2706964

Morrow, Susan L. 2005. "Quality and Trustworthiness in Qualitative Research in Counseling Psychology." *Journal of Counselling Psychology*, Vol. 52, no.2: 250 – 260. https://psycnet.apa.org/doi/10.1037/0022-0167.52.2.250

Morse, J. M. 1994. "Emerging from the Data: The Cognitive Processes of Analysis in Qualitative Inquiry." In, J. M. Morse, ed., *Critical Issues in Qualitative Research Methods*, pp. 117-133. SAGE.

Mosher, Dave. 2019. "Space Junk Kessler Syndrome Chain Reaction Prevention: Billionaires Plan to Launch Tens of Thousands of New Satellites." Business Insider – Tech. https://www.businessinsider.com/space-junk-kessler-syndrome-chain-reaction-prevention-2018-3

Nagan, Winston P., and Aitza M. Haddad. 2012. "Sovereignty in Theory and Practice." *San Diego International Law Journal*, Vol. 13: 429-466. University of Florida Law Scholarship Repository – Faculty Scholarship. https://scholarship.law.ufl.edu/cgi/viewcontent.cgi?article=1303&context=facultypub

NASA. 2021. “James Webb Space Telescope.” Goddard Space Flight Center. https://jwst.nasa.gov/content/webbLaunch/whereIsWebb.html

NASA. 2020. “The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes.” NASA, October 13, 2020, 1-18. https://www.nasa.gov/specials/artemis-accords/img/Artemis-Accords-signed-13Oct2020.pdf

NASA. 2020. “Space Law Bibliography.” *NASA Headquarters Library*. https://www.nasa.gov/centers/hq/library/find/bibliographies/space_law

NASA / Aaron Cohen. 1989. “Report of the 90-Day Study on Human Exploration of the Moon and Mars.” *NASA News*, 1-159. https://www.lpi.usra.edu/lunar/strategies/90_Day_Study.pdf

NASA Astromaterials Curator. 2020. “Lunar Rocks and Soils from Apollo Missions.” https://curator.jsc.nasa.gov/lunar/index.cfm

NASA / Holly Zell, ed. 2017. “The Earth’s Atmospheric Levels.” NASA Science. https://www.nasa.gov/mission_pages/sunearth/science/atmosphere-layers2.html

NASA. 2009. “Pioneering the Space Frontier: An Exciting Vision of Our Next Fifty Years in Space.” *The Report of the National Commission on Space*, 1-225. https://www.nasa.gov/pdf/383341main_60%20-%2020090814.5.The%20Report%20of%20the%20National%20Commission%20on%20Space.pdf

NASA. 1998. “International Space Station: International Cooperation.” Mission Pages - NASA TV Online, Space Station. https://www.nasa.gov/mission_pages/station/cooperation/index.html

NASA / Missions News. 2011. “Astronomers Find Largest Most Distant Reservoir of Water.” Missions News, July 22, 2011. https://www.nasa.gov/topics/universe/features/universe20110722.html

NASA / Jet Propulsion Laboratory (JPL). 2020.”2020 Technology Highlights.” Jet Propulsion Laboratory, California Institute of Technology. 1-34. https://scienceandtechnology.jpl.nasa.gov/sites/default/files/documents/JPL_2020_Technology_Highlights.pdf

NASA. 2020. “NASA’s OSIRIS-Rex Spacecraft Successfully Touches Asteroid.” Release 20-103, Oct. 20, 2020. https://www.nasa.gov/press-release/nasa-s-osiris-rex-spacecraft-successfully-touches-asteroid

NASA / Jet Propulsion Laboratory (JPL). 2019. “Strategic Technologies.” Jet Propulsion Technology Laboratory, California Institute of Technology. 1-64. https://scienceandtechnology.jpl.nasa.gov/sites/default/files/documents/JPL_Strategic_Technologies_2019.pdf

NASA / Solar System Exploration. 2001. “NEAR Shoemaker.” NASA Missions. https://solarsystem.nasa.gov/missions/near-shoemaker/in-depth/#:~:text=What%20was%20NEAR%20Shoemaker%3F,first%20to%20land%20on%20one.

NASA / Office of Space Science. 2004. “How Big is Our Universe?: The Universe is a Big Place. But How do we Know?” NASA Education – Featured Materials, July 15, 2004. https://www.nasa.gov/audience/foreducators/5-8/features/F_How_Big_is_Our_Universe.html

NASA Space Tech. 2019. “NASA Invests in Tech Concepts Aimed at Exploring Lunar Craters, Mining Asteroids.” *Media Advisory* 19-045. https://www.nasa.gov/press-release/nasa-invests-in-tech-concepts-aimed-at-exploring-lunar-craters-mining-asteroids

National Archives. 2020. “Document for July 29th: National Aeronautics and Space Act of 1958.” *Historical Documents – Today’s Document – Eighty Fifth Congress of the United States of America*. Public Law 85-568. https://www.archives.gov/historical-docs/todays-doc/?dod-date=729

National Archives. 2017. “Nixon and the U.S. Space Program.” *Presidential Libraries and Museums*. https://www.archives.gov/presidential-libraries/events/centennials/nixon/exhibit

National Archives. 2022. “Homestead Act (1862).” Milestone Documents. https://www.archives.gov/milestone-documents/homestead-act#:~:text=The%20Homestead%20Act%2C%20enacted%20during,plot%20by%20cultivating%20the%20land.

National Center for Atmospheric Research (NCAR) / University Corporation for Atmospheric Research (UCAR) / National Science Foundation (NSF). 2020. “Levels of Earth’s Atmosphere.” *Learning Zone, UCAR Center for Science Education*. https://scied.ucar.edu/atmosphere-layers#:~:text=Moving%20upward%20from%20ground%20level,the%20realm%20of%20interplanetary%20space.

National Environmental Satellite Data and Information Service (NESDIS) / National Oceanic and Atmospheric Administration (NOAA) / U.S. Department of Commerce. 2016. “Where is Space?” https://www.nesdis.noaa.gov/content/where-space

National Geographic. 2023. “Oct 4, 1957, CE: USSR Launches Sputnik.” National Geographic Education. https://education.nationalgeographic.org/resource/ussr-launches-sputnik/

National Human Genome Research Institute (NHGRI). 2021. “Eugenics and Scientific Racism.” Fact Sheet. https://www.genome.gov/about-genomics/fact-sheets/Eugenics-and-Scientific-Racism

National Research Council. 2014. *Pathways to Exploration: Rationales and Approaches for a U.S. Program of Human Space Exploration*. The National Academies Press. https://doi.org/10.17226/18801.

National Research Council / Committee on International Space Programs. 1998. U.S.–European Collaboration in Space Science. 1-155. *The National Academies of Sciences, Engineering, Medicine*. National Academies Press. http://nap.edu/5981

National Space Science Data Center and Arizona State University. 2020. “Digital Petrographic Slide Collection: Browse DPSC Images and Data.” http://ser.sese.asu.edu/cgi-bin/DPSC_Browse.pl

Nature Astronomy. 2019. “Sustainable Space Mining.” Nature Astronomy *Editorial*. Vol. 3: 465. https://doi.org/10.1038/s41550-019-0827-7

Neto, Olavo De O. Bittencourt, Hofmann, Mahulena, Mason-Zwaan, Tania and Dimitra Stefoudi, eds. 2020. *Building Blocks for the International Framework for the Governance of Space Resource Activities: A Commentary*. Eleven International Publishing. Boom Portal/Digitale Boeken. https://boeken.rechtsgebieden.boomportaal.nl/publicaties/9789462361218#0

Neumann, John von, and Oskar Morgenstern. 1944. *Theory of Games and Economic Behavior: 60th Anniversary Commemorative Edition*. Princeton University Press. JSTOR. https://www.jstor.org/stable/j.ctt1r2gkx.30

New World Encyclopedia. 2019. “Outer Space.” https://www.newworldencyclopedia.org/entry/outer_space

Nicter, Luke A. 2020. *The Last Brahmin: Henry Cabot Lodge Jr. and the Making of the Cold War*. Yale University Publishing.

Nie, Mingyan. 2020. “Space Privation in China’s National Strategy of Military-Civilian Integration: An Appraisal of Critical Legal Challenges.” *Elsevier Space Policy*, Vol. 52, no. 101372: 1-8. Science Direct. https://doi.org/10.1016/j.spacepol.2020.101372

Niebuhr, Reinhold. 1932 / 2013. *Moral Man and Immoral Society: A Study in Ethics and Politics*. 2nd Edition. Westminster John Knox Press.

Niebuhr, Reinhold. 1953. *Christian Realism and Political Problems*. Scribner.

Norman, Angell. 1912 / 2012. *The Great Illusion: A Study of the Relation of Military Power to National Advantage*. Fourth Revised and Enlarged Edition. G.P. Putnam’s Sons.

Nye, Joseph S., Jr., and David A. Welch. 2015. *Understanding Global Conflict and Cooperation: An Introduction to Theory and History*. Pearson.

Nye, Joseph S., Jr., and Robert Keohane. 2011. *Power and Interdependence* (Longman Classics in Political Science). Fourth Edition. Pearson.

Nye, Joseph S., Jr. 2008. *Understanding International Conflicts: An Introduction to Theory and History (Longman Classics in Political Science)*. Seventh Edition. Pearson.

Nye, Joseph S., Jr. 2005. *Soft Power: The Means to Success in World Politics*. Illustrated Edition. Public Affairs.

Nye, Joseph S., Jr. 2004. *Power in a Global Information Age: From Realism to Globalization*. First Edition. Routledge.

Obama, President Barack H. 2013. “Fact Sheet: 2013 National Space Transportation Policy.” *Space Policy Archive*.

https://aerospace.org/sites/default/files/policy_archives/Natl%20Space%20Trans%20Policy%20fact%20sheet%2021Nov13.pdf

Obama, President Barack. 2010. "Remarks by the President on Space Exploration in the 21st Century at the John F. Kennedy Space Center, Merritt Island, Florida." The White House / Office of the Press Secretary. NASA Transcripts and Documents. https://www.nasa.gov/news/media/trans/obama_ksc_trans.html

Oduntan, Gbenga. 2015. "Who Owns Space? US Asteroid-Mining Act is Dangerous and Potentially Illegal." *The Conversation*. https://theconversation.com/who-owns-space-us-asteroid-mining-act-is-dangerous-and-potentially-illegal-51073

Oduntan, Gbenga. 2012. *Sovereignty and Jurisdiction in Airspace and Outer Space: Legal Criteria for Spatial Delimitation*. Routledge Research in International Law. Taylor and Francis Group.

Office of the Historian, Foreign Service Institute / Department of State. 1959/2020. "National Security Council Report: Basic National Security Policy." Foreign Relations of the United States, 1958-1960; National Security Policy; Arms Control and Disarmament, Vol. III, Document 70. https://history.state.gov/historicaldocuments/frus1958

Olusoji, John Nester. 2017. "Africa in Space: Legal Issues and Responsibilities Related to Space Technology Development." *United Nations/South Africa Symposium on Basic Space Technology 2017. UNOOSA*. https://www.unoosa.org/documents/pdf/psa/activities/2017/SouthAfrica/slides/Presentation53.pdf

Onuf, Nicholas Greenwood. 2012. *Making Sense, Making Worlds: Constructivism in Social Theory and International Relations*. New International Relations Series. Taylor & Francis Group. ProQuest Ebook Central. Pp. 4 – 20. https://ebookcentral-proquest-com.ezproxy.liberty.edu/lib/liberty/detail.action?pq-origsite=summon&docID=1181073

Onuf, Nicholas Greenwood. 1989 / 2012. *World of Our Making: Rules and Rule in Social Theory and International Relations.* Reprint. Routledge. Taylor & Francis Group.

Onwuekwe, Chika. 2004. "The Commons Concept and Intellectual Property Rights Regime: Whither Plant Genetic Resources and Traditional Knowledge?" *The University of New Hampshire Law Review*, Vol. 2, no. 1: 65-90. https://scholars.unh.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1031&context=unh_lr

Organization of American States / Department of Legal Services (OAS). 2020. "Vienna Convention on the Law of Treaties Signed at Vienna 23 May 1969: Entry into Force, 27 January 1980." Department of Legal Services, Documents. https://www.oas.org/legal/english/docs/Vienna%20Convention%20Treaties.htm

Osiander, Andreas. 2001. "Sovereignty, International Relations, and the Westphalian Myth." *International Organization*, Vol., 55, no2: 251-287. Published by the IO Foundation and the Massachusetts Institute of Technology. https://library.fes.de/libalt/journals/swetsfulltext/10676369.pdf

Ostrom, Elinor. 1986. *How Inexorable is the "Tragedy of the Commons": Institutional Arrangements for Changing the Structure of Social Dilemmas*. Indiana University, Office of the Vice President.

