FUTURE
for Advanced Research & Studies

THE NEW FRONTIER OF DISCOVERY

Challenges and Prospects of Cooperation in Outer Space

Jaida Aboulfotouh and Yara Ahmed, Editors

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Introduction

Jaida Aboulfotouh and Yara Ahmed

Humans have always been mesmerized by outer space, driven by their primordial desire to explore. The release of new infrared photographs of distant galaxies, by NASA's James Webb Space Telescope has not just left everyone in awe, but was able to capture a fascinating universe beyond man's imagination. Outer space has become the new frontier of discovery.

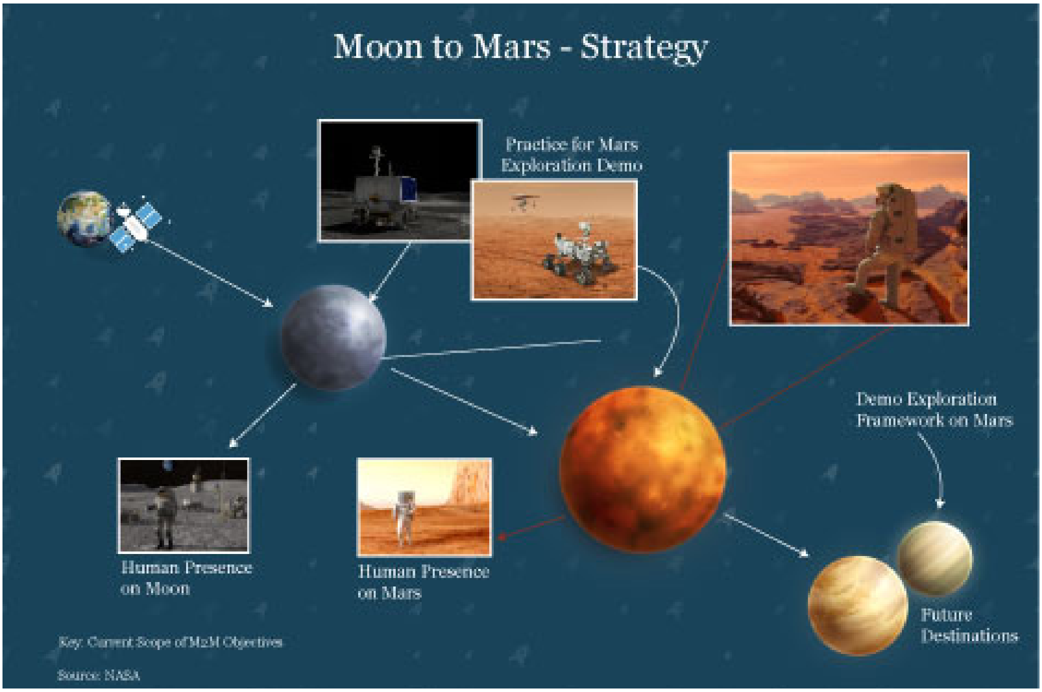
That is why, NASA has just embarked on a new age of lunar exploration, fifty years after its Apollo mission. Recently, Chinese astronauts landed at China's space station for the first ever in-orbit crew rotation in Chinese space history[1], while two Russian cosmonauts also ventured outside the International Space Station for a nearly seven-hour spacewalk.[2] The United Arab Emirates is also making history and will be launching the Arab world's first lunar rover. "The Emirati-built four-wheel rover will be stored inside Japanese lunar exploration company ispace's Hakuto-R Mission 1 lander, which will transport the vessel to the Moon's surface."[3] Therefore, a vastly growing number of states, yet also private entities are now engaged in space exploration, creating a new era of space age.

The inception of 'space age' occurred when the former Soviet Union launched Sputnik 1, the world's first artificial satellite. The launch of Russian satellite shocked the United States, which did not just lead to the creation of NASA, but to the inauguration of the space race between the two superpowers during the Cold War. Yet, in the 1970s, both states, as means to administer their rivalry and reduce the risk of nuclear war, have decided to collaborate in jointly manned space enterprises. Hence, the initial stage of outer space exploration could be characterized by a multilateral approach, denoting the use of outer space for the benefit and the interest of all mankind, as stipulated in the Outer Space Treaty. Moreover, the United Nations General Assembly established the Committee on the Peaceful Uses of Outer Space in 1958, to govern the exploration of outer space and also to promote international cooperation in the use of outer space peacefully.[4]

The current era of 'space age', however, has witnessed an increase of activity in outer space, evident in the dominance of such activities in our daily lives:

enabling internet connectivity, satellite imagery, security systems, climate mapping etc. Yet, there has also been an exponential growth of space economy, where commercial entities acquired their own launch capabilities into outer space, accompanied with a vast interest in space mining, which is regarded as a significant source of economic growth.

Due to these new dynamics of space age, where different players are able to embark into space sector, there is a need to examine the current regulations of this new realm, to address the growth opportunities and the challenges in outer space, and to advance international cooperation and standards in this industry.



In the first part of this research study, Jaida Aboulfotouh provides a historical outline of laws governing space culminating in the Outer Space Treaty (OST), and four other subsequent treaties. She then assesses the current rules of engagement, articulated primarily in the OST and more specifically the 'principle of non-appropriation', and space as 'province of all mankind'. She further delves into the debate concerning the applicability of international space law to private entities. Aboulfotouh lastly discussed three limitations of international space law.

Secondly, Dr Saskia van Genugten assesses the economic promise of 'space mining'. Dr Genugten argues that states, as well as private companies have various motives to be allured by the idea of mining. She further challenges that the current economic estimates of asteroid mining have not factored in extraction and transportation costs. Despite that state-led efforts in studying feasibility of mining, Dr Genugten claims that the private sector has not been able to invest in space mining operations at the same level, due to multiple challenges. Lastly, she assesses whether, currently, costs and barriers outweigh the potential benefits of asteroid mining.

Given the context of evolving dynamics of space exploration, Dr Namrata Goswami discusses, in the third and final part of this study, the shifts in space discourse, in the post-Cold War era. She further highlights commercialization of space activities, and analyses the avenues of cooperation in space exploration whether between states, or public-private partnerships. Dr Goswami sheds light on the role of geopolitics in utilization of space resources and the different partnerships in space exploration programmes. Lastly, she specifies the role of states such as the United Arab Emirates in providing a platform to discuss curbing great power competition in space and the potential exploitation of space by private actors.

Endnotes

1. Woo, Ryan, and Liangping Gao. “Chinese Astronauts Board Space Station in Historic Mission.” Reuters. Thomson Reuters, November 30, 2022. https://www.reuters.com/lifestyle/science/china-launches-crewed-spacecraft-chinese-space-station-state-television-2022-11-29/.
2. Sharma, Anoushka. “Russian Cosmonauts Spacewalk Outside Space Station Orbiting above Brazil.” NDTV.com. NDTV, November 19, 2022. https://www.ndtv.com/world-news/russian-cosmonauts-spacewalk-outside-space-station-orbiting-above-brazil-3536498.
3. Bell, Jennifer. “Arab World’s First Moon Mission Delayed by a Day.” Al Arabiya English, November 30, 2022. https://english.alarabiya.net/News/gulf/2022/11/30/Final-countdown-Arab-world-s-first-Moon-mission-undergoes-last-preparations.
4. Atkins , Scott, Martyn Taylor , and Holly McAdam. “Governance in Outer Space: The Case for a New Global Order.” Global law firm | Norton Rose Fulbright, 2022. https://www.nortonrosefulbright.com/en/knowledge/publications/e8862684/governance-in-outer-space-the-case-for-a-new-global-order.

Chapter 1

Rules of Engagement:

The legal landscape of outer space

Jaida Aboulfotouh

Over the last few years, outer space activities have amplified. Policies and strategies have been introduced to increase investment in new space initiatives in both the public and private sectors as an essential boost to future economic growth. "Space economy is seen as a river of untapped potential."[1] Space exploration provides the pathway to bring innovative and serendipitous benefits to a variety of areas, whether climate change, global security, food security, water management, etc.