Ostrom, Elinor, Dietz, Thomas, Dol, Nives, Stern, Paul C., Stonich, Susan, and Elke U. Weber, eds. 2002. *The Drama of the Commons*. National Research Council – National Academies Press. https://doi.org/10.17226/10287

Ostrom, Elinor. 1990/2015. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press.

Ostrom, Elinor. 2009. *Understanding Institutional Diversity*. Princeton University Press.

Oxford Guide to Latin in International Law, 1st ed. 2011. "Lex Specialis Derogat Legi Generali." In *Oxford Reference*, by Aaron X. Fellmeth and Maurice Horwitz. Oxford University Press. Online Version. https://www.oxfordreference.com/display/10.1093/acref/9780195369380.001.0001/acref-9780195369380-e-1303;jsessionid=EB1A29AB70386714A90C7922644DE742

Oye, Kenneth A. 1985. "Explaining Cooperation Under Anarchy: Hypotheses and Strategies." *World Politics*, Vol. 38, no. 1: 1-24. Published by Cambridge University Press. JSTOR. https://doi.org/10.2307/2010349

Paliouras, Zachos A. 2014. "The Non-Appropriation Principle: The *Grundnorm* of International Space Law." *Leiden Journal of International Law*, Vol. 27, Iss.1:37-54. Cambridge University Press. https://doi.org/10.1017/S0922156513000630

Pandya, Jayshree. 2019. "The Race to Mine Space." Forbes Cognitive World. https://www.forbes.com/sites/cognitiveworld/2019/05/13/the-race-to-mine-space/?sh=25edce4f1a70

Pannier, Russell. 1992. "An Analysis of the Theory of Original Intent." *William Mitchell Law Review*, Vol. 18, Iss. 3, Art. 15: 696-728. https://open.mitchellhamline.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=2292&context=wmlr

Pardo, Arvid. 1967. "Speech to UN General Assembly, Twenty-Second Session: Law of the Seas." *UN Official Records – Convention Agreements*. https://www.un.org/Depts/los/convention_agreements/texts/pardo_ga1967.pdf

Patton, Steven. 2012. "The Peace of Westphalia and its Effects on International Relations, Diplomacy, and Foreign Policy." *The Histories*, Vol., 10, no1: 91-99. https://digitalcommons.lasalle.edu/cgi/viewcontent.cgi?article=1146&context=the_histories

Paxson III, Edwin W. 1993. "Sharing the Benefits of Outer Space Exploration: Space Law and Economic Development." *Michigan Journal of International Law*, Vol. 14, Iss.3: 487-517. https://repository.law.umich.edu/mjil/vol14/iss3/8?utm_source=repository.law.umich.edu/mjil/vol14/iss3/8&utm_medium=PDF&utm_campaign=PDFCoverPages

Pearlman, Robert Z. 2013. “Nixon’s Space Legacy Unveiled at National Archives.” Space. https://www.space.com/19176-nixon-space-legacy-national-archives.html

Pearson, Ezzy. 2018. “Space Mining: The New Goldrush.” *Science Focus*. https://www.sciencefocus.com/space/space-mining-the-new-goldrush/

Permanent Court of International Justice. 1927. “The Case of the S.S. “LOTUS” – France v. Turkey.” *Collection of Judgments*. Twelfth (Ordinary Session.” Series A.-No. 10, September 7th, 1927. Publications of the Permanent Court of International Justice. https://www.icj-cij.org/public/files/permanent-court-of-international-justice/serie_A/A_10/30_Lotus_Arret.pdf

Peterson, Martin J. 1997. “The Use of Analogies in Developing Outer Space Law.” *International Organization*, Vol. 51, no.2: 245-274. Published by the MIT Press. JSTOR. https://www.jstor.org/stable/2703450

Peterson, Martin J. 1996. “The Worlds of Global Commons Regimes: A Review of, The Global Commons: A Regime Analysis, by John Vogler.” *Mershon International Studies Review*, Vol. 40, no. 2: 289-291. Published by Wiley on behalf of The International Studies Association. https://doi.org/10.2307/222783

Peterson, Martin J., ed. 2015. *The Prisoner's Dilemma*. Cambridge University Press.

Pfetsch, Frank R. 2011. “Power in International Negotiations: Symmetry and Asymmetry.” *Dans Negociations*, Vol. 2, no. 16: 39 – 56. CAIRN.INFO. https://www.cairn.info/revue-negociations-2011-2-page-39.htm

Pillai, Mohanan Bhaskaran and Geetha Ganapathy Dore, eds. 2020. *Global Commons: Issues, Concerns and Strategies*. SAGE Publications. ProQuest Ebook Central. http://ebookcentral.proquest.com/lib/liberty/detail.action?docID=6261052

Planetary Resources – The Asteroid Mining Company. 2015. “President Obama Signs Bill Recognizing Asteroid Resource Property Rights in Law.” http://www.planetaryresources.com/2015/11/president-obama-signs-bill-recognizing- asteroid-resource-property-rights-into-law/

Polit, Denise F., and Cheryl Tatano Beck. 2017. *Nursing Research: Generating and Assessing Evidence for Nursing Practice*. 9th ed. Lippincott Williams & Wilkins.

Pomeroy, John Norton. 1828-1885. *An Introduction to the Constitutional Law of the United States: Especially Designed for Students, General, and Professional*. Fourth Edition – Revised and Enlarged. Houghton, Osgood. Gale Primary Sources. https://go.gale.com/ps/i.do?p=MOML&u=vic_liberty&id=GALE|F0102925577&v=2.1&it=r&sid=summon

Popular Mechanics. 2004. “Mining the Moon.” Popular Mechanics – Space – Moon, December 06, 2004. https://www.popularmechanics.com/space/moon-mars/a235/1283056/

Posner, Richard. 1995. *Overcoming Law*. Harvard University Press.

Posner, Richard. 1996. “Pragmatic Adjudication.” Faculty Scholarship. University of Chicago Law School, Chicago Unbound. *Cardozo Law Review*, Vol. 18, no. 1: 1-20. HeinOnline. https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=2818&context=journal_articles

Pound, Roscoe. 1925. “Grotius in the Science of Law.” *American Journal of International Law*, Vol. 19, Iss. 4: 685-688. https://doi.org/10.2307/2188307

Pound, Roscoe. 1923. *Philosophical Theory and International Theory*. Vol. 1. Bibliotheca Visserina. P.72.

Powell, Jefferson H. 1999. “The Founders and the President’s Authority Over Foreign Affairs.” *William and Mary Law Review*, Vol. 40, no. 5: 1471-1537. https://scholarship.law.duke.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1381&context=faculty_scholarship

Powell, Jefferson H. 1985. “The Original Understanding of Original Intent.” *Harvard Law Review*, Vol. 98, No. 5: 885-948. JSTOR. https://www.jstor.org/stable/1340880

Puchala, Donald J., and Raymond F. Hopkins 1983. “International Regimes: Lessons from Inductive Analysis.” In *International Regimes.* Edited by Stephen D Krasner. Cornell University Press. pp., 61-90.

Puchala, Donald J., and Raymond F. Hopkins. 1982. “International Regimes: Lessons from Inductive Analysis.” *International Organization*, Vol. 36, no. 2: 245-275. Published by The MIT Press. Swarthmore Works. https://works.swarthmore.edu/fac-poli-sci/170

Pufendorf, Samuel. 1673 / 1927. *On the Duty of Man and Citizen: According to Natural Law*. Translated by W. A. Oldfather. Clarendon Press.

Pufendorf, Samuel. 1658 / 1931. *The Elements of Universal Jurisprudence*. Translation of the 1672 Edition by W. A. Oldfather. Clarendon Press.

Pufendorf, Samuel. 1672. *On the Law of Nature and Nations: Eight Books*. Translation of the 1688 Edition by C. H. Oldfather and W. A. Oldfather. Clarendon Press.

Putkov, Vladimir. 2007. “Sputnik, The Outer Space Treaty, Today- 1957, 1967, 2007: Sputnik and Russia’s Outer Space Activities.” In, Celebrating the Space Age: 50 Years of Space Technology, 40 Years of the Outer Space Treaty.” Conference Report, April 2-3, 2007, 2-4. UNIDIR. https://unidir.org/sites/default/files/conferences/pdfs/conference-report-eng-0-103.pdf

Raclin, Grier C. 1986. “From Ice to Ether: The Adoption of a Regime to Govern Resource Exploitation in Outer Space.” *Northwestern Journal of International Law & Business*, Vol. 4, Iss.7: 728-757. https://scholarlycommons.law.northwestern.edu/cgi/viewcontent.cgi?article=1214&context=njilb

Ralph, Nicholas, Birks, Melanie, and Ysanne Chapman. 2014. “Contextual Positioning: Using Documents as Extant Data in Grounded Theory Research.” *SAGE Journals*, July-September 2014: 1-7. https://doi.org/10.1177%2F2158244014552425

Ramel, Frédéric. 2014. “Access to the Global Commons and Grand Strategies: A Shift in Global Interplay.” *The Institute for Strategic Research of the Ecole Militaire* (IRSEM), no. 30: 1-35. https://www.irsem.fr/data/files/irsem/documents/document/file/1166/Etude_30_En.pdf

Randolph, Justus J. 2009. “A Guide to Writing the Dissertation Literature Review. Practical Assessment, Research, and Evaluation, Vol. 14, no. 13: 1-13. https://doi.org/10.7275/b0az-8t74

Ranganathan, Surabhi. 2016. “Global Commons.” *European Journal of International Law*, Vol. 27, no. 3: 693-718. HeinOnline. https://heinonline.org/HOL/Page?handle=hein.journals/eurint27&collection=journals&id=708&startid=708&endid=733

Rapkin, David P., and Dan Braaten. 2009. “Conceptualizing Hegemonic Legitimacy.” *Review of International Studies*, Vol. 35, no. 1: 113-149. Published by Cambridge University Press. JSTOR. https://www.jstor.org/stable/20542767

Rapp, Lucien. 2018. “Space Lawmaking.” *The Space Review* – Essays and Commentary about the Final Frontier. In Association with Space News. Monday, July 02, 2018. Pp. 1-10. https://www.thespacereview.com/article/3523/1

Ratcliffe, John. 2020. “DNI John Ratcliffe’s Remarks at the Eighth Meeting of the National Space Council.” *Office of the Director of National Intelligence*. https://www.dni.gov/index.php/newsroom/speeches-interviews/speeches-interviews-2020/item/2172-dni-john-ratcliffe-s-remarks-at-the-eighth-meeting-of-the-national-space-council

Reinstein, Ezra J. 1999. “Owning Outer Space.” *Northwest Journal of International Law and Business*, Vol. 20, Iss.1:59-98. https://scholarlycommons.law.northwestern.edu/njilb/vol20/iss1/7

Rengger, Nicholas. 2000. “Political Theory and International Relations: Promised Land or Exit from Eden?” *International Affairs* (Royal Institute of International Affairs 1944-), Vol. 76, no.4: 755-770. Published by Oxford University Press on behalf of the Royal Institute of International Affairs. JSTOR. https://www.jstor.org/stable/2626458

Reus-Smit, Christian and Duncan Snidal, eds. 2010. *The Oxford Handbook of International Relations*. Oxford University Press.

Reynolds, Glenn H. 1992. “International Space Law: Into the Twenty-First Century.” *Vanderbilt Journal of Transnational Law*, Volume 25, Iss. 2, Art. 5: 225-255. https://scholarship.law.vanderbilt.edu/cgi/viewcontent.cgi?article=1972&context=vjtl

REUTERS. 2022. “EU Unlikely to Cut Russia Off SWIFT for Now, Sources Say.” Business – Finance. https://www.reuters.com/business/finance/eu-unlikely-cut-russia-off-swift-now-sources-say-2022-02-24/

Reynolds, Glenn Harlan. 1993. “Reviewed Work: Space Law: Past, Present, and Future by Carl Q. Christol, 1991.” *Jurimetrics*, Vol. 33, no.3: 445-448. Published by American Bar Association. JSTOR. https://www.jstor.org/stable/29762307

Rhyne, Charles. 1958. “The Legal Horizons of Space Use and Exploration.” 104 Congressional Record 6153 - 6355, April 22, 1958.

Rich, David, Schertz, Joshua, and Adam Hugo. 2020. “The Space Resource Report: 2020.” *The Space Resource*, pp 1-37. https://www.thespaceresource.com/news/2020/the-space-resource-report

Rich, David. 2019. “So Long, and Thanks for All the Samples: Hayabusa2 Leaves Asteroid Ryugu.” *The Space Resource*. https://www.thespaceresource.com/news/2019/11/so-long-and-thanks-for-all-the-samples-hayabusa2-leaves-asteroid-ryugu

Richards, Lyn 1998. “Closeness to Data: The Changing Goals of Qualitative Data Handling.” *SAGE - Qualitative Health Research*, Vol. 8: 319-328. https://journals.sagepub.com/doi/pdf/10.1177/104973239800800303

Richardson, J. S. 1991. “Imperium Romanum: Empire and the Language of Power.” *The Journal of Roman Studies*, Vol. 81, 1-9. Published by the Society for the Promotion of Roman Studies. JSTOR. https://www.jstor.org/stable/300484

Rios, Diego, and Eleonora Cresto. 2015. “Prisoner’s Dilemma, One Shot and Iterated.” *International Encyclopedia of the Social and Behavioral Sciences*. 2nd Edition, Vol. 18: 930-937. http://dx.doi.org/10.1016/B978-0-08-097086-8.63065-9

Risse, Mathias. 2008. “Original Ownership of the Earth: A Contemporary Approach.” *RWP08-073, Faculty Research Working Research Series*. Harvard University – John F. Kennedy School of Government. https://core.ac.uk/download/pdf/6618211.pdf

Rittberger, Volker, and Peter Mayer. 1993. *Regime Theory and International Relations*. Oxford University Press.

Roberts, Thomas G. 2020. “Space Launch to Low Earth Orbit: How Much Does it Cost?” Aerospace Data Repository. https://aerospace.csis.org/data/space-launch-to-low-earth-orbit-how-much-does-it-cost/

Rogers, Mike, and Glenn Nye. 2019. “Securing the Highest Ground: Integrating Commercial Space Innovation into National Security Missions.” *Center for the Study of the Presidency and Congress / National Security Institute. NSSP Report*, 1-35. https://static1.squarespace.com/static/5cb0a1b1d86cc932778ab82b/t/5d5ecda75489fb0001d85500/1566494123916/CSPC+NSSP+Report+Digital+Version+-+Securing+the+Highest+Ground%5B235%5D.pdf

Rogowski, Ronald. 1978. “Rationalist Theories of Politics: A Midterm Report.” *World Politics*, Vol. 30, no. 2: 296-323. Published by Cambridge University Press (2011). https://doi.org/10.2307/2009962

Rogowski, Ronald. 1968. “International Politics: The Past as Science.” *International Studies Quarterly*, Vol. 12, no. 4: 394-418. Published by Wiley on behalf of The International Studies Association. JSTOR. https://doi.org/10.2307/3013525

Rolfe, Gary. 2006. “Validity, Trustworthiness and Rigor: Quality and the Idea of Qualitative Research.” *Journal of Advanced Nursing*, Vol. 53, no. 3: 304-310. DOI: 10.1111/j.1365-2648.2006.03727.x

Rosenau, James N. 1999. “Toward an Ontology for Global Governance.” In, Martin Hewson and Thomas Sinclair, eds. *Approaches to Global Governance Theory*. SUNY Press.

Rosenberger, Leif. 2020. *Economic Statecraft and US Foreign Policy: Reducing the De Man d for Violence*. Routledge Studies in US Foreign Policy. Routledge / Taylor and Francis Group. https://doi.org/10.4324/9780429026362

Rosenthal, Joel H. 2002. *Righteous Realists: Political Realism, Responsible Power, and American Culture in the Nuclear Age (Political Traditions in Foreign Policy Series)*. LSU Press.

Ross, Wilbur. 2018. “That Moon Colony? Maybe Not Far Off.” New York Times, May 25, 2018, p. A23. https://www.nytimes.com/2018/05/24/opinion/that-moon-colony-will-be-a-reality-sooner-than-you-think.html

Rousseau, Jean-Jacques. 1755. *A Discourse Upon the Origin and Foundation of the Inequality among Mankind*. International Relations and Security Network. Primary Resources in International Affairs (PRIA). http://faculty.wiu.edu/M-Cole/Rousseau.pdf

Rousseau, Jean-Jacques. 1761 / 1913. *The Social Contract & Discourses*. J. M. Dent & Sons Ltd., and E. P. Dutton & Co. Liberty Fund Network. https://oll.libertyfund.org/title/cole-the-social-contract-and-discourses

Rousseau, Jean-Jacques. 1915. *The Political Writings of Jean Jacques Rousseau*. Edited by G. E. Vaughan. Two Volumes. Cambridge University Press.

Rowbo, Barbara J. 1982. “Airspace-Outerspace? The Geostationary Orbit and the Need for a Precise Definition of Outer Space.” *New York Law School Journal of International and Comparative Law*, Vol. 4, no.1:115-130. https://digitalcommons.nyls.edu/cgi/viewcontent.cgi?article=1137&context=journal_of_international_and_comparative_law

Ruddy, F. S. 1968. “Res Nullius and Occupation in Roman and International Law.” *University of Missouri at Kansas City Law Review*, Vol. 36, no.2: 274-287. https://heinonline.org/HOL/Page?handle=hein.journals/umkc36&collection=journals&id=280&startid=280&endid=293

Rudiger, Wolfrum, ed. 2012. *The Max Planck Encyclopedia of Public International Law*. Volumes 1-10. Oxford University Press.

Ruggie, John Gerard. 1983. “International Regimes, Transactions, and Change: Embedded Liberalism in the Postwar Economic Order.” In, *International Regimes*, 1983, edited by Stephen D. Krasner. Cornell University Press. pp., 195-232.

Ruggie, John Gerard. 1982. “International Regimes, Transactions, and Change: Embedded Liberalism in the Postwar Economic Order.” *International Organization*, Vol. 36, no. 2: 379-415. Published by The MIT Press. JSTOR. https://www.jstor.org/stable/2706527

Russian Federation. 2019. “Law of the Russian Federation No. 5663-1 of August 20, 1993 / 2006.” WTO. https://www.wto.org/english/thewto_e/acc_e/rus_e/wtaccrus58_leg_375.pdf

Ruthven, Malise, ed. 2018. *Carving Up the Globe: An Atlas of Diplomacy*. Harvard University Press.

Salas, Eduardo, Fiore, Stephen, Warner, Norman, and Michael Letsky. 2010. “Emerging Multi-Disciplinary Theoretical Perspectives in Team Cognition: An Overview.” *Theoretical Issues in Ergonomics Science*, Vol. 11, Iss. 4: 245-249. https://doi.org/10.1080/14639221003729110

Sand, Peter H. 2004. “Sovereignty Bounded: Public Trusteeship for Common Pool Resources?” *Global Environmental Politics*, Vol. 4, Iss. 1: 47-71. Massachusetts Institute of Technology (MIT) Press Direct. https://doi.org/10.1162/152638004773730211

Sax, Joseph L. 1980-1981. “Liberating the Public Trust Doctrine from Its Historical Shackles.” *University of California Davis Law Review*, Vol. 14, no. 2: 185-194. HeinOnline. https://heinonline.org/HOL/Page?handle=hein.journals/davlr14&collection=journals&id=197&startid=197&endid=206

Schachter, Oscar. 1952. “Who Owns the Universe?” Colliers Weekly, March 22, 1952. https://www.unz.com/print/Colliers-1952mar22-00036/

Schaefer, Matthew. 2018. “The Contours of Permissionless Innovation in the Outer Space Domain.” *University of Pennsylvania Journal of International Law*, Vol. 39, no.1: 103-184. Penn Law Legal Scholarship Repository. https://www.congress.gov/bill/114th-congress/house-bill/2262/text

Scheingold, Stuart A. 1974. *The Politics of Rights*. Yale University Press.

Schelling, Thomas C. 1981. *The Strategy of Conflict: With a New Preface by the Author*. Harvard University Press. The University of Pennsylvania Law. https://www.law.upenn.edu/live/files/1313-schelling-the-strategy-conflict

Schlatter, Richard. 1951. *Private Property: The History of an Idea*. Rutgers University Press.

Schmidt, Brian C. 2004. “Realism as Tragedy.” *Review of International Studies – Cambridge Core*, Vol. 30, Iss.3: 427-441. Published Online by Cambridge University Press. https://doi.org/10.1017/S0260210504006151

Schmitt, Harrison H., Henley, Mark W., Kuhlman, Kim, Kulcinski, Gerald L., Santarius, John F., and Lawrence A. Taylor. 2006. “Decadal Helium-3: Lunar Helium-3 Fusion Resource Distribution.” https://www.lpi.usra.edu/decadal/leag/DecadalHelium3.pdf

Schoettle, E.C.B. 1963. *Making American Space Policy*. Massachusetts Institute of Technology (MIT). https://dspace.mit.edu/bitstream/handle/1721.1/48373/makingamericansp00scho.pdf?sequence=1

Schwarzenberger, Georg. 1957. "The Forms of Sovereignty: An Essay in Comparative Jurisprudence." *Current Legal Problems*, Vol. 10, Iss. 1: 264-295. Oxford Academic. https://doi.org/10.1093/clp/10.1.264

Scotti, Monique. 2017. "NASA Plans Mission to a Metal-Rich Asteroid Worth Quadrillions." Global News. Science. https://globalnews.ca/news/3175097/nasa-plans-mission-to-a-metal-rich-asteroid-worth-quadrillions/

Secretariat of the Antarctic Treaty. 1991/2023. "The Protocol on Environmental Protection to the Antarctic Treaty." Environmental Protection – Environment Protocol. Pp. 1-18. https://www.ats.aq/e/protocol.html#:~:text=The%20Protocol%20on%20Environmental%20Protection%20to%20the%20Antarctic%20Treaty%20was,2).

Secure World Foundation (SWF). 2017. "Letter for the Record for the Hearing on "Reopening the American Frontier: Exploring How the Outer Space Treaty Will Impact American Commerce and Settlement in Space." U.S. Senate Committee Hearing. https://www.govinfo.gov/content/pkg/CHRG-115shrg29998/html/CHRG-115shrg29998.htm

Selden, John Esq (1584-1654). 1652. *Mare Clausum or Of the Dominion or Ownership of the Sea – Two Books: In the First it is Shew'd that the Sea, by the Lavy of Nature or Nations, is not Common to all Men, but Capable of Private Dominion or Proprietie, as Well as the Land*. Translated into English by Marchamont Nedham. Printed by William Du-Gard. Published Online by the University of Michigan Library. http://name.umdl.umich.edu/A59088.0001.001

Shaw, Malcolm N., QC. 2008. *International Law*. Sixth Edition. Cambridge University Press. Space Law University. https://spacelaw.univie.ac.at/fileadmin/user_upload/p_spacelaw/shaw_International_Law_6th_ed_sources.pdf

Sherriff, Lucy. 2020. "Scientists in China Discover Rare Moon Crystal that Could Power Earth." Discovery.com Online. https://www.discovery.com/science/scientists-in-china-discover-rare-moon-crystal-that-could-power-

Shubik, Martin. 1983/1984. *Game Theory in the Social Sciences: A Game Theoretic Approach to Political Economy*. MIT Press.

Shutkin, William Andrew. 1993. "Pragmatism and the Promise of Adjudication." *Vermont Law Review*, Vol. 18, no.1: 57-66.

Sikolia, David, Biros, David, Mason, Marlys, and Mark Weiser. 2013. "Trustworthiness of Grounded Theory Methodology Research in Information Systems." In *Proceedings of the Eighth Midwest Association for Information Systems Conference*, Normal, Illinois, May 24-25, 2013. AIS Electronic Library (AISeL).

https://aisel.aisnet.org/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1006&context=mwais2013

Simmons, Beth A. 1998. “Compliance with International Agreements.” *Annual Reviews of Political Science*, Vol. 1: 75-93. https://projects.iq.harvard.edu/files/wcfia/files/991_complianceintlagreements.pdf

Simsarian, James. 1938. “The Acquisition of Legal Title to Terra Nullius.” *Political Science Quarterly*, Vol. 53, no. 1: 111-128. Published by the Academy of Political Sciences. JSTOR. https://doi.org/10.2307/2143606

Slaughter, Anne-Marie, Mahbubani, K., Walt, Stephen M., Nakayama, T., O’Neil, Shannon K., Mohan, C.R., Niblett, R., and Stefan Theil. 2022. “U.S. Grand Strategy After Ukraine: Seven Thinkers Weigh In on how the War will Shift U.S. Foreign Policy.” *Foreign Policy Analysis*. https://foreignpolicy.com/2022/03/21/us-geopolitics-security-strategy-war-russia-ukraine-china-indo-pacific-europe/

Slaughter, Anne-Marie, Tulumello, Andrew S., and Stepan Wood. 1998. “International Law and International Relations Theory: A New Generation of Interdisciplinary Scholarship.” *The American Journal of International Law*, Vol. 92, no. 3: 367-397. Cambridge University Press. JSTOR. https://www.jstor.org/stable/2997914

Slaughter, Anne-Marie. 1995. “Reviewed Work: Regime Theory and International Relations, by Volker Rittberger and Peter Mayer.” *The American Journal of International Law*, Vol. 89, no. 2: 454-456. Published by Cambridge University Press. JSTOR. https://www.jstor.org/stable/2204218

Smelser, Neil J., and Paul B. Baltes, eds. 2001. “Analytic Induction.” In *International Encyclopedia of the Social and Behavioral Sciences*, edited by Smelser, Neil J., and Paul B. Baltes. https://www.sscnet.ucla.edu/soc/faculty/katz/pubs/Analytic_Induction.pdf

Smirnoff, Michel. 1962. “The Legal Status of Celestial Bodies.” *Journal of Air Law and Commerce*, Vol. 28, Iss. 4, Art. 11: 385-404. https://scholar.smu.edu/jalc/vol28/iss4/11

Smith, B.L. 1997. “Matching Space-Related Intellectual Property Rights to Space Industry Needs.” In: Haskell, G., Rycroft, M., eds. *Space of Service to Humanity*. Space Studies, vol 1. Springer, Dordrecht. https://doi.org/10.1007/978-94-011-5692-9_29

Snidal, Duncan. 1985. “Coordination Versus Prisoners’ Dilemma: Implications for International Cooperation and Regimes.” *The American Political Science Review*, Vol. 79, no.4: 923-942. American Political Science Association. https://www.jstor.org/stable/1956241

Snyder, Glenn Herald, and Paul Diesing. 1978/2016. *Conflict Among Nations: Bargaining, Decision Making, and System Structure in International Crises*. Princeton University Press.