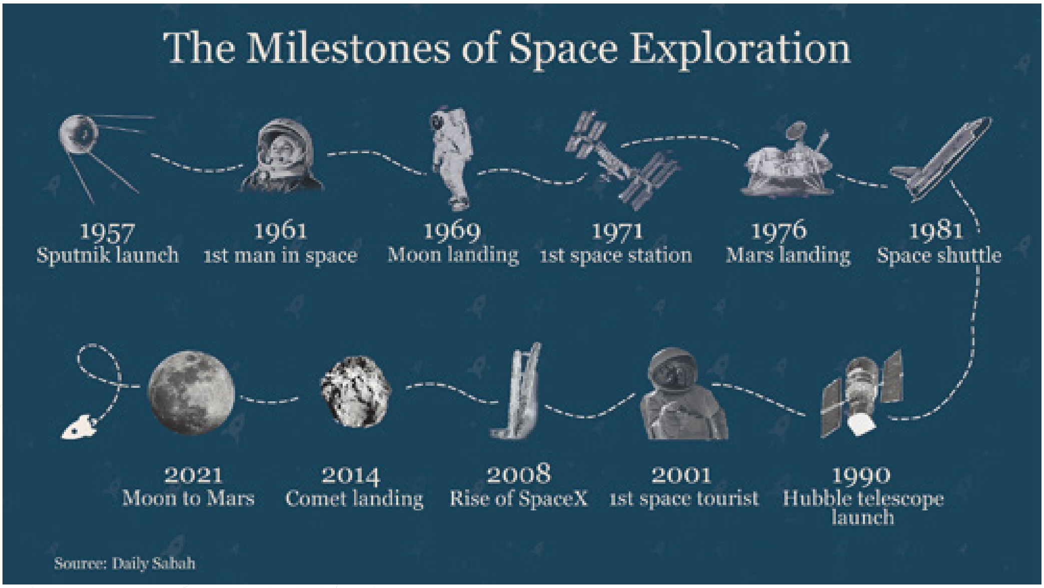
In the US, the National Aeronautics and Space Administration (NASA) launched its 'Artemis I' mission in November 2022 with the objectives of establishing a permanent human presence on the moon and exploring the possibility of extracting valuable resources, such as water and rare materials.[2] Russia's Space Agency, ROSCOSMOS, will also launch its Luna-25 mission in 2023 to examine whether soft-landing technology can touch down on the moon's surface. In addition, the number of commercial missions to outer space has been increasing in several states such as the US, Russia, China, and India. In the US, private aerospace companies, such as Blue Origin, SpaceX and Virgin Galactic, have entered the market.[3] In Russia, the private company Success Rockets launches satellites into space, while in India, Skyroot Aerospace was able to develop its first launch vehicle, "becoming the first Indian private company to launch a rocket, the Vikram-suborbital (VKS) into space on November 18."[4]

With the continuous advancement in space activities and the emergence of private actors in outer space exploration, it is of major importance to examine the rules of engagement in the new frontier. It is essential to understand the historical development of laws governing space and the ongoing debates on some of the contemporary regulations, discussing the limitations of the current rules of engagement in outer space activities.

The History of Space Law

Exploring outer space has always been a fascination for humans, from the Babylonian astronomers of 700 BCE, who recorded the paths of planets, to the ancient Inca and Aztec builders of astronomical observatories and the ancient Egyptian astronomers, who may have discovered variable stars.[5] However, the law governing space was an idea without shape or substance for several decades.[6] Only in 1932 was the first comprehensive monograph which presented some fundamental concepts of space law written. The first doctoral dissertation examining concepts of space law was conducted in 1953.[7] Yet, it is widely recognised that international space law is a by-product of the Cold War; a result of the successful launchings of the Soviet satellite Sputnik 1 in 1957 and the American satellite Explorer 1 in 1958. These launches demonstrate that both the former Soviet Union and the US took an active interest in the development of international space policy.[8] The principal objective when negotiating space laws was actually security, due to the fact that the space race involved two world powers vying for technological superiority.

The launch of Sputnik is often portrayed as a black eye to the United States in its quest for space superiority, from a country that should have been its technological inferior. The oft forgotten part of that narrative is that the Soviet launch raised a serious strategic threat to the United States, in that it showed that the Soviet Union was much closer to the technology that would allow for the intercontinental delivery system for a nuclear warhead (an Intercontinental Ballistic Missile - ICBM).[9]



Consequently, friction increased between the two countries as they both have been developing nuclear weapons, leading to a great strategic risk for both sides. This prompted the necessity of negotiating principles to lessen such tensions and eventually the development of the **UN Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space**. These principles primarily included obligations such as the ban on the 'national appropriation' of space, as well as placing strong emphasis on transparency and international cooperation. They aimed to lay the basis of a legal regime that promoted the peaceful exploration of space and simultaneously reduced tensions in the new arena,[10] while also creating the foundation for the détente between the two states throughout the following decade.

These principles were later integrated into the **Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies—**the so-called **Outer Space Treaty—**which was ratified by 63 participants in the United Nations (UN) in 1967. This treaty is considered a landmark in the development of international space law and it remains in effect today among participating countries. As of November 2022, the Outer Space Treaty has received 112 ratifications and 89 signatures.[11]

Signing of the Outer Space Treaty in 1967
Source: The Space Review

This treaty was followed by four others: the 1968 **Rescue and Return Agreement**, the 1972 **Liability Convention**, the 1974 **Registration Convention** and, finally, the 1979 **Moon Agreement**.[12] These four UN treaties are also supplemented with several non-binding instruments: the resolutions adopted by the UN General Assembly and documents produced by the UN Committee on the Peaceful Uses of Outer Space.

Therefore, it should be noted that both soft and hard space law form *lex specialis* (a law governing a specific subject matter), which, along with international law in general, administers all space activities irrespective of their nature. In addition to these international instruments, many states have national legislation governing space-related activities.

Current Rules of Engagement

According to Dr Frans G. von der Dunk, Director of Public Relations of the International Institute of Space Law, outer space is similar to international waters in the sense that no one can fully take ownership or control of it, but it is still open to use by everyone.[13] Hence, the Outer Space Treaty aims to govern space activities and therefore is acknowledged as the cornerstone for space law. The main principles of the treaty assert that:

> The exploration of space should be carried out peacefully for the benefit of mankind.
> Placing of nuclear weapons and other weapons of mass destruction is prohibited in space or on any celestial body.
> The moon and other celestial bodies cannot belong to a state, but are for the benefit of the international community.
> Development of military bases, facilities, and fortifications, and experimentation of all types of weapons in outer space are prohibited.[14]

A number of essential principles in the treaty aim to govern space activities—namely, the concept of space as the 'province of all humankind', the freedom of exploration and utilisation of outer space by all states without discrimination and, most importantly, the notion of non-appropriation of outer space.

The intention of declaring outer space as '**province of all mankind**' in Article I of the treaty was to safeguard that activities in outer space do not threaten international security. However, a clear and distinctive definition of the term was not provided, which was perceived as limiting the main purpose and object of the treaty: to safeguard international peace. Nevertheless, some scholars have asserted that the principle denotes that "all nations [have] vested rights in common resources and should be shared equitable among them"[15] in outer space. This affirms the freedom to explore and use outer space by all, providing that such activities do not prevent others from accessing space.

Article II of the treaty entails one of the most important yet debateable notions of international space law: the '**principle of non-appropriation**'. This means that no object in outer space can become the property of any public entity (states), or private entity (non-governmental actors, companies, etc.). This notion has been reaffirmed in Article VI (2) of the Moon Agreement, which also asserts that the moon is not and should not be subject to national appropriation by any claim of sovereignty by states. Hence, this principle is conducive to preserving the continuous and sustainable exploration and development of natural resources in outer space. Therefore, this principle stipulates that the legal nature of outer space is a *res communis omnium,* derived from the Roman legal doctrine, which denotes freedom of use for all. It stipulates that all states have equal rights to explore and use outer space. "Space scholars use the term *res communis omnium* to point out the fact that no State's sovereignty can be exercised in outer space, because it represents an area of common interest of all mankind."[16]

However, the legal conundrum is in the question of how far outer space exploration by states—as well as private entities, which have not been mentioned in the treaty—can go to remain in consonance with the non-appropriation principle. It is important to note that for the drafters of the Outer Space Treaty, such a provision was essential to reduce the possibility of both the former Soviet Union and the US acquiring legal rights to appropriate any kind of celestial bodies, which they could subsequently utilise to advance their nuclear weapon ambitions during the Cold War. Hence, private entities were not included in the treaty under the premise that states would be the sole actors in space. However, there have been clear inconsistencies in state practices, making the interpretation of the non-appropriation principle dubious and unclear.