Soldatkin, Vladimir. 2019. “Russia Wants to Join Luxembourg in Space Mining.” Reuters, Technology News, March 6, 2019. https://www.reuters.com/article/us-luxembourg-russia-space/russia-wants-to-join-luxembourg-in-space-mining-idUSKCN1QN1OQ

Solomone, Stacey. 2013. *China's Strategy in Space. Springer Briefs in Space Development*: 1-117. International Space University. Springer. https://link.springer.com/content/pdf/10.1007%2F978-1-4614-6690-1.pdf

Space Foundation. 2021. The Space Report 2021, Quarter 3: Exploring Space Requires Reliable Technology Solutions. *The Space Report Online*. https://www.thespacereport.org/wp-content/uploads/2021/10/TSR21-Q3-DIGITAL.pdf

Space Mining Technologies. 2020/2023. "In-Situ Resource Utilization." https://space-mining.tech/in-situ-resources-utilization/

Space Policy Online. 2022. "About Dr Jill Stuart." Space Policy – Outer Space Policy, Politics, and Law. https://www.space-policy.com/about-dr-jill-stuart/

Space Policy Online. 2021. "Commercial Space Activities." Space Policy Online. https://spacepolicyonline.com/topics/commercial-space-activities/

Specht, Doug. 2019. *The Media and Communications Study Skills Student Guide*. University of Westminster Press. JSTOR. https://www.jstor.org/stable/j.ctv11cvxcf.13

Sreejith, S.G. 2008. "Whither International Law, Thither Space Law: A Discipline in Transition." Doctor of Laws, Dissertation. *California Western International Law Journal*, Vol. 38, No. 2, Art. 4: 331-417. https://scholarlycommons.law.cwsl.edu/cgi/viewcontent.cgi?article=1123&context=cwilj

St. Augustine. 426 A.D./1958. *The City of God*. Edited and abridged by Vernon J. Bourke. Doubleday / Crown Publishing Group.

Stake, Robert E. 2010. *Qualitative Research: Studying How Things Work*. Guilford Press.

Statista. 2021. "Global Gross Domestic Product (GDP) at Current Prices from 1985 to 2026." https://www.statista.com/statistics/268750/global-gross-domestic-product-gdp/

Steer, Cassandra. 2017. "Global Commons, Cosmic Commons: Implications of Military and Security Uses of Outer Space." *Georgetown Journal of International Affairs*, Vol. 18, no.1: 9-16. Project Muse. Published by Georgetown University Press. https://doi.org/10.1353/gia.2017.0003

Stein, Arthur A. 1983. "Coordination and Collaboration: Regimes in an Anarchic World." In, *International Regimes*, 1983, edited by Stephen D. Krasner. Cornell University Press. pp., 115-140. Cambridge University Press / Cambridge Core. https://doi.org/10.1017/S0020818300018968

Stein, Arthur A. 1982. "Coordination and Collaboration: Regimes in an Anarchic World." *International Organization*, Vol. 36, no. 2: 299-324. Published by The MIT Press. JSTOR. https://www.jstor.org/stable/2706524

Stein, Arthur A. 1985. "Coordination: Duncan Snidal, 'Coordination Versus Prisoner's Dilemma: Implications for International Cooperation and Regimes." *American Political Science Review*, Vol. 79: 923-942.

Stevenson, D. 2018. “Canons of Construction: Adapted from Scalia & Garner.” University of Houston School of Law, Faculty, Spring 2018, 1-5. https://www.law.uh.edu/faculty/adjunct/dstevenson/2018Spring/CANONS%20OF%20CONSTRUCTION.pdf

Stine, Deborah D. 2009. “U.S. Civilian Space Policy Priorities: Reflections 50 Years after Sputnik.” *CRS Report for Congress 2008*, 7-5700: 1-21. https://digital.library.unt.edu/ark:/67531/metadc462908/m1/1/high_res_d/RL34263_2008Jun20.pdf

Stone, Christopher D. 2004. “Common but Differentiated Responsibilities in International Law.” *The American Journal of International Law*, Vol. 98, no.2: 276-301. Cambridge University Press. JSTOR. https://www.jstor.org/stable/3176729

Strange, Susan. 1982. “Cave! Hic Dragones: A Critique of Regime Analysis.” *International Organization*, Vol. 36, no. 2: 479-496. Published by The MIT Press. JSTOR. https://www.jstor.org/stable/2706530

Straub, Detmar, Boudreau, Marie-Claude, and David Gefen. 2004. “Validation Guidelines for IS Positivist Research.” *Communications of the Association for Information Systems*, Vol. 13, Article 24: 380-427. https://aisel.aisnet.org/cgi/viewcontent.cgi?article=3243&context=cais

Strauss, A. L., and A. M. Corbin. 1998. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. Second Edition. SAGE.

Strauss, A. L., and A. M. Corbin. 1990. *The Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. SAGE.

Strauss, A. L. 1987. *Qualitative Analysis for Social Scientists*. SAGE.

Strunk, William Jr., and E. B. White. 2000. *The Elements of Style*. Fourth Edition. Longman.

Stuart, Jill. 2013. “Regime Theory and the Study of Outer Space Politics.” *E-International Relations – Articles*, 1-4. https://www.e-ir.info/2013/09/10/regime-theory-and-the-study-of-outer-space-politics/

Stutt, Amanda. 2020. “The Global Race to Mine Outer Space.” Mining Dot Com. https://www.mining.com/the-global-race-to-mine-outer-space/#:~:text=Both%20interest%20in%20and%20financial,have%20surged%20in%20recent%20years.

Sundahl, Mark J., and V. Gopalakrishnan, eds. 2011. “New Perspectives on Space Law: Proceedings of the 53rd IISL Colloquium on the Law of Outer Space.” Young Scholars Session. Indian Space Research Organization / International Institute of Space Law (IISL). http://iislwebo.wwwnlss1.a2hosted.com/wp-content/uploads/2015/03/NewPerspectivesonSpaceLaw.pdf

Swaminathan, Sriram. 2005. "The Applicability of Space Law Principles to Basic Space Science: An Update." *Seminars of the United Nations Programme on Space Applications – Selected Researches from Activities Held in 2004*. United Nations 2005 / NASA Astrophysics Data System, 117 – 141. http://articles.adsabs.harvard.edu/cgi-bin/nph-iarticle_query?2005UNPSA..16..117S&defaultprint=YES&filetype=.pdf

SWIFT. 2022. *The Global Provider of Secure Financial Messaging Service*. https://www.swift.com/

Task Force on International Relations in Space / National Aeronautics and Space Administration. 1987. *International Space Policy for the 1990's and Beyond*. NASA.

Taylor, Kurt. 2019. "Fictions of the Final Frontier: Why the United States SPACE Act of 2015 is Illegal." *Emory International Law Review*, Vol. 33, Iss.4:653-678. https://law.emory.edu/eilr/_documents/volumes/33/4/taylor.pdf

Ter Meulen, Jacob, and P. J. J. Diermanse. 1950. *Bibliographie des ecrits imprimes de Hugo Grotius*. La Haye.

Thakur, Ramesh, and Luk Van Langenhove. 2006. "Global Insights: Enhancing Global Governance Through Regional Integration." *Global Governance*, Vol. 12, no. 3: 233-240. Published by Brill. JSTOR. https://www.jstor.org/stable/27800615

The Hague International Space Resources Governance Working Group. 2022. *Building Blocks for the Development of an International Framework for the Governance of Space Resource Activities: A Commentary.* 2002. Edited by Olavo de O. Bittencourt Neto, Mahulena Hofmann, Tanja Masson-Zwaan, and Dimitra Stefoudi. Boomportaal / Digitale Boeken. Eleven International Publishers. https://boeken.rechtsgebieden.boomportaal.nl/publicaties/9789462361218#152

The History of Economic Thought (HET). 2021. "William Forster Lloyd, 1795-1852: Major Works." *Institute of New Economic Thinking*. http://www.hetwebsite.net/het/profiles/lloyd.htm

The Law Dictionary. 2020. Black's Law Dictionary, 2nd Edition, Online. https://thelawdictionary.org/

The State Council Information Office of the People's Republic of China. 2016. "White Research on China's Space Activities in 2016." 1-18. *Space Policy Archive*. https://aerospace.org/sites/default/files/policy_archives/China%20Space%20Activities%20Dec16.pdf

The United Nations. 1945. "Charter of the United Nations and Statute of the International Court of Justice." Certified True Copy. San Francisco, 26 June 1945, in Force 24 October 1945. https://treaties.un.org/doc/Publication/CTC/uncharter-all-lang.pdf

The United Nations General Assembly. 1947. "Measures to be Taken against Propaganda and the Inciters of a New War." *Hundred and Eighth Plenary Meeting, 2nd Session*. United Nations Digital Library. https://digitallibrary.un.org/record/209883?ln=en

The United Nations. 2005. "Convention on the High Seas: Done at Geneva on 29 April 1958." NOAA. https://www.gc.noaa.gov/documents/8_1_1958_high_seas.pdf

The United Nations General Assembly. 1959. “Resolution 1472 (XIV) A. International Co-operation in the Peaceful Uses of Outer Space.” 856th Plenary Meeting, 12 December 1959. UNOOSA. https://www.unoosa.org/pdf/gares/ARES_14_1472E.pdf

The United Nations General Assembly. 1961. “Resolution 1721 (XVI). International Co-operation in the Peaceful Uses of Outer Space.” 1085th Plenary Meeting. UNOOSA. https://www.unoosa.org/pdf/gares/ARES_16_1721E.pdf

The United Nations General Assembly. 1962. “Resolution Adopted by the General Assembly: 1962 (XVIII). Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space.” 1280th Plenary Meeting 1963. *UNOOSA* – Principles and Treaties. https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/legal-principles.html

The United Nations. 1967. “Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Opened for Signature Jan. 27, 1967.” UNOOSA. https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html

The UN General Assembly. 1970. Resolution 2625 (XXV). UNGA Official Records, Twenty-Fifth Session, Supplement no. 28/A/8028. https://unispal.un.org/DPA/DPR/unispal.nsf/0/25A1C8E35B23161C852570C4006E50AB

The United Nations. 2017. *International Law Handbook: Collection of Instruments*. United Nations Headquarters Publications, pp 1-660. https://legal.un.org/avl/studymaterials/handbook/english/book_1.pdf

The United Nations. 1982. *United Nations Convention on the Law of the Sea (UNCLOS)*. Division for Ocean Affairs and the Law of the Sea. https://www.un.org/Depts/los/convention_agreements/texts/unclos/UNCLOS-TOC.htm

The United Nations. 1979. “Agreement Governing the Activities of States on the Moon and Outer Space.” UN Doc. A/34/664, Opened for Signature, Nov. 1979, UN Doc. A/34/20, Annex 2; UN Doc. A/RES/34/68; 1363 UNTS (1979) ILM 1434 [Moon Agreement].

The United Nations. 1968. “Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, Opened for Signature Apr. 22, 1968.” 19 U.S.T. 7570, 672 U.N.T.S. 119 [Rescue and Return Agreement or ARRA].

The United Nations. 1972. “Convention on International Liability for Damage Caused by Space Objects, Opened for Signature Mar. 29, 1972.” 24 U.S.T. 2389, 961 U.N.T.S. 187 [Liability Convention].

The United Nations. 1975. “Convention on the Registration of Objects Launched into Outer Space, Opened for Signature Jan. 14, 1975.” 28 U.S.T. 695, 1023 U.N.T.S. 15 [Registration Convention).

The United Nations. 1970. *United Nations Convention on the Law of the Sea. UNCLOS*. https://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf

The United Nations. 1967. “Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Opened for Signature Jan. 27, 1967.” 18 U.S.T. 2410, 610 U.N.T.S. 205 [Outer Space Treaty or OST].