Some assert that private entities fall under the authorisation and, jurisdiction of their states; hence, the principle inherently applies to them. Therefore, states—as well as any other actors—are not permitted to appropriate any celestial bodies from outer space. These bodies "are entitled to free and equal access to the environment of space which is in the interest of all countries, but in doing so, no assertion on any claim of ownership over these extraterritorial areas is permitted."[17] Others claim that since private actors have not been mentioned in the treaty, then they are permitted to possess, explore and use outer space resources. In the case of *Nemitz vs. the United States,* Greg Nemitz, a US citizen, claimed ownership of an asteroid, aiming to collect rental fees from NASA for the occupations of its spacecraft on the asteroid. His claim was based on the foundation that the Outer Space Treaty does not apply to him, since it is an agreement solely between states.[18] The suit was rejected by a US District Court due to the 'lack of a recognizable legal theory' behind Nemitz' claims.[19] Because the exploration of outer space currently has entered a new era of commercial activities and active involvement of private entities, there is another interpretation of the notion, which affirms that there must be a distinction between illegal appropriation and permissible extraction. This viewpoint asserts that the objective of the extraction of celestial bodies is the use and commercialisation of such resources, rather than territorial demands or sovereign titles to the bodies. "This line of thought points to the legal regime of the High Seas under the 1982 Convention on the Law of the Sea (UNCLOS), in particular to the regulation of fishing, allowing State Parties in principle to freely fish in the High Seas, as a relevant analogy."[20]

Other fundamental principles were also addressed in other treaties and instruments, such as international cooperation, the preservation of space and Earth, the rescue of astronauts, liability for damages caused by space objects, the use of space-related technologies and the sharing of information about potential dangers in outer space. However, treaties do not explicitly address potential or actual armed conflicts. The main substantive provision of the Outer Space Treaty in the security realm is the obligation in Article III that space activities should comply with international law, referring to the UN Charter. Hence, according to Dr von der Dunk, the UN Charter's baseline prohibition on the use of force which might impose threats on the territorial integrity or political independence of any state, as well as the two essential categories of exceptions to it—namely, the right to self-defence specified in UN or UN-authorised military sanctions—apply to outer space as well.[21]

Limitations of International Space Law

In May 2020, SpaceX was the first ever private corporation to send humans into space, not only marking a remarkable technological achievement, but also generating a new 'space-for-space' industry, namely "goods and services designed to supply space-bound customers."[22]

However, the current space law has some limitations, since it focuses solely on state activities and hence does not account for the evolving advancements in the space industry or the increasing involvement of private companies in space activities. Some of the gaps in international space law can be formulated as follows:

1. Lack of an enforcement mechanism

One of the primary issues of the current legal system is the lack of an enforcement mechanism and a clear threshold for what counts as a violation or infringement, giving leeway for China, Russia, France and the US during the arms race to embark on atmospheric nuclear tests. “For instance, the United States and Russia have both carried out atmospheric nuclear tests and tested weapons such as R-36 missile developed by Russia in 1967.”[23]

2. Lack of sufficient protection from cyberattacks in space

Currently, much of the world’s fundamental infrastructure depends on space for its daily functioning. “Essential systems—such as communications, air transport, maritime trade, financial services, weather monitoring, and defence—all rely heavily on space infrastructure, including satellites, ground stations and data links at the national, regional and international level.”[24] Therefore, because of the increasingly digitised critical infrastructure, satellites, for example, are vulnerable to cyberattacks. While the Tallinn Manual addresses how international law should apply to cyberwarfare and the laws of armed conflict in space, cyber hacking in space does not have a clear legal framework.[25]

3. Lack of sufficient regulations for private entities

SpaceX’s recent advancements and the efforts of Blue Origin, Boeing and Virgin Galactic to send people in space sustainably pioneered the concept of spaceflight led by private firms. Moreover, currently there is a huge number of satellites worldwide, since almost every state uses information generated from space; however, many of them are privately owned.[26] Asteroid mining has also gained much interest from private companies, which are registering “around the world to begin the exploitation of asteroids for precious metals (such as platinum) and compounds (such as rare-earth minerals).”[27]

However, this privatisation of outer space presents challenges to space governance. The current legal regime, as mentioned before, does not contain sufficient provisions on how to deal with the peculiarities of private entity activity. The law was crafted around an architecture that did not include a full panoply of non-governmental actors, and has left numerous questions about the obligations that states have to regulate these entities’.[28] While several states, such as the UAE, Luxembourg and Japan, have created a domestic legal framework to regulate the activities of private companies in space, new international norms and rules are needed to establish a global code of conduct.


James Webb Space Telescope: Pillars of Creation
Source: NASA

Conclusion

The past few years have witnessed the largest advancements in the space field since the Cold War. The Outer Space Treaty of 1967, adopted under the auspices of the UN, laid down the foundations of international space law. Currently, the Outer Space Treaty and subsequent UN treaties constitute the normative framework governing state activities in outer space. This system has been essential in maintaining exponential growth in the space activities of countries and sustaining the global space economy.

Yet, today, private stakeholders have started to increase their outer space activities. Billionaires, including Elon Musk, Jeff Bezos, Paul Allen, and Richard Branson, have disrupted the market, leading outer space to be driven by several actors: states and private or non-traditional actors. With such advancements, the current legal regime of space must change to be able to deal with 21st century challenges and maintain its initial goal; that the exploration of space should be carried out peacefully for the benefit of mankind.

Endnotes

1. Scott Atkins and Kai Luck, "Outer Space: The New Frontier for Restructuring and Insolvency," International Corporate Rescue 18, no. 5 (September 2021).
2. Kathryn Hambleton, ed., "Around the Moon with NASA's First Launch of SLS with Orion," NASA, August 23, 2022, https://go.nasa.gov/3VlpZ5u
3. Shoma Bhattacharjee, ed., "A Look at Countries with Commercial Space Missions and Their Private Players," cnbctv18.com, November 18, 2022, https://bit.ly/3ARj8sg
4. Scott Atkins and Kai Luck, "Outer Space: The New Frontier for Restructuring and Insolvency."
5. Roger D. Launius, The Smithsonian History of Space Exploration: From the Ancient World to the Extraterrestrial Future (Washington, DC: Smithsonian Books, 2018), 13
6. Launius, The Smithsonian History of Space Exploration: From the Ancient World to the Extraterrestrial Future, 13
7. Ibid, 13.
8. Encyclopædia Britannica, s.v. "Space Law," https://bit.ly/3UqkjWM
9. P. J. Blount, "Renovating Space: The Future of International Space Law," Denver Journal of International Law & Policy 40, no. 1 (January 2011).
10. Blount, "Renovating Space: The Future of International Space Law."
11. " Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty), Jan. 27, 1967 18 UST 2410; 610 UNTS 205; 6 ILM 386 (1967) https://bit.ly/3BiGAiz
12. Michael Beaver, "Current Space Law Limitations and Its Implications on Outer Space Conflicts," E-International Relations, June 17, 2015, https://bit.ly/3F7XeT9
13. Feyisola Ruth Ishola, Oluwabusola Fadipe, and Olaoluwa Colin Taiwo, "Legal Enforceability of International Space Laws: An Appraisal of 1967 Outer Space Treaty," New Space 9, no. 1 (2021): 33–37, https://doi.org/10.1089/space.2020.0038.
14. Ishola, Fadipe, and Taiwo, "Legal Enforceability of International Space Laws: An Appraisal of 1967 Outer Space Treaty," 33–37.
15. Joanne Irene Gabrynowicz, "The 'Province' and 'Heritage' of Mankind Reconsidered: A New Beginning" (paper presented at the Second Conference on Lunar Bases and Space Activities of the 21st Century, September 1992). https://bit.ly/3VjPlAF
16. Fabio Tronchetti, "The Outer Space Treaty, the Moon Agreement and the 1996 Declaration on Space Benefits," in The Exploitation of Natural Resources of the Moon and Other Celestial Bodies: A Proposal for a Legal Regime (Leiden: Martinus Nijhoff, 2009), 12.
17. Tosaporn Leepuengtham, "International Space Law and Its Implications for Outer Space Activities," The Protection of Intellectual Property Rights in Outer Space Activities (2017): 8–31, https://doi.org/10.4337/9781785369629.00005.
18. John G. Wrench, "Non-Appropriation, No Problem: The Outer Space Treaty Is Ready for Asteroid Mining," Case Western Reserve Journal of International Law 51, no. 1 (2019), https://doi.org/https://scholarlycommons.law.case.edu/jil/.
19. Keay Davidson, "Final Frontier for Lawyers – Property Rights in Space / Land Claims, Com-

mercial Schemes and Dreams Have Legal Eagles Hovering," SFGATE, January 16, 2012, https://bit.ly/3OPRyBE

20. Tanja L. Masson-Zwaan and Mahulena Hofmann, "Space Resources Activities," Essay, in Introduction to Space Law (Alphen aan den Rijn, the Netherlands: Wolters Kluwer, 2019), 7–8.

21. Blount. "Renovating Space: The Future of International Space Law."

22. Weinzierl , Matthew, and Mehak Sarang. "The Commercial Space Age Is Here." Harvard Business Review, February 12, 2021. https://bit.ly/3OOdhcQ

23. Ishola, Fadipe, and Taiwo, "Legal Enforceability of International Space Laws: An Appraisal of 1967 Outer Space Treaty," 33–37.

24. "Cybersecurity Threats in Space: A Roadmap for Future Policy," Wilson Center, https://bit.ly/3AUmKKc

25. Patricia Lewis, "Create a Global Code of Conduct for Outer Space – Chatham House," Final Legal Frontier, October 14, 2020, https://bit.ly/3AUu3Se

26. Lewis, "Create a Global Code of Conduct for Outer Space – Chatham House."

27. Ibid.

28. Blount. "Renovating Space: The Future of International Space Law."

Chapter 2

Mining Asteroids:

Promising potential, but not there yet

Dr Saskia van Genugten

Space is commercialising. With a growing number of states, as well as private companies able to launch satellites and spacecraft, our solar system is getting crowded. The promise of the space economy is expanding at a dazzling rate: in 2021, the space economy was estimated to have an estimated worth of USD 496 billion - an almost 10% increase from the previous year.[1] But even that number would be dwarfed if we consider the potential of mining asteroids for critical raw and rare materials. Taking that potential into account would force us to think in 'quintillions', instead of 'billions'.

The concept of 'space mining' is steadily alluring, which is slowly being translated into traction and action. After all, the world is witnessing a growth in demand for critical materials and precious metals, entailed for technologies considered vital for energy transition, which is to shift our reliance on fossil fuels to renewable energy sources and other green energies. Also, the idea of getting resources from space is contextualized in the current trend of retaining a larger degree of strategic autonomy in critical supply chains. Being able to claim pieces of space would come with huge economic benefits, as well as with a serious amount of national prestige. But will it ever become reality?

The Lure of Space Resources

The idea of 'mining' space seems indeed appealing for various reasons. While bringing back to earth small samples of asteroid material helps us greatly in our understanding of the composition and evolution of our solar system, 'mining' such asteroids at a more industrial scale would provide resources worth exponentially more than the world's current aggregate GDP. NASA has estimated that the so-called asteroid belt - a strip between Mars and Jupiter of around 1 million asteroids – has a 'market' value of USD 700 quintillion.[2] Even mining asteroids closer to home (Near-Earth Asteroids, NEAs) could make every person in the world a millionaire at least, only if the wealth is equally shared. It is evident that whoever succeeds in mining asteroids, will revolutionize the economy on Earth as we know it.

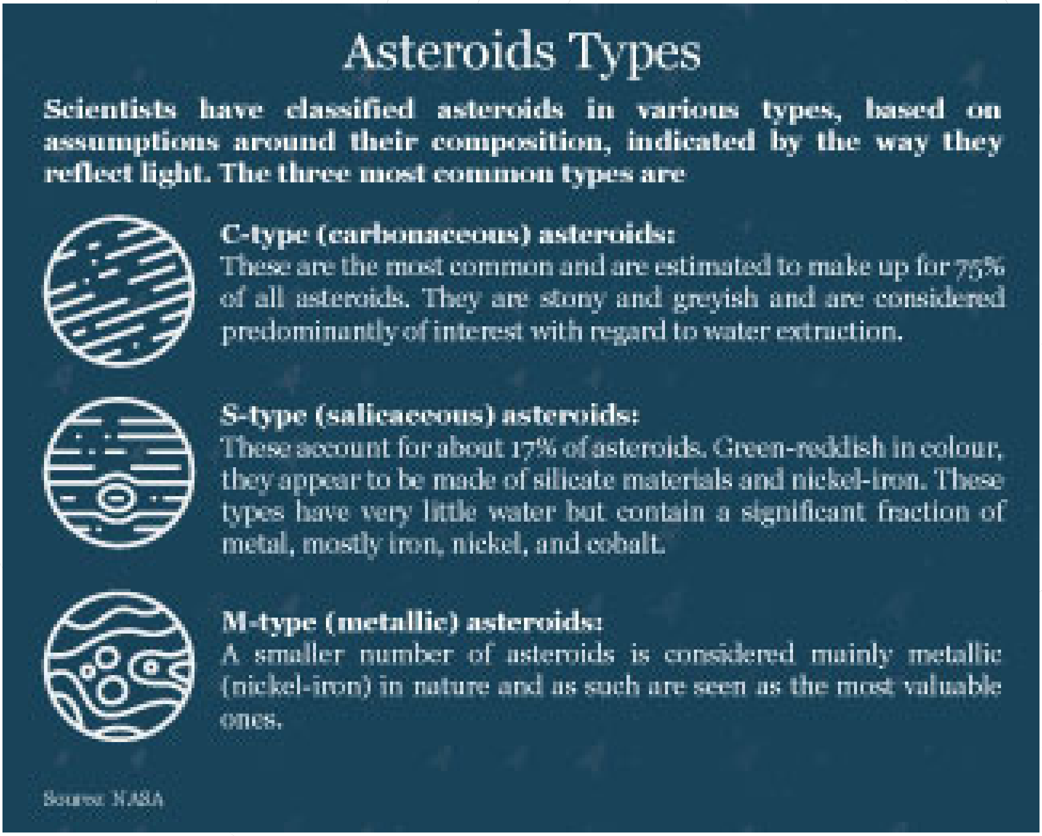
Entrepreneurs look at space in the context of surging annual demand for rare earth elements. Annual demand doubled to 125,000 tons in the fifteen years to 2021 and is projected to reach 315,000 tons in 2030.[3] This growth in demand is partly related to the fact that these elements are critical to many green technologies, from fuel cells to high-capacity batteries, to wind turbines and solar panels. As was aptly described in a recent academic paper on the topic, the energy transition can be boiled down to "a shift from [a reliance on] fossil fuels to metals."[4] A lack of such metals is seen as an important risk factor that can hamper the growth of renewable energy technologies.[5] For example, the supply of permanent magnet materials will need to increase substantially to meet the demand for electrical vehicles.[6]

A third reason why state and private actors are looking at space for resources, is more geopolitical in nature and linked to an erosion of trust between various industrialized states of this world.[7] Space mining can raise a state or a group of states' 'strategic autonomy'. The fact that the majority of mining of metals (58% in 2020) takes place in China, currently creates an elevated feeling of discomfort in other parts of the world. China has also almost full control over the purification process of such metals (90%) and of permanent magnet production (90%). Even if countries such as Angola, Australia and the United States (US) deliver on promises to ramp up production, China would still be controlling around 80% of the global refining of vital metals for years and decades to come.[8]

The Economic Promise of Asteroid Mining

Asteroids are pieces of rocks, metals and dust floating around in the solar system. Some are just a couple of meters large, while others are kilometres wide. They are not very different from planets, but are simply considered 'too small' to be called planets. Studying asteroids helps with our understanding of the solar system and its origins, but ever more entrepreneurs are getting excited about them due to their promise of unprecedented wealth. Most obviously, that wealth derives from the precious minerals and metals that could be transported back to Earth.

In terms of extracting metals and minerals, many eyes are on an upcoming NASA mission to an asteroid called 16 Psyche, which is the largest of the metallic asteroids (M-type asteroids, see below) and part of the asteroid belt between Mars and Jupiter.[9] Early estimations put the value of 16 Psyche at USD 10,000 quadrillion.[10] More recent studies are suggesting slightly less dramatic numbers, as the asteroid might not be made of solid metal, but even then, mining such an asteroid successfully would be a huge disruptor in the market for critical raw materials.[11]



Of course, multiple caveats and perils exist. To be a truly interesting option for terrestrial use, we need to compensate for extraction and transportation costs. That is why currently, asteroid mining studies tend to focus on metals with a high market value, such as platinum group metals. The metals of this group are also of increasing interest due to the geopolitical competition and the current global drive to try and minimalize political risks in supply chains. After all, platinum group metals are currently being mined in just a handful of countries, including Russia.