The United Nations. 2002. *United Nations Treaties and Principles on Outer Space*. UNOOSA Publications. https://www.unoosa.org/pdf/publications/STSPACE11E.pdf

The White House. 2017. “National Security Strategy of the United States.” https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf

Theys, Sarina. 2018. “Introducing Constructivism in International Relations Theory.” E-International Relations. https://www.e-ir.info/2018/02/23/introducing-constructivism-in-international-relations-theory/

Thomas, David R. 2006. “A General Inductive Approach for Analyzing Qualitative Evaluation Data.” *American Journal of Evaluation*, Vol. 27, no. 2: 237-246. American Evaluation Association. DOI: 10.1177/1098214005283748

Thomas, George M., Meyer, John W., Ramirez, Francisco O., and John Boli. 1987. *Institutional Structure: Constituting State, Society, and the Individual*. Sage.

Thomas J. Meskill Law Library. 2020. “Outer Space Law: General Space Law Resources.” *University of Connecticut School of Law*. https://libguides.law.uconn.edu/c.php?g=1047257

Thorne, Sally. 2000. “Data Analysis in Qualitative Research.” *BMJ Journals / Evidenced-Based Nursing*, Vol. 3, Iss. 3: 68-70. http://dx.doi.org/10.1136/ebn.3.3.68

Tie, Yiona Chun, Birks, Melanie, and Karen Francis. 2019. “Grounded Theory Research: A Design Framework for Novice Researchers.” *SAGE Open Medicine Journal*, Vol. 7: 2050312118822927. Doi: 10.1177/2050312118822927

Tilly, Charles, ed. 1975. *The Formation of National States in Western Europe*. Princeton University Press.

Tolley, Elizabeth E., Ulin, Priscilla R., Mack, Natasha, Robinson, Elizabeth T., and Stacey M. Succop. 2016. *Qualitative Methods in Public Health: A Field Guide for Applied Research*. 2nd ed. Wiley.

Toma, Peter A. 1956. “Soviet Attitude Towards the Acquisition of Territorial Sovereignty in the Antarctic.” *The American Journal of International Law*, Vol. 50, no.3: 611-626. Published by Cambridge University Press. JSTOR. https://doi.org/10.2307/2195509

Tronchetti, Fabio. 2007. “The Non-Appropriation Principle Under Attack: Using Article II of the Outer Space Treaty in its Defence.” International Institute of Air and Space Law, IAC-07-E6.5.13 https://iislweb.org/docs/Diederiks2007.pdf

Tronchetti, Fabio. 2009. *The Exploitation of Natural Resources of the Moon and Other Celestial Bodies: A Proposal for a Legal Regime*. Martinus Nijhoff Publishers. https://brill.com/view/title/16685

Tronchetti, Fabio. 2013. *Fundamentals of Space Law and Policy*. Springer Briefs in Space Development: 1-107. International Space University / Springer. https://link.springer.com/content/pdf/10.1007%2F978-1-4614-7870-6.pdf

Troy, Jodok. 2012. *Christian Approaches to International Affairs*. Palgrave Macmillan.

Truman, President Harry. 1945. "Charter of the United Nations." *Space Policy Archive*. https://aerospace.org/sites/default/files/policy_archives/UN%20Charter.pdf

Trump, President Donald J. 2021. Renewing America's Proud Legacy of Leadership in Space: Activities of the National Space Council and the United States Space Enterprise." *Final Report. The White House / National Space Council*. 1-31. https://aerospace.org/sites/default/files/2021-01/NSpC%20Final%20Report%2015Jan21.pdf

Trump, President Donald J. 2020. "Executive Order on Encouraging the International Support for the Recovery and Use of Space Resources." *The White House – Executive Orders. Infrastructure & Technology*. https://www.whitehouse.gov/presidential-actions/executive-order-encouraging-international-support-recovery-use-space-resources/

Trump, President Donald J. 2020. "The National Space Policy: Memorandum of December 9, 2020." Presidential Documents, Federal Register, Vol. 85, no 242: 81755-81733. https://www.govinfo.gov/content/pkg/FR-2020-12-16/pdf/2020-27892.pdf

Trump, President Donald J. 2020. "A New Era for Deep Space Exploration and Development." *The White House / National Space Council*, 1-17. Space Policy Archive. https://aerospace.org/sites/default/files/2020-07/NSpC%20New%20Era%20for%20Space%2023Jul20.pdf

Trump, President Donald J. and Robert M. Lightfoot, Jr. 2017. "National Aeronautics and Space Administration: Charter of the National Space Council Users' Advisory Group." 1-3. *Space Policy Archive*. https://aerospace.org/sites/default/files/policy_archives/NSpC%20Users%20Advisory%20Group%20Charter%206Dec17.pdf

Tuck, Richard. 1979. *Natural Rights Theories*. Cambridge University Press.

Tucker, Jonice Gray, Stipano, Daniel, Hall, Kari, Clegg, Brendan, and Anthony Carral. 2020. "Square Peg Meets Round Hole: Regulatory Responses to Challenges Created by Innovation in Banking." *The Business Lawyer*, Vol. 75: 2491-2517. Buckley Firm. American Bar Association – Articles. https://buckleyfirm.com/sites/default/files/Buckley-Article-Square-Peg-Meets-Round-Hole-Regulatory-Responses-to-Challenges-Created-by-Innovation-in-Banking-ABA-The-Business-Lawyer.pdf

Turabian, Kate L. 2008. *A Manual for Writers of Research, Theses, and Dissertations: Chicago Style for Students & Researchers*. Eight Edition. The University of Chicago Press.

United Arab Emirates (UAE) Government. 2022. “Space Science and Technology – The Official Portal of the UAE Government.” https://u.ae/en/about-the-uae/science-and-technology/key-sectors-in-science-and-technology/space-science-and-technology#:~:text=The

United Arab Emirates (UAE). 2019. “Federal Law No. (12) of 2019 On the Regulation of the Space Sector.” Official Gazette, Issue No. 669, p. 111. https://www.moj.gov.ae/assets/2020/Federal%20Law%20No%2012%20of%202019%20on%20THE%20REGULATION%20OF%20THE%20SPACE%20SECTOR.pdf.aspx

United Arab Emirates (UAE) Government. 2016. “National Space Policy – English.” UAE Government Publication, 2016, 1-55. UAE National Space Policy in English

United Nations. 1959. “Report of the Ad Hoc Committee on the Peaceful Uses of Outer Space.” United Nations Digital Library. https://digitallibrary.un.org/record/840867?ln=en

United Nations Committee on the Peaceful Uses of Outer Space. 1966. “Report of the Legal Sub-Committee on the Work of its 5th Session (12 July-4 August and 12-16 September 1966) to the Committee on the Peaceful Uses of Outer Space.” United Nations Digital Library. https://digitallibrary.un.org/record/822453?ln=en

United Nations General Assembly. 1968. Report of the Committee on the Peaceful Uses of Outer Space. Official Records, Twenty-Third Session, Agenda Item 24. https://www.unoosa.org/pdf/gadocs/A_7285E.pdf

United Nations. 2020. “Decisions and Actions by the Committee on the Peaceful Uses of Outer Space and its Legal Subcommittee Taken by Written Procedure.” *General Assembly Official Records, Seventy-Fifth Session Supplement No. 20*. https://www.unoosa.org/res/oosadoc/data/documents/2020/a/a7520_0_html/A_75_20E.pdf

United Nations Institute for Disarmament Research. 2015. “Regional Perspectives on Norms of Behavior for Outer Space Activities.” *United Nations Publications* - UNIDIR/2015/1, 1-42. United Nations Digital Library. https://unidir.org/files/publications/pdfs/regional-perspectives-on-norms-of-behaviour-for-outer-space-activities-en-622.pdf

United Nations Office for Outer Space Affairs (UNOOSA). 1967. “Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies.” *UN General Assembly – Twenty-First Session*. Resolutions. https://www.unoosa.org/pdf/gares/ARES_21_2222E.pdf

United Nations Office for Outer Space Affairs / Committee on the Peaceful Uses of Outer Space / Legal Subcommittee. 2021. “Status of International Agreements Relating to Activities in Outer Space as of 1 January 2021.” *COPUOS Legal Subcommittee, Sixtieth Session*, Vienna, 31 May – 11 June 2021. AC105_C2_2021_CRP10E. UNOOSA. https://www.unoosa.org/res/oosadoc/data/documents/2021/aac_105c_22021crp/aac_105c_22021crp_10_0_html/AC105_C2_2021_CRP10E.pdf

United Nations Office for Outer Space Affairs. 2021. “United States of America, ST/SG/SER.E/945: Information Furnished in Conformity with the Convention on Registration of Objects Launched

into Outer Space." *UNOOSA*. https://www.unoosa.org/oosa/en/osoindex/data/documents/us/st/stsgser.e945.html

United Nations Office for Outer Space Affairs (UNOOSA). 2020. "Building Blocks for the Development of an International Framework on Space: Working Research Submitted by Luxembourg and the Netherlands." *OOSADOC* A/AC.105/C.2/L.315 LSC 59th Session. https://www.unoosa.org/oosa/oosadoc/data/documents/2020/aac.105c.2l/aac.105c.2l.315_0.html

United Nations Office for Outer Space Affairs. 2022. "Status of International Agreements Relating to Activities in Outer Space." United Nations Office for Outer Space Affairs. https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/status/index.html

United Nations / Dag Hammarskjold Library Online. 2023. "What are Travaux Preparatoires and How can I find them?" FAQ. What are travaux préparatoires and how can I find them? - Ask DAG! (un.org)

United Nations Office for Outer Space Affairs. 2021. "Space Law: Resolutions." *UNOOSA*. https://www.unoosa.org/oosa/en/ourwork/spacelaw/resolutions.html

United Nations Office for Outer Space Affairs. 2021. "National Space Law Database." UNOOSA. https://www.unoosa.org/oosa/en/ourwork/spacelaw/nationalspacelaw.html

United Nations Office for Outer Space Affairs (UNOOSA). 2003. "Capacity Building in Space Law." Proceedings, United Nations/International Institute of Air and Space Law. Workshop. ST/SPACE/14. UNOOSA. United Nations. https://www.unoosa.org/pdf/publications/st_space_14E.pdf

United Nations Office for Outer Space Affairs. 1974. "Convention on Registration of Objects Launched into Outer Space." *UNOOSA.* https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/registration-convention.html

United Nations Office for Outer Space Affairs. 2020. "Committee on the Peaceful Uses of Outer Space." *COPUOS 2020*. https://www.unoosa.org/oosa/en/ourwork/copuos/index.html

United Nations. 2019. "Report of the Committee on the Peaceful Uses of Outer Space: Sixty-Second Session (12-21 June 2019)." *General Assembly Official Records*, Seventy-Fourth Session, Supplement No. 20: 1-75. https://www.unoosa.org/res/oosadoc/data/documents/2019/a/a7420_0_html/V1906077.pdf

United Nations / Office of Legal Affairs. 2013/2018. *Treaty Handbook*. Prepared by the Treaty Section of the Office of Legal Affairs. https://treaties.un.org/doc/source/publications/thb/english.pdf

United Nations / Office of Legal Affairs. 2017. *International Law Handbook: Collection of Instruments*. Book One. Pp. 1-681. https://legal.un.org/avl/studymaterials/handbook/english/book_1.pdf

United Nations Office at Geneva. 1919/1920. *The Covenant of the League of Nations*. UN Library Archives. https://www.ungeneva.org/en/library-archives/league-of-

nations/covenant#:~:text=The%20Treaty%20of%20Versailles%20was,a%20preamble%20and%2026%20articles.

United Nations Office for Outer Space Affairs (UNOOSA). 2017. “International Space Law: United Nations Instruments.” *Publishing and Library Section*, 1-94. United Nations Office in Vienna. https://www.unoosa.org/res/oosadoc/data/documents/2017/stspace/stspace61rev_2_0_html/V1605998-ENGLISH.pdf

United Nations Treaty Collection. 2021. “Depository of Treaties.” UNTC. https://treaties.un.org/Pages/Home.aspx?clang=_en

United Nations Audio Visual Library of International Law. 2023. Historic Archives. https://legal.un.org/avl/historicarchives.html

United Nations International Law Commission. 2023. “Analytical Guide to the Work of the International Law Commission: Sources of International Law.” https://legal.un.org/ilc/guide/gfra.shtml

United Nations Codification Division Publications – Office of Legal Affairs. 2023. Diplomatic Conferences. https://legal.un.org/diplomaticconferences/

United Nations. 2023. The Yearbook of the United Nations, Online. https://www.un.org/yearbook

United Nations Legal. 2001. “Responsibility of States for Internationally Wrongful Acts.” https://legal.un.org/ilc/texts/instruments/english/draft_articles/9_6_2001.pdf

United Nations / Division for Ocean Affairs and the Law of the Sea. 2023. “Oceans & Law of the Sea – UN.” https://www.un.org/Depts/los/index.htm

United States Department of State. 2023. “The Artemis Accords.” https://www.state.gov/artemis-accords/

UNOOSA. 1975/76. “Registration Convention.” https://www.unoosa.org/pdf/gares/ARES_29_3235E.pdf

UNOOSA. 1972. “Liability Convention.” https://www.unoosa.org/pdf/gares/ARES_26_2777E.pdf

UNOOSA. 1968. “Agreement on the Rescue of Astronauts, Return of Astronauts, and the Return of Objects Launched into Outer Space: 2345 (XXII).” Adopted by the General Assembly. https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/rescueagreement.html

Universite Du Luxembourg. 2018. “Asteroid Science Intersections with In-Space Mine Engineering – ASIME 2018: Abstracts.” *Global Geophysical Fluid Center*. https://geophy.uni.lu/users/tonie.vandam/asime-2018/Abstract_book.pdf

Uri, John. 2019. “50 Years Ago: After Apollo, What? Space Task Group Report to President Nixon.” *NASA History*. https://www.nasa.gov/feature/50-years-ago-after-apollo-what-space-task-group-report-to-president-nixon

Urquhart, Cathy. 2013. *Grounded Theory for Qualitative Research: A Practical Guide*. SAGE Research Methods. https://dx.doi.org/10.4135/9781526402196

Urquhart, Cathy, Lehmann, Hans, and Michael D. Myers. 2010. “Putting the 'Theory' Back into Grounded Theory: Guidelines for Grounded Theory Studies in Information Systems." *Information Systems Journal*, Vol. 20, Iss. 4: 357 – 381. https://doi.org/10.1111/j.1365-2575.2009.00328.x

U.S.-China Economic and Security Review Commission. 2019. “Hearing on China in Space: A Strategic Competition?” *One Hundred Sixteenth Congress – First Session*, 1-254. https://www.uscc.gov/sites/default/files/2019-10/April%2025%202019%20Hearing%20Transcript.pdf

U.S. Congress. 1991-1992. “H.R. 6133 – Land Remote Sensing Policy Act of 1992.” Public Law No. 102-555. 102nd Congress (1991-1992). https://www.congress.gov/bill/102nd-congress/house-bill/6133#:~:text=Provides%20for%20licensing%20private%20entities,satellites%20or%20vehicles%20as%20platforms.

U.S. Congress. 2015. “U.S. Space Launch Commercial Competitiveness Act.” Public Law 114-90, Section 51302, 129 Stat. 704 (2015). https://www.congress.govlbill/114th-congress/house-bil/2262

U.S. Congress. 2004. “Commercial Space Launch Amendments Act of 2004.” Public Law No. 108-492. 108th Congress (2003-2004). https://www.congress.gov/bill/108th-congress/house-bill/5382/text

U.S. Congress. 2000. “Commercial Space Transportation Competitiveness Act of 2000.” Public Law No. 106-405. 106th Congress (1999-2000). https://www.congress.gov/bill/106th-congress/house-bill/2607/text

U.S. Congress. 1998. “Commercial Space Act of 1998.” Public Law No. 105-303. 105th Congress (1997-1998). https://www.congress.gov/bill/105th-congress/house-bill/1702

U.S. Congress. 1988. “H.R.4399: Commercial Space Launch Act Amendments of 1988.” Public Law 100-639. 100th Congress (1987-1988). https://www.congress.gov/bill/100th-congress/house-bill/4399/text

U.S. Congress. 1984. “Commercial Space Launch Act.” Public Law 98-575. 98th Congress (1983-1984). https://www.congress.gov/bill/98th-congress/house-bill/3942/text

U.S. Congress, Office of Technology Assessment. 1988. “Reducing Launch Operations Costs: New Technologies and Practices.” OTA-TM-ISC-28. U.S. Government Printing Office. https://ota.fas.org/reports/8833.pdf

U.S. Department of State. 2021. “Independent States in the World.” Dependencies and Areas of Special Sovereignty. https://www.state.gov/independent-states-in-the-world/

U.S. Department of Energy / Office of Energy Efficiency & Renewable Energy. 2022. “Hydrogen Production: Electrolysis.” Hydrogen and Fuel Cell Technologies Office. https://www.energy.gov/eere/fuelcells/hydrogen-production-

electrolysis#:~:text=Electrolysis%20is%20the%20process%20of,a%20unit%20called%20an%20electrolyzer.

U.S. Department of Transportation, Federal Aviation Administration. 2002. “Liability Risk-Sharing Regime for U.S. Commercial Space Transportation: Study and Analysis.” 1-289. https://www.faa.gov/about/office_org/headquarters_offices/ast/media/faaliabilityrisksharing4-02.pdf

U.S. Geological Services. 2022. “Mapping, Remote Sensing, and Geospatial Data: What is Remote Sensing and What is it Used For?” USGS FAQs. https://www.usgs.gov/faqs/what-remote-sensing-and-what-it-used#:~:text=Remote%20sensing%20is%20the%20process,sense%22%20things%20about%20the%20Earth.

U.S. Government Printing Office. 1967. Treaty on Outer Space: Hearings before the Committee on Foreign Relations, U.S. Senate, 90th Cong., 1st Sess., Executive D, March 7, 13, and April 12, 1967. *HeinOnline*. https://heinonline.org/HOL/Page?handle=hein.cbhear/treoutspc0001&div=1&id=&page=&collection=ustreaties

U.S. House of Representatives. 2015. House Report 114-119. 114th Congress, First Session. https://www.congress.gov/114/crpt/hrpt119/CRPT-114hrpt119.pdf

U.S. Senate. 2023. The Homestead Act of 1862. https://www.senate.gov/artandhistory/history/common/image/Homestead_Act.htm

U.S. Senate Committee on Commerce, Science and Transportation / Subcommittee on Space, Science, and Competitiveness. 2017. “Reopening the American Frontier: Exploring How the Outer Space Treaty will Impact American Commerce and Settlement in Space.” Committee Hearing. 115th Congress, 1st Session, May 23, 2017. https://www.govinfo.gov/content/pkg/CHRG-115shrg29998/html/CHRG-115shrg29998.htm

U.S. Senate Committee on Foreign Relations. 1967. “Hearings on Executive D, Before the Senate Committee On Foreign Relations: Treaty on Outer Space.” 90th Congress, 1st Session, 31-37. March 7 & 13 and April 12, 1967.

U.S. Senate Committee on Foreign Relations. 1967. “Hearings on Executive D, Before the Senate Comm. On Foreign Relations: Treaty on Outer Space.” 90th Congress, 1st Session, 4. S. Exec. Doc. No. 8.

Valentine, Lee. 2002. “A Space Roadmap: Mine the Sky, Defend the Earth, Settle the Universe.” *Space Studies Institute*. http://ssi.org/reading/researchs/space-studies-institute-roadmap/

Van Dyke, Vernon. 1964. *Pride and Power: The Rationale of the Space Program*. Pall Mall Publishing.

Vattel, Emer de. 1758. *Le Droit Des Gens, Ou Principles De La Loi Naturelle, Appliques a La Conduite et Aux Affaires des Nations et des Souverains*. 2 Volumes. A Londres. Liberty Fund Network OLL. https://oll.libertyfund.org/title/vattel-le-droit-des-gens-ou-principes-de-la-loi-naturelle-2-vols

Vattel, Emer de. 1834. *The Law of Nations*. Natural Law and Enlightenment Classics. Edited by Knud Haakonssen. Liberty Fund Network OLL. http://files.libertyfund.org/files/2246/Vattel_1519_LFeBk.pdf

Virgin Galactic. 2021. "Virgin Galactic Unity 22 Space Flight." https://www.virgingalactic.com/

Vlasic, Ivan A. 1967. "The Space Treaty: A Preliminary Evaluation." *California Law Review*, Vol. 55, no. 2: 507-520. https://lawcat.berkeley.edu/record/1110084/files/fulltext.pdf

Vogler, John. 2012. "Global Commons Revisited." *Global Policy*, Vol. 3, Iss. 1: 61-70. London School of Economics and Political Science and John Wiley & Sons Ltd. https://doi.org/10.1111/j.1758-5899.2011.00156.x

Vogler, John. 1995. *The Global Commons: A Regime Analysis*. John Wiley and Sons.

Von der Dunk, Frans G. 2020. *Advanced Introduction to Space Law*. Elgar Advanced Introductions. Edward Elgar Publishing. Pp. 1-137.

Von der Dunk, Frans G., and Fabio Tronchetti, eds. 2019. *Handbook of Space Law*. Research Handbooks in International Law. Pp. 1-1047. Edward Elgar Publishing.

Von der Dunk, Frans G. 2017. "Asteroid Mining: International and National Legal Aspects." *Michigan State International Law Review*, Vol. 26, no. 1: 83-102. HeinOnline. https://heinonline.org/HOL/Page?handle=hein.journals/mistjintl26&collection=journals&id=93&startid=93&endid=112

Von der Dunk, Frans G. 2015. "The US Space Launch Competitiveness Act of 2015." *JURIST – Academic Commentary*, 1-4. https://www.jurist.org/commentary/2015/11/frans-vonderdunk-space-launch/

Von der Dunk, Frans G. 2012. "A Tale of Two Oceans: Governance of Terrestrial and Outer Space "Global Commons."" *Asian Journal of Air and Space Law*, Vol. 2, no.1: 31-60. Digital Commons at University of Nebraska – Lincoln. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1085&context=spacelaw

Von der Dunk, Frans G. 2011. "The Origins of Authorization: Article VI of the Outer Space Treaty and International Space Law." *Space, Cyber and Telecommunications Law Program Faculty Publications, College of Law, University of Nebraska* – Lincoln. 1-20. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1068&context=spacelaw

Von der Dunk, Frans G. 2002. "Sovereignty and Space: When and Where Shall the Twain Meet?" In, *State, Sovereignty, and International Governance*, 2012. Edited by Gerard Twain et al. Oxford Academic Online. Pp. 462-481. https://doi.org/10.1093/acprof:oso/9780199245383.003.0020

Von Karman, Theodore, with Lee Edson. 1965. *The Wind and Beyond: Theodore Von Karman – Pioneer in Aviation and Pathfinder in Space*. Little, Brown, and Company. https://archive.org/details/windbeyondtheo00vonk/page/n5/mode/2up?view=theater

Voronina, Anastasia. 2016. “The Hows and Whys of International Cooperation in Outer Space: International Legal Forms of Cooperation of States in Exploration and Use of Outer Space.” Theses, Dissertations, and Student Research in Space, Cyber, and Telecommunications Law. College of Law, University of Nebraska. Digital Commons. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1000&context=spacelawthesis

Wadegaonkar, Damodar. 1969. “Legal Problems of Outer Space.” *Indian Journal of International Law*, Vol. 9, no. 1: 47-142. http://www.isil-aca.org/download/contents/1969.pdf

Waibel, Michael. 2015. “Principles of Treaty Interpretation: Developed for and Applied by National Courts?” University of Cambridge, Faculty of Law. *Legal Studies Research Series*, Research No. 16/2015: 1-28. https://researchs.ssrn.com/sol3/researchs.cfm?abstract_id=2595681

Waldheim, Kurt. 1967. “International Cooperation from the U.N. Viewpoint.” Speech by Dr. Kurt Waldheim before the 13th Annual Meeting of the American Astronautical Society, Dallas, Texas. In, “The Evolution of the Outer Space Treaty.” 1967, by Dembling and Arons. *Documents of Outer Space Law*, Vol. 33, 440. https://digitalcommons.unl.edu/spacelawdocs/3

Wall, Mike. 2017. “President Obama’s Space Legacy: Mars, Private Spaceflight, and More.” Space News / Spaceflight, January 20, 2017. https://www.space.com/35394-president-obama-spaceflight-exploration-legacy.html

Wall, Mike. 2013. “Asteroid-Mining Project Aims for Deep-Space Colonies.” Space, January 22, 2013, Online. https://www.space.com/19368-asteroid-mining-deep-space-industries.html

Walt, Stephen M. 2019. *The Hell of Good Intentions: America’s Foreign Policy Elite and the Decline of U.S. Primacy*. FSG.

Waltz, Kenneth. 1979. *Theory of International Politics*. Addison-Wesley. https://www.press.umich.edu/pdf/9780472099818-ch1.pdf

Waltz, K. N. 1986. “Reflections on Theory of International Politics: A Response to My Critics.” In, *Neorealism and Its Critics*, edited by Keohane R., pp. 322–346. Columbia University Press.

Waltz, Kenneth. 1959. *Man, the State, and War*. Cambridge University Press.

Warrender, Howard. 1966. *The Political Philosophy of Hobbes*. Clarendon Press.