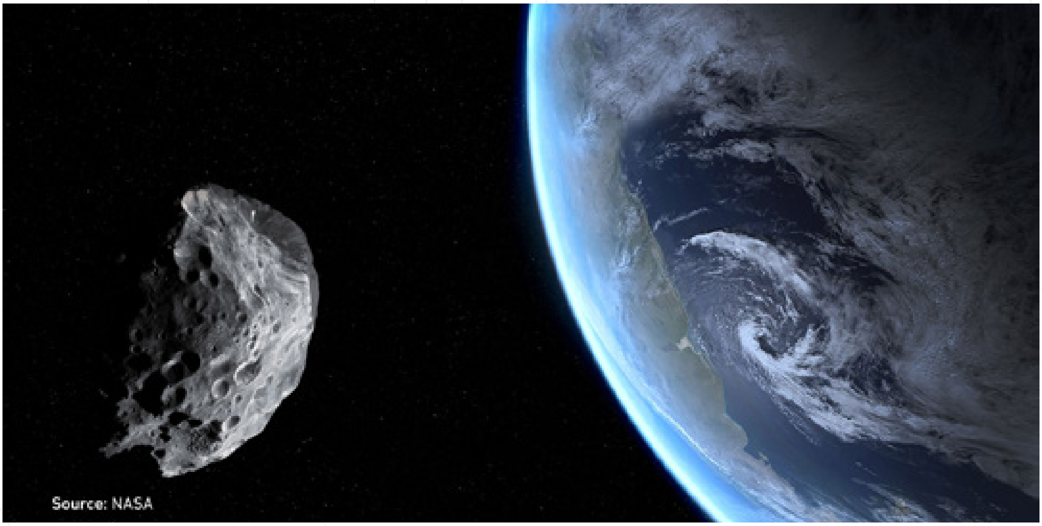
Less intuitively, extracting water from asteroids, to be used for 'in space' applications, is considered worthwhile and would be a game-changer for space-faring. Extracting water from space might perhaps seem cumbersome, but when successfully done, water can be used as drinking water in space or for irrigation. It can further be 'split' into breathable air (oxygen) and rocket propellant (hydrogen). This would bring the prospect of neither having to add to a mission the weight of the fuel for a return flight, nor large stocks of drinking water and food. Lighter loads will reduce the cost of launching a mission significantly. Water extraction from asteroids is already considered a feasible practice. NASA's mission to study an asteroid named Bennu, came to the conclusion that water is probably the most important resource for extraction, even though the asteroid also contains heaps of gold and platinum.[12]

The State of Play: State-Funded Research vs. Commercial Exploitation

Almost all of the world's largest (state-led) space agencies have shown an interest in understanding asteroids and are discussing the feasibility of capturing and 'mining' one of them. Given the costs, the necessary upfront investments, and the clear business risks, the private sector has (with some exceptions) not yet jumped on the (long-term) opportunities. Following the general trend of the commercialisation of space, this picture is slightly changing, however, still very few dares to invest in (future) space mining operations.

In the bigger picture of space-related research, we know very little about asteroids.[13] In 1991, NASA's Galileo spacecraft was the first to generate clear images of asteroids. A decade later, in 2001, NASA's Near-Earth Asteroid Rendezvous (NEAR) spacecraft became the first spacecraft to touch down on an asteroid, after conducting a year-long study of Eros, a Near-Earth Asteroid. And in 2007, NASA's Dawn mission made it to the main asteroid belt to explore the asteroid Vesta, followed by a trip to Ceres, which is now actually considered a 'dwarf planet'. Meanwhile, in 2006, Japan's Hayabusa mission landed - and took off again - from a Near-Earth Asteroid called Itokawa. Hayabusa returned some asteroid material back to Earth in 2010 and Japan built on its experience to build a second asteroid sample-return mission (Hayabusa2). The second mission visited a near-Earth asteroid named Ryugu and conducted a study that included blasting the asteroid with an artificial crater. In December 2020, the mission returned pieces of Ryugu to Earth.

At the moment, there are several missions ongoing and planned, providing also a good sense of the main players in this field. NASA is certainly leading, with its OSIRIS-Rex mission expected back on Earth in September 2023 and mission Lucy scheduled to attempt the first-ever flyby to the asteroids out in Jupiter's orbit. NASA also has made the decision to go ahead with the Psyche mission, now scheduled to be launched in October 2023, meaning it will reach the metal-rich asteroid in 2029.[14] China is currently looking at asteroids from the perspective of protecting our planet and is planning to use one to test planetary defense techniques.[15] It is also planning its first asteroid sample return mission for 2025 (Tianwen 2 mission).[16] Russia, as well, is planning to join China as part of that mission.[17]



Source: NASA

Is There a Business Case for Space Mining?

A handful of private businesses have explored, or are exploring the idea of space mining as a commercially viable activity. In 2012-2013, a few private companies from the US were the first ones to explore this avenue. One of them was Planetary Resources (co-founded by Singularity University's executive chairman Peter Diamandis), which had set itself the long-term goal of mining asteroids. It started with a focus on designing and developing capabilities and tools such as telescopes and satellites. The company has certainly not yet mined any asteroid, but it did help with bringing the idea a step closer to reality. Its telescopes and satellites identified around 15,000 asteroids.[18]

More recently, the private market around space mining is witnessing a new wave of excitement. Several individual states, including the UAE, as well as regional organizations such as the European Union are putting increased emphasis on the opportunities of the space economy for private businesses. This new drive is being accelerated by technological advancements making space more accessible and a certain level of privatization and commercialization of the market for launchers and satellites. One of the companies that is currently receiving a fair amount of attention is AstroForge, which was founded this year (2022) by former SpaceX and former Virgin Galactic employees. Their vision is to mine and refine metals in space before bringing them to Earth; they have booked their first test mission with a SpaceX rocket for next year.[19] A second company making headlines is TransAstra, which currently focuses on creating rocket propellant from mined water. In its view, the biggest issue hampering progress is funding, stating that with sufficient funding, they could launch an asteroid mission in 5-7 years from now.[20]

Great Potential, Great Obstacles and Great (Unknown) Consequences

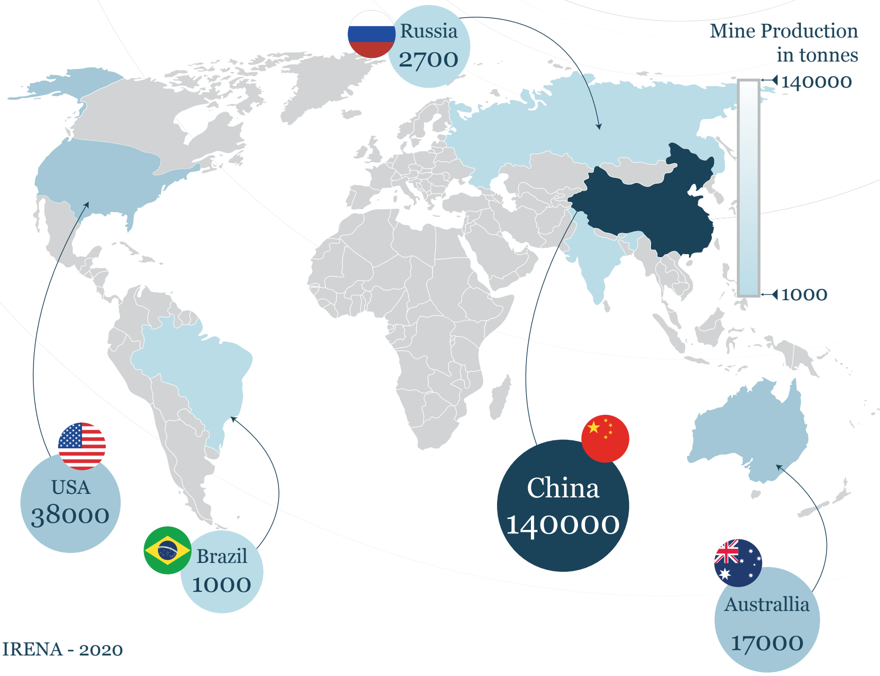
Space mining will not be a 'mainstream' activity anytime soon. While small steps are being taken, the road to a viable business case remains long and full of obstacles. That said, the current geopolitical competition, in combination with technological advances and the eagerness of some new space powers to build up their space-faring profiles, could potentially accelerate the current pace of progress and, who knows, at some point in the future, the science and practice of asteroid mining can take a leap forward.