Washington, President George. 1796. “Transcript of President George Washington’s Farewell Address (1796).” U.S. Government Archive. https://www.ourdocuments.gov/doc.php?flash=false&doc=15&page=transcript

Webb, James E., and Robert McNamara. 1961. “Recommendations for Our National Space Program: Changes, Policies, Goals.” NASA Memo Exploring the Moon, from James E . Webb and Robert McNamara to Vice President Lyndon B. Johnson, May 8, 1961. Excerpt. *Smithsonian National Air and Space Museum*. https://airandspace.si.edu/multimedia-gallery/5086hjpg?id=5086

Weber, Ron. 2004. “The Rhetoric of Positivism Versus Interpretivism: A personal View.” *MIS Quarterly*, Vol. 28, no. 1: iii-xii. https://misq.org/misq/downloads/download/editorial/25/

Weber, Cynthia. 2009. *International Relations Theory: A Critical Introduction*. Third Edition. Routledge.

Weber, Max. 1918. “Science as a Vocation” (‘*Wissenschaft als Beruf’*). http://www.wisdom.weizmann.ac.il/~oded/X/WeberScienceVocation.pdf

Weber, Max, Parsons, Talcott, and A. M. Henderson. 1964. *The Theory of Social and Economic Organization*. The Free Press / Macmillan Publishing Co., Inc.

Wei, Lingling. 2022. “China Declared Its Russia Friendship had ‘No Limits.’ It’s Having Second Thoughts.” *The Wall Street Journal*, March 3, 2022. https://www.wsj.com/articles/china-russia-xi-putin-ukraine-war-11646279098

Weichert, Brandon J. 2020. *Winning Space: How America Remains a Superpower*. Republic Book Publishers. ProQuest Ebook Central. https://ebookcentral-proquest-com.ezproxy.liberty.edu/lib/liberty/reader.action?docID=6235805

Weitzman, E. A. 2000. “Software and Qualitative Research.” In N.K. Denzin and Y.S. Lincoln, eds. 2000. *Handbook of Qualitative Research*. pp. 803-820. SAGE.

Welwood, William. 1636. “An Abridgement of all Sea Laws Gathered Forth of all Writings and Monuments…” Printed by Thomas Harper. Early English Books Online. https://quod.lib.umich.edu/e/eebo/A14929.0001.001?view=toc

Wendt, Alexander. 1992. “Anarchy is What States Make of It: The Social Construction of Power Politics.” *International Organization*, Vol. 46, no. 2: 391-425. The MIT Press. JSTOR. https://www.jstor.org/stable/2706858

Wendt, Alexander. 1995. “Constructing International Politics.” *International Security*, Vol. 20, no. 1: 71-81. The MIT Press. JSTOR. https://www.jstor.org/stable/2539217

Whewell, William. 1853. *Grotius: On the Rights of War and Peace*. An Abridged Translation. Cambridge University Press.

White, Gillian. 1984. “Book Review: International Regimes. Edited by Stephen D. Krasner. [Ithaca and London: Cornell University Press. 1983. 368 pp. $29.95.” *International and Comparative Law Quarterly*, Vol. 33, no. 3: 746-748. HeinOnline. https://heinonline.org/HOL/P?h=hein.journals/incolq33&i=754

Whiteway, J. A., et al. 2009. “Mars Water-Ice Clouds and Precipitation.” *Science Magazine Reports*, Vol. 325, Iss. 5936: 68-70. DOI: 10.1126/science.1172344

Whittington, Mark R. 2022. “China has Returned Helium-3 from the Moon, Opening Door to Future Technology.” *The Hill*, Opinion / Technology, September 18, 2022. https://thehill.com/opinion/technology/3647216-china-has-returned-helium-3-from-the-moon-opening-door-to-future-technology/

Williams, Michael C., ed. 2007. *Realism Reconsidered: The Legacy of Hans Morgenthau in International Relations*. Oxford University Press.

Williams, Michael C. 2005. *The Realist Tradition and the Limits of International Relations*. Cambridge University Press. https://doi.org/10.1017/CBO9780511491771

Williams, Michael C. 2004. "Why Ideas Matter in IR: Morgenthau, Classical Realism, and the Moral Construction of Power Politics." *International Organization*, Vol. 58, Iss.4: 633-665. Published Online by Cambridge University Press. https://doi.org/10.1017/S0020818304040202

Williams, Sylvia Maureen. 1987. "The Law of Outer Space and Natural Resources." *The International and Comparative Law Quarterly*, Vol. 36, no.1:142-151. Cambridge University Press on behalf of the British Institute of International and Comparative Law. JSTOR. https://www.jstor.org/stable/pdf/760465.pdf?refreqid=excelsior%3A3c7eb684c7580beab7711b7660f5637e

Wood, Johnny. 2018. "How Nations are Collaborating to Further Space Exploration." *SPECTRA*. https://spectra.mhi.com/how-nations-are-collaborating-to-further-space-exploration

World Economic Forum. 2018. "Global Competitiveness Index 4.0." *Global Competitiveness Report – Competitiveness Rankings*. https://reports.weforum.org/global-competitiveness-report-2018/competitiveness-rankings/?doing_wp_cron=1594783185.8477530479431152343750

World Intellectual Property Organization (WIPO). 2022. PCT – The International Patent System. https://www.wipo.int/pct/en/

World Space Mining Registry. 2021. "Asteroid Mining Companies & Technology." https://www.wsmcr.org/pages/asteroid-mining-technology

Wrench, John G. 2019. "Non-Appropriation, No Problem: The Outer Space Treaty is Ready for Asteroid Mining." *Case Western Reserve Journal of International Law*, Vol. 51, Iss. 1, Art. 11: 437-461. Scholarly Commons, Case Western Reserve University School of Law. https://scholarlycommons.law.case.edu/jil/vol51/iss1/11

Wright, Quincy. 1921. "The Control of Foreign Relations." *The American Political Science Review*, Vol. 15, no. 1: 1-26. Published by American Political Science Association. JSTOR. https://doi.org/10.2307/1944023

Wu, Ji. 2017. *Calling Taikong: A Strategy Report and Study of China's Future Space Science Missions*. Science Policy Reports Book Series 2017: 1-51. Science Press Beijing / Springer. https://link.springer.com/content/pdf/10.1007%2F978-981-10-6737-2.pdf

Wuthrich, Bryan. 1999. "The U.S. Space Program and the National Interest." Research Delivered at the Southern Illinois Phi Alpha Theta Regional Conference, April 1999. *Historia*. https://www.eiu.edu/historia/wuthrich.pdf

Young, Oran R. 1983. “Regime Dynamics: The Rise and Fall of International Regimes.” In *International Regimes.* Edited by Stephen D Krasner. Ithaca, Cornell University Press, 93-114.

Young, Oran R. 1982. “Regime Dynamics: The Rise and Fall of International Regimes.” *International Organization*, Vol. 36, no. 2: 277-297. Published by The MIT Press. JSTOR. https://www.jstor.org/stable/2706523

Zbigniew, Brzezinski. 1971. “Half Past Nixon.” *Foreign Policy*, no. 3: 3-21. Published by Slate Group, LLC. JSTOR. https://doi.org/10.2307/1147828

Zhukov, Gennady, and Yuri Kolosov. 2014. *International Space Law*. 2nd Edition, Stereotyped. Translated by Boris Belitzky. CTATYT MOCKBA. https://mgimo.ru/upload/2016/05/KOLOSOV_space_law_eng.pdf

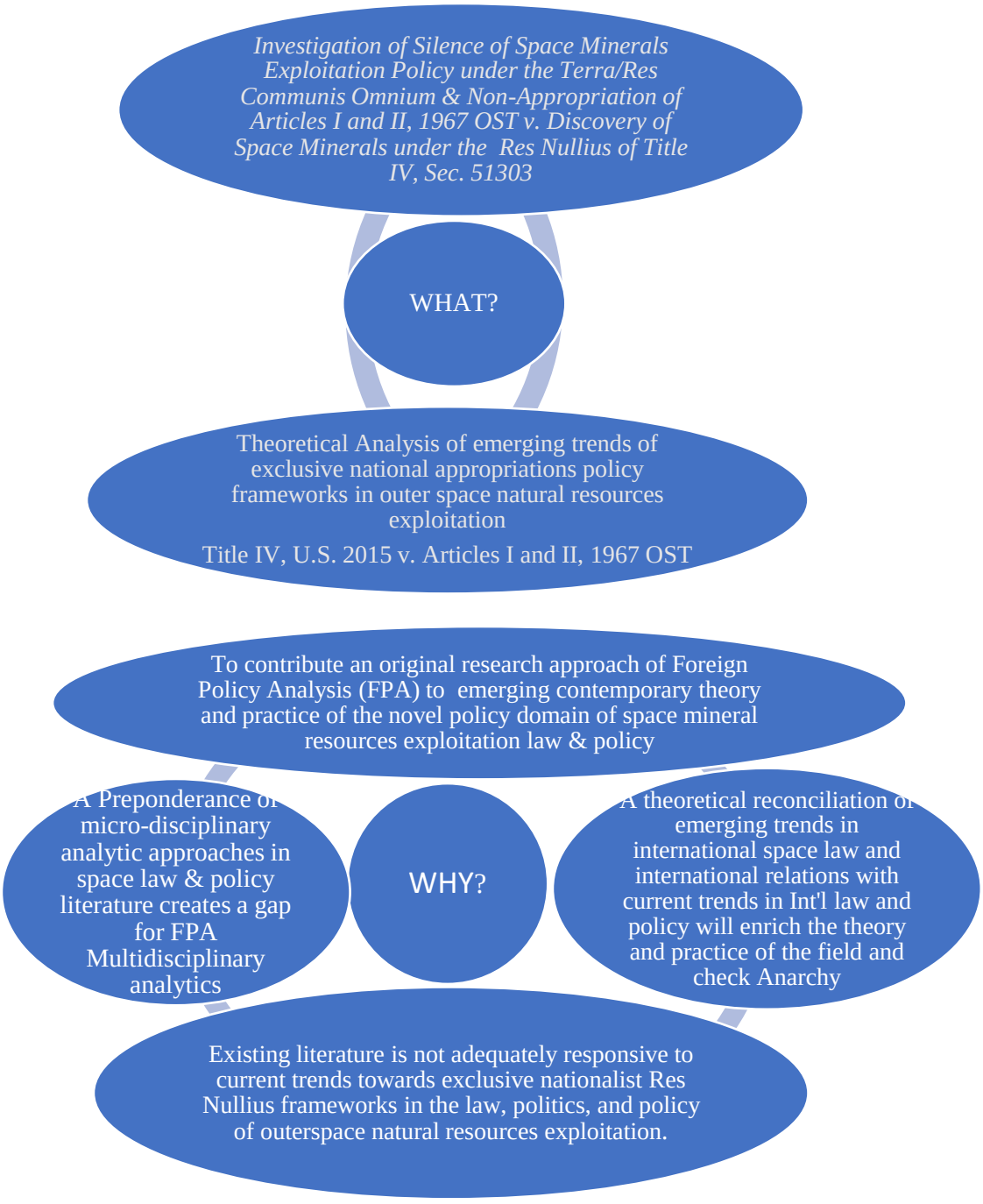
Znaniecki, Florian. 1934. *The Method of Sociology*. Farrar and Rinehart.