Venturing into space to find out more about our solar system's asteroids really needs a combination of large investments, technological know-how, and a risk-tolerant or even risk-prone mind-set. Innovations are needed to reduce the costs of launching a space mission, otherwise it will be close to impossible to offset the transportation costs. The current mapping and resource analysis technology needs to be optimized. And to really get into 'industry scale' mining, a whole different set of skills and expertise is again needed. When it comes to that, current oil and gas producers are considered well-placed to assist.

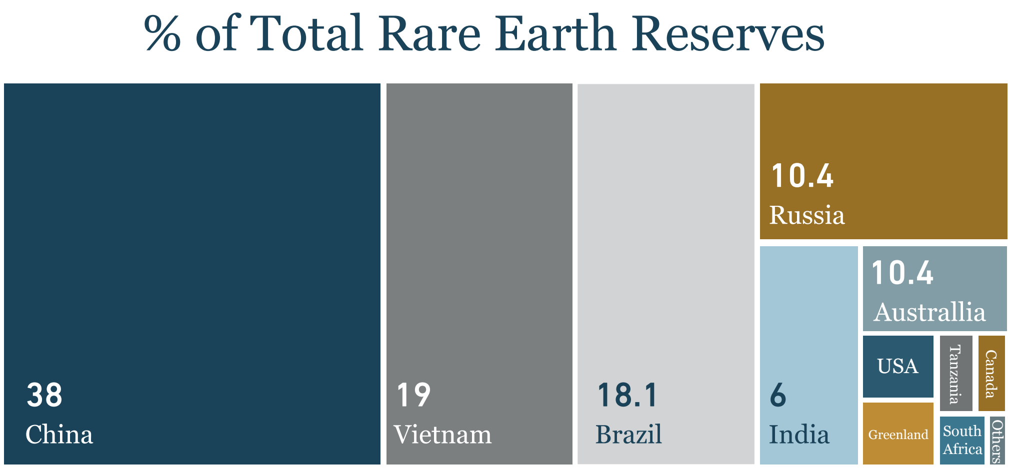
Lastly, we can expect a fierce legal and perhaps ethical discussion to unfold around space mining. Currently, the legal debate at the multilateral level is considered deadlocked, while several individual countries have unilaterally adopted laws with regard to space mining (US, Luxemburg, Japan, and the UAE).[21] Article 2 of the 1967 Outer Space Treaty reads that "space (...), including the moon and other celestial bodies, shall not be subject to national appropriation by claim of sovereignty, use or occupation, or in any other manner."[22] This does not really forbid anyone to use resources in space for profit, and the national laws in existence know to circumvent this by stating that property rights affect only the 'extracted resources and not the celestial bodies'. Governments can leave this grey legal area for now for what it is, but we can expect a large set of legal issues to arise when someone is actually successful in mining an object in space.

The Outer Space Treaty does for example declare that states can 'use' space for 'the benefit of mankind.' Based on that, there is an issue to be raised about what the mining of asteroids could potentially mean for the development of countries that are currently providers of rare earth elements. Some will point to the fact that, on the positive, inhumane mining practices and the exploitation that is often associated with this, can cease to exist. On the other hand, some economists predict that mining space would destroy the global raw material sectors on Earth. Developing countries would be hard(est) hit, losing significant export products, while not being in a position to develop any asteroid mining capacities themselves.[23] If, for example, a country like South Africa would lose its competitive advantage to mine platinum, that could wipe out a national industry currently providing for more than 8% of GDP and employing more than 450,000 people.[24]

Rare Earth Production



Source: IRENA - 2020



Source: IRENA

Conclusion

Mining asteroids is one of the new frontiers in our human venturing into space. For the moment, it remains a frontier far from within reach, as asteroid mining raises significant questions and massive hurdles to be overcome. The obstacles are both technological, economic, legal, and perhaps ethical in nature. At the same time, the economic, environmental, and political pressure to find alternatives to mining and depleting our own Earth is growing.

The economic imperative is probably clearest, given the massive wealth in natural resources asteroids carry with them and the general growing demand for such resources. The concept of space mining is, however, not just receiving attention from those seeking pure commercial opportunities, but also from those looking at accelerating the greenification of our economies and those that care about the sustainable use of Planet Earth's own resources. The environmental argument builds indeed around the fact that current technologies underpinning the world's energy transition are creating a large growth in demand for rare earth elements. The political pressure manifests itself as a desire for more strategic autonomy and diversification or nationalization of supply chains. After all, the current production and refinement of certain precious metals are in the hands of just a few countries, amongst them China, Russia, and unstable African countries.

That said, for the moment, the real costs and barriers vastly outweigh the potential benefits of asteroid mining. Where we are at costly, multiannual space missions through which we are slowly increasing our understanding of a small number of asteroids in our solar system. The road to any form of sustainable and profitable mining of these asteroids will be long, and requires massive investments, massive technological innovations, and some serious risk-taking and 'daredevil' states and entrepreneurs. Yet, after all, the potential might be there.

Endnotes

1. The Space Foundation, "The Space Report 2022", 27 July 2022 https://bit.ly/3EIgN42
2. "There's big money to be made in asteroid mining", Business Insider, 4 November 2016, https://bit.ly/3EMrJh2
3. "Rare Earth Magnet Market Outlook to 2035", Adamas Intelligence, April 2022, https://bit.ly/3EFBptK
4. Rene Kleijn, "The energy transition: a monumental shift in resources and policies", Leiden-Delft-Erasmus White Paper, 21 June 2022, https://bit.ly/3AWJIQV
5. "A Scarcity of Rare Metals Is Hindering Green Technologies", https://bit.ly/3XGAl1p
6. Dolf Gielen and Martina Lyons, "Critical Materials for the Energy Transition: Rare Earth Elements", IRENA, 2022.
7. Joris Teer and Mattia Bertolini, "Reaching breaking point: The semiconductor and critical raw material ecosystem at a time of great power rivalry", HCSS, 19 October 2022.
8. Jason Mitchell, "China's stranglehold of the rare earths supply chain will last another decade", Mining Technology, 26 April 2022, https://bit.ly/3AXjldv
9. "Psyche, the iron giant of asteroids, may be less iron than researchers thought", Brown University, 14 February 2022, https://bit.ly/3VFjfzh
10. Elizabeth Gamillo, "This Metal-Rich, Potato-Shaped Asteroid Could Be Worth $10 Quintillion", Smithsonian Magazine, 4 January 2022, https://bit.ly/3AUZcoe
11. Fiona Nichols-Fleming et al, "Porosity Evolution in Metallic Asteroids: Implications for the Origin and Thermal History of Asteroid 16 Psyche", JGR Planets, 1 February 2022. https://bit.ly/3ONppLd
12. "Water on Asteroid Bennu Could Mean ‹Pay Dirt' for Space Miners", Space.com, 19 March 2019, https://bit.ly/3iqkuUJ
13. "Exploration: Asteroids", European Space Agency, https://bit.ly/3ONrOG3
14. Jamie Carter, "NASA Will Launch 'Psyche' Mission To Explore Asteroid Worth More Than The Global Economy", 29 October 2022, https://bit.ly/3FcfVGc
15. Elizabeth Howell, "China plans asteroid deflection test in 2026: reports", Space.com, 18 July 2022, https://bit.ly/3ER3MFk
16. Andrew Jones, "China to launch Tianwen 2 asteroid-sampling mission in 2025", Space.com, 18 May 2022, https://bit.ly/3OLt9Nj
17. Andrew Jones, "Russia joins China's mission to sample an asteroid and study a comet", Space.com,23 April 2021, https://bit.ly/3GTeqxV
18. Shriya Yarlagadda "Economics of the Stars: The Future of Asteroid Mining and the Global Economy", Harvard International Review, 8 April 2022, https://bit.ly/3GULqpw
19. Tasmin Lockwood, "Asteroid mining startup founded by ex-SpaceX and Virgin Orbit engineers books first test mission with SpaceX", Business Insider, 2 June 2022, https://bit.ly/3VBoik1
20. "The first crop of space mining companies didn't work out, but a new generation is trying again", CNBC, 9 October 2022, https://cnb.cx/3u8x0e7

21. Nikola Schmidt and Martin Svec, “Breaking the Deadlock in the Space Mining Legal Debate”, New Space, 12 May 2022.

22. The United Nations Treaties on Outer Space. New York:United Nations, 1984. https://bit.ly/3VxXqBy

23. Shriya Yarlagadda “Economics of the Stars: The Future of Asteroid Mining and the Global Economy”

24. Vicky Stark, “South Africa Poised to Exploit Growing Demand for Platinum Group Metals”, VOA, 10 May 2022. https://bit.ly/3gIwwIk

Chapter 3

Space Cooperation Initiatives:

The new space economy and the role of the United Arab Emirates

Dr Namrata Goswami

The realm of space discovery competition commenced, when the erstwhile Union of Soviet Socialist Republics (USSR) launched the first human made satellite Sputnik (meaning way or path), on October 4, 1957. From that day onward, two strategic concepts emerged: That space is now accessible for humankind to utilize and that it could be a frontier for human expansionist spirit.

During the Cold War, the US and Soviet Union competed rigorously in the race to space. The Soviet Union was able to infiltrate this field through putting the first man in Low Earth Orbit (LEO), when Yuri Gagarin braved all odds and entered LEO on April 12, 1961. The US later was also able to have the first space mission to reach the moon in 1969. However, at a later stage of the war, some unprecedented forms of cooperation in space exploration between both superpowers was evident, when the Apollo-Soyuz missions were launched on July 15, 1975, and hatches between the two vehicles were opened on July 17, 1975, initiating their official joint activities in space.[1] Critically, this was supported by a strategic view of general détente that led to a thawing of mutual rivalry between 1969 and 1979.[2] During this decade, multiple discussions occurred between both sides regarding arm control, and various treaties were signed; including the Nuclear Non-Proliferation Treaty, Antiballistic Missile Treaty, and the Helsinki Final Act.[3]

In 1967, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and the Other Celestial Bodies or the Outer Space Treaty (OST) was signed.[4] The OST is meant to provide the basic framework for international space law. It states amongst other principles that "the exploration and use of outer space shall be carried out for the benefit and in the interest of all countries and shall be the province of all mankind… outer space is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[5]

Given the evolving dynamics of the global space exploration, this article highlights the changes to the space discourse in the post-Cold War period, discusses the commercial space activities, and analyses the avenues for space cooperation. The article further specifies the role of states such as the United Arab Emirates (UAE) in supporting the emergence of a novel era of space economy, but also in curbing the differences that great power competition can bring to bear.

Geopolitics and Outer Space Dynamics

Post the Cold War along with the rise of China as a 'space-power', the objectives of space missions shifted from sustaining supremacy in this new realm, to focusing on economic gains and national security protection.[6] Hence, the Chinese Mars' missions aim not only to preserve prominence, but also to cap returns on investments from its space infrastructure encompassing satellite internet, its BeiDou navigation system, its lunar robotic missions and plans for asteroid exploration and space mining. Wu Weiren, the chief architect of China's lunar mission states that China's *Chang'e* lunar missions' objectives are to discover resources and water ice of the lunar south pole.[7] Chinese scientists estimate that the Earth-Moon Economic Zone could return an annual investment of USD 10 trillion, once China establishes the logistic supply chain for cislunar space (space between Earth and

Moon).[8]

The US has followed suit with an 'Artemis' lunar program of its own, entailing partnerships with 20 states.[9] The Artemis Accords Preamble informs us that "the core of the Accords is the requirement that all activities will be conducted for peaceful purposes, per the tenets of the Outer Space Treaty."[10] The program incorporates establishing an Artemis base camp and safety zones on the Moon.[11] However, unlike China, the US does not have an Earth-Moon Economic Zone strategic vision. Most of its strategic thinking on space is limited to Earth's Orbit from a climate science, space exploration and defence perspectives. For the US, the moon is viewed as a pit stop to understand how to get to Mars, whereas for China, the moon is intrinsically important for its own sake.

Narratives of Cooperation

Given the growing global interest of space exploration and celestial bodies resources' extraction, there are key trends that are emerging within the space discourse calling for cooperation.

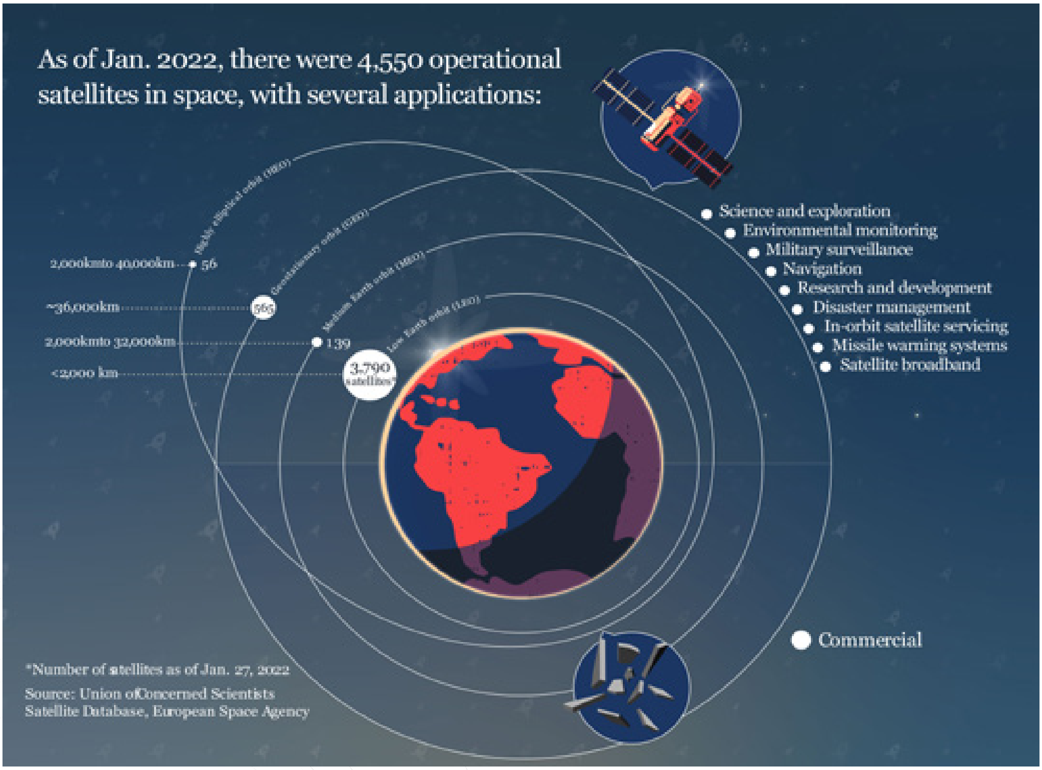
First, low Earth orbit based commercial and state funded space stations offer avenues for collaboration. China's Tiangong space station plans will not just host several international scientific experiments, but also plans to conduct unilateral experiments including testing reproduction in space. Axiom Space is building the world's first commercial space station called Axiom station,[12] billed as a successor to the International Space Station (ISS) slotted to deorbit in 2030.[13] This will manifest as an area of space cooperation between states and commercial enterprises.

Second, space cooperation is also evident in missions to Mars. China and Russia aspire to collaborate in their Mars missions. India and NASA collaborated in assisting the former to launch its Mars mission. UAE collaborated with Japan for the launch of its first Mars Hope Probe. The more advanced and abundant the space probes and Mars settlements, further cooperation between states as well as the private sector will be required to launch such missions. Companies, like SpaceX, have a clear goal of getting to Mars one day and this will require space regulations to administer private companies' permanent presence in space, without infringing upon the OST guidance of non-appropriation of territory.

Military Space Race

Despite the above-mentioned cooperative endeavours in space exploration, concerns about weaponization and militarisation of space have emerged since the First Gulf War of 1991. The US, during the war, relayed data from satellites to ground military stations for precise missile tracking and targeting, as well as 'out of sight' military force deployment. On the other hand, China has now developed a fleet of military space satellites that support its military space deployment and conducted an Anti-Satellite (ASAT) weapon test in 2007.