Zwart, Melissa de, and Dale Stephens. 2019. “The Space (Innovation) Race: The Inevitable Relationship between Military Technology and Innovation.” *Melbourne Journal of International Law*, Vol. 20, no. 1: 1-28. http://classic.austlii.edu.au/au/journals/MelbJIL/2019/2.html

APPENDICES

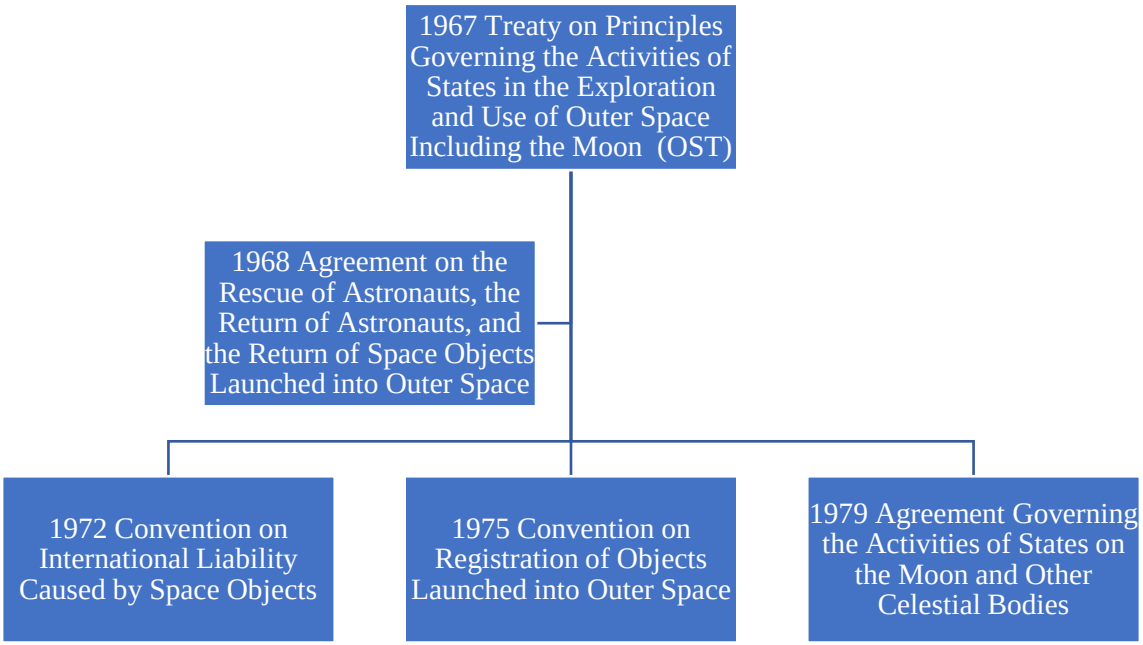
Annex I

Research Summary



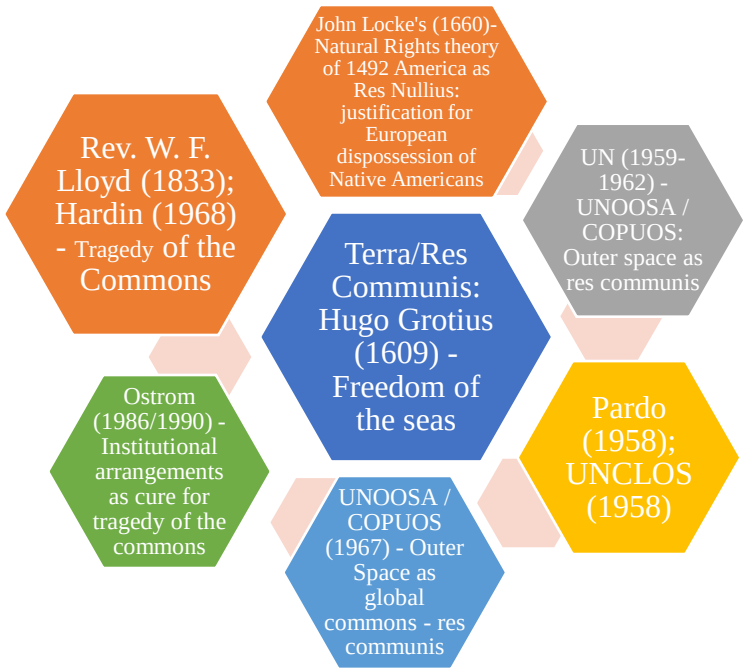
Annex II

The Corpus of International Space Law

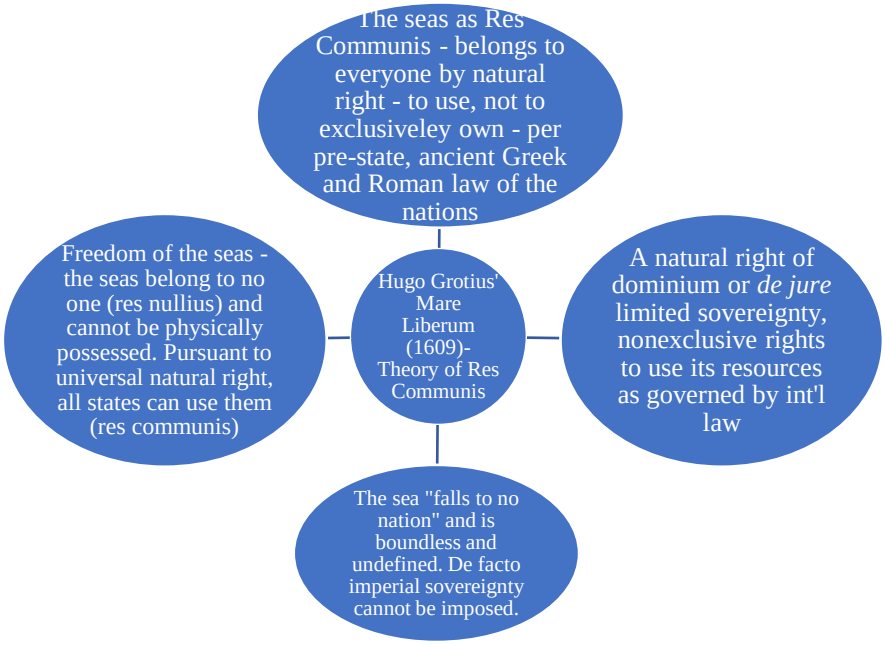


Annex III

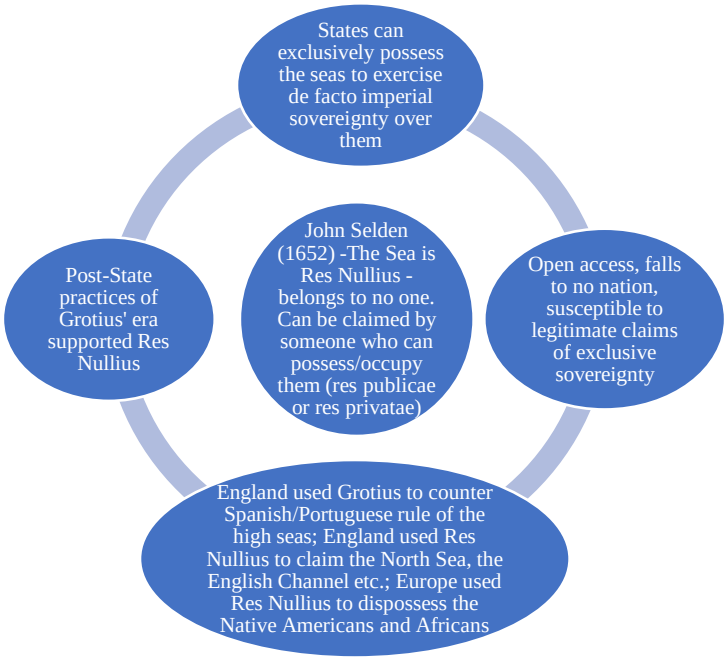
The Historical Trajectory of the 'Global Commons' Concept



Global Commons as Res Communis – Grotius 1609.

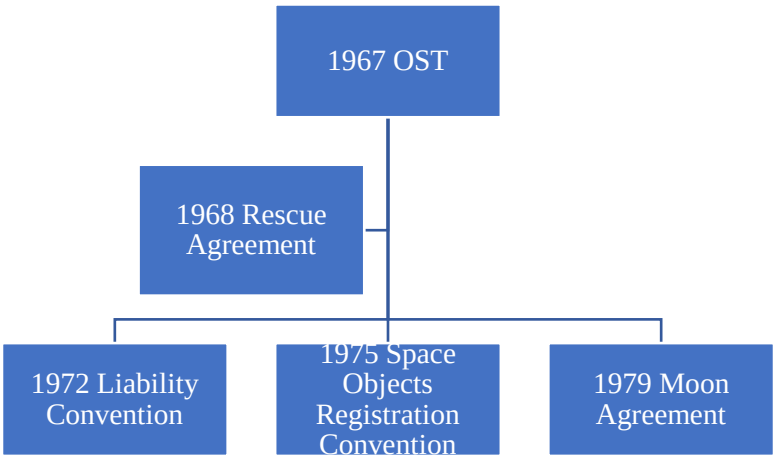


John Selden 1652 – English Jurist, Classical Res Nullius Refutation of Grotius.



Annex IV

The 1967 OST as Diffuse: Birthing Subsequent Legal Instruments of International Space law



Annex V

Copyright Permission to Use Two Infographics: Erik Kulu (2021)

Erik Kulu <[redacted]
Tue 9/5/2023 3:27 PM
To: Japhets, Samuel Chuks <[redacted]>
Dear Samuel,
Yes, approval granted to use and publish the two images in all types of works.
By the way, I made small updates earlier in the year, hopefully you are using the latest versions.
Congratulations on completing your dissertation!
Best wishes,
Erik Kulu

On Tue, 5 Sept 2023 at 22:08, Japhets, Samuel Chuks <[redacted]> wrote:
Dear Mr. Eric Kulu,
I hope you are having a great summer.
It's me again, Samuel Japhets, the PhD Public/Foreign Policy candidate at Helms School of Government, Liberty University, Lynchburg VA., USA.
I included the email trail below to refresh your memory on your kind approval to use two images (specified below) from your article: https://www.factoriesinspace.com/

Factories in Space
Space economy - Making products for Earth and space
www.factoriesinspace.com

I have been instructed to specifically request your written approval to "use and publish" the two images since my approved doctoral dissertation will be published in Liberty University's Scholarly Commons and other reputable academic publications.
https://digitalcommons.liberty.edu/
Of course, if you object, I will remove the images after the doctoral defense scheduled for September 13, 2023. The two images are titled: "In-Space Manufacturing" and "In-Space Economy"
I look forward again to your positive consideration of my request - given that this would contribute to the expansion of knowledge in the evolving field of space mining policy (which my doctoral dissertation focuses on).
Thank you in anticipation.
Sincerely,
Samuel C. Japhets

Re: [External] Re: Request for Permission to Use Infographics for Academic Research
Japhets, Samuel Chuks <[redacted]>Sat 1/22/2022 2:33 PM
To: Erik Kulu <[redacted]>
Cc: [redacted]>
Thank you so much, Mr. Kulu.
Wishing you well in your space-centric works.
I appreciate.
Samuel C. Japhets

From: Erik Kulu <[redacted]>
Sent: Saturday, January 22, 2022, 2:06 PM
To: Japhets, Samuel Chuks <[redacted]>
Cc: [redacted]>
Subject: [External] Re: Request for Permission to Use Infographics for Academic Research

---

Dear Samuel,
Yes, permission gladly given to use the two infographics.
Thank you for asking! I was very busy last week so it was a good idea to resend.
Best regards,
Erik Kulu
On Sat, 22 Jan 2022 at 13:57, Japhets, Samuel Chuks <[redacted]> wrote:

Note: this is a resend. January 22, 2022.
January 16, 2022
Erik Kulu[redacted]
Copyright Owner, www.factoriesinspace.com

Dear Mr./Capt. Erik Kulu,
As a graduate student in the Helms School of Government at Liberty University, I am conducting research as part of the requirements for a PhD degree in Public/Foreign Policy. The title of my dissertation research project is "***Res Communis v. Res Nullius* in Outer Space Natural Resources Exploitation Regimes."** The purpose of my research is to provide a theoretical analysis of multilevel conflicts in the legal aspects of the Global Commons concept underpinning U.S. domestic and UN international regimes of outer space natural resources exploitation.
I am writing to request your permission to utilize your two infographics respectively captioned "**In-Space Economy**" and "**In-Space Manufacturing (ISM)"**. These are found in your Factories in Space database at the page captioned "In-Space Manufacturing & Space Economy Commercializing Microgravity." The website is https://www.factoriesinspace.com/
I intend to use in whole, the two infographic images as part of a body of evidence in the Chapter Four "Findings" section establishing the exponential paradigm shift from 1967 Outer Space Treaty's focus on "Exploration" to 21st century national and private sector interests in the "Exploitation" of outer space natural resources using innovative technologies and evolving advances in the scientific knowledge of the resources.
Your approval to use the two images in whole will be expressly highlighted beneath the images in the research, in the appendix of the research, as well as in the references section. There will be no further use of the two requested images beyond this educational research purpose in the specific location of the research.
With regards to timeline, I would appreciate your response as soon as you can because I need the data for the ongoing research and analysis this Spring 2022 Semester.
Questions about this dissertation research could be emailed to [redacted] or to the Dissertation Committee Chair, Dr. Erik Root [redacted] as well as to [redacted]
Thank you, in anticipation.
Sincerely, Samuel C. Japhets
Dip.Th. (Pastoral Theology, 1991), *BS.* (Legal Studies, 2009), *JD.* (Law, 2015), *MDiv.* (Pre-PhD, Christian Apologetics, 2018. Rawlings School of Divinity, Liberty University), *PhD (Public Policy / Foreign Policy,* Candidate 2022, Helms School of Government, Liberty University).

"Justitia et Veritate"

VITA

Samuel Chuks Japhets is a doctoral candidate with the Helms School of Government, Liberty University, pursuing the Ph.D. in Public Policy – Foreign Policy, with special research interest in U.S. space mining law & policy. He earned a bachelor's degree in Legal Studies from Purdue University Global (formerly Kaplan University), Chicago, Illinois, and the juris doctor degree in Law, with specialization in the Executive Track, from William Howard Taft Law School, Santa Ana, CA. Subsequently, he earned the master of divinity (MDiv.) in Christian Apologetics, from the Rawlings School of Divinity, Liberty University, Lynchburg, VA. Samuel has continued his lifelong career as an international nondenominational Christian Preacher but following a successful defense of his Ph.D. in 2023, he plans a career change to contribute more to humanity by expanding his intellectual skills to national politics, policymaking, and teaching in Academia.