Recently, there has been a spurge of military capabilities expansion in outer space. For example, China established a People's Liberation Army Strategic Support Force (PLASSF) in 2015; the US established its Space Force in 2019; India tested an ASAT weapon in 2019 and established a new Defence Space Agency; and NATO declared space an operational domain.



Congestion in space especially LEO from space debris is another growing concern globally, as well as space traffic management given the growing number of satellite constellations in space and the limited strategic slots there. Accordingly, the UK sponsored General Assembly resolution 75/36 that "encouraged member states to study existing and potential threats and security risks to space systems, including those arising from actions, activities, or systems in outer space or on Earth."[14]

The Emerging Issue of Space Resource Utilization

Nowadays, there has been an evident shift in discourse on space from the focus on just space exploration to space resource extraction and space economy development. Resources like space based solar power (SBSP) have been picked up by countries like China, the UK and now the European Space Agency, a concept that aims to collect solar energy in space.

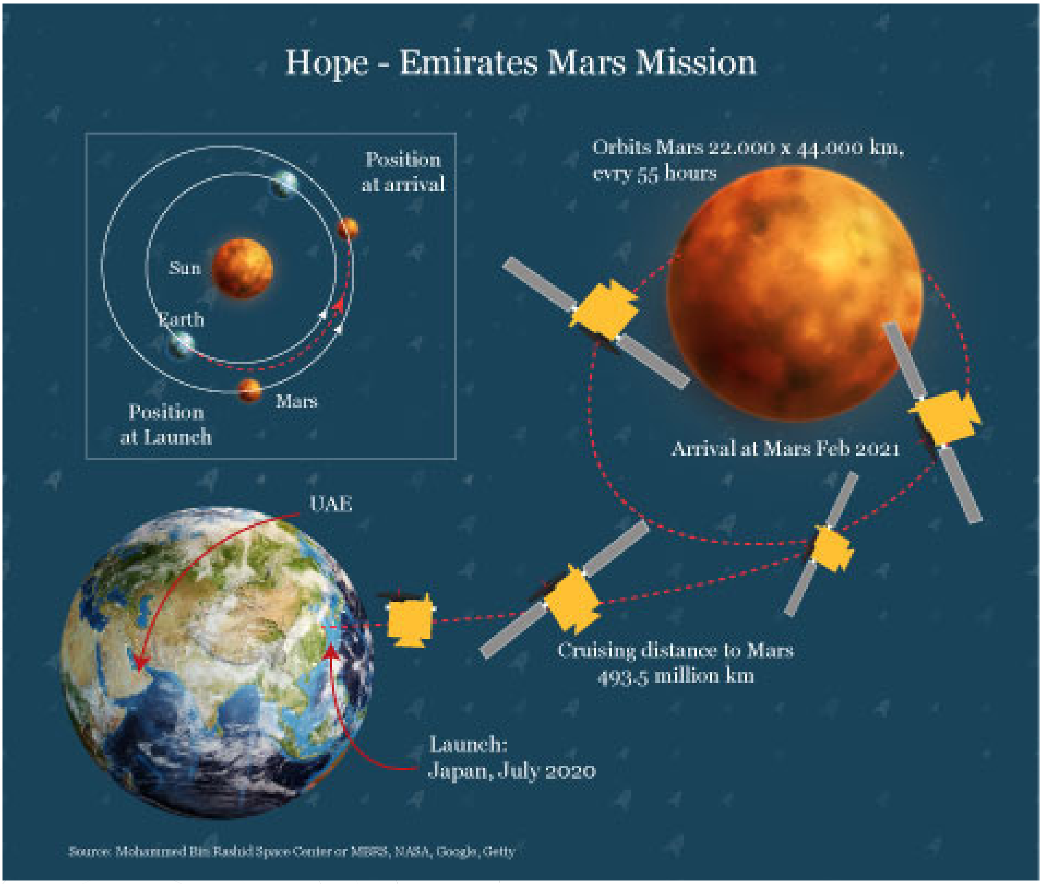
Asteroid mining is another notion that is becoming salient. There are approximately a million asteroids till date, with about 17,000 to 18,000 Near Earth Asteroids (NEA) and counting.[15] Some of the NEA are pure metal based, like platinum, and are worth trillions of dollars.[16] An example is 3554 Amun (diametre of 3.341 km), which is estimated to be worth USD 20 trillion.[17]

Lunar mining, of resources like water ice and Helium 3 are the focus of the US, China, India, Japan and Luxembourg. The United States passed the Commercial Space Launch Competitiveness Act in 2015 that allowed American citizens to keep the resources they mine. Luxembourg has passed its own space resource legislation.[18] Last year in December, Japan enacted its "Act on Promotion of Business Activities Related to the Exploration and Development of Space Resources (Act No. 83 of 2021) (Space Resources Act)."[19] Under the Japanese act, 'space resources' are defined as water, minerals, and other natural resources, which exist in outer space, including on the moon and other celestial bodies. (Art. 2, item 1.) The act stipulates as well that a person needs to obtain permission to able to pursue space resources extraction activities.[20] On November 4, 2022, Japan granted Japanese company ispace the first permit to extract resources on the Moon. According to Sanae Takaichi, Japan's Minister of State for Space Policy, "If ispace transfers ownership of lunar resources to NASA in accordance with its plan, it will be the first case in the world of commercial transactions of space resources on the Moon by a private operator… this will be a ground-breaking first step toward the establishment of commercial space exploration by private operators."[21]

The Role of the United Arab Emirates and Outer Space Exploration

It is in this era of evolving space economy, the UAE finds itself with resources to have a role in shaping the future space dynamics. With a space budget of about USD 5 billion, the UAE aims to develop its satellite capabilities and a lunar and

Mars program, to include a city on Mars by 2117. All this falls under the strategic plan to develop space infrastructure and prepare UAE to play critical role in space by 2030. In 2019, UAE sent the first Emirati astronaut, Hazza Al Mansoori to the International Space Station. The UAE Hope Probe to Mars that successfully entered Mars orbit in 2021 was built as part of a collaborative effort between the UAE space agency, the University of Boulder, Colorado and was launched on a Japanese rocket H-IIA from the Tanegashima Space Center in Japan. With an annual budget of USD 5.4 billion,[22] the UAE has a space budget that is capable of building into international collaboration and build the space capacities it requires, with an enabling internal regulatory and investment environment.



The UAE announced the establishment of its space agency, the Mohammad Bin Rashid Space Center, in 2014 with the explicit aim to develop the country as the regional hub for outer space activities in the Middle-East.[23] Some of the issues that the UAE Space Agency sought to deal with are utilizing space for management and prediction of global natural disasters, mitigate the effect of climate change and deal with the issue of resource scarcity.

The Emirates Mars Mission "Hope Probe" was the first uncrewed interplanetary mission that successfully launched on July 19, 2020 and reached Mars orbit on February 09, 2021. The probe studied the Mars environment for a year through:

> a) The Emirates Exploration Imager (EXI), a multi brand camera that imaged the Martian atmosphere in three visible bands and three ultraviolent band;
> b) The Emirates Mars Infrared Spectrometer (EMIRS), which was a cooperative experiment with Arizona State University and the Mohammad Rashid Space Center to measure dust, ice clouds as well as water vapor, and
> c) The Emirates Mars Ultraviolet Spectrometer (EMUS) that measured changes in Mars thermosphere, the hydrogen and oxygen structures in Mars exosphere.[24]

In fact, NASA's Maven and the UAE's Hope Probe signed a new partnership to share data. According to Maven's principal investigator, Shannon Curry, "Maven and the Emirati Mars Mission [EMM] are each exploring different aspects of the Martian atmosphere and upper-atmosphere system…combined, we will have a much better understanding of the coupling between the two, and the influence of the lower atmosphere on the escape to space of gas from the upper atmosphere."[25]

1. UAE collaborative efforts

The UAE space program is perceived as the first Arab probe to reach Mars and encourages the peaceful application of space research.[26] Moreover, the UAE space agency assumed membership of the International Space Exploration Coordination Group (ISECG).[27] Dr Mohammed Al Ahbabi, Director General of the UAE Space Agency, specifies, "certain countries might have problems here on Earth, but you will see them cooperate in space."[28] The UAE views its membership of the UN's Committee on the Peaceful Uses of Outer Space (COPUOS) as critical to call for the discussion of issues like ASAT weapon testing, responsible behaviour in space as well as space traffic and space debris management. In fact, through its membership, the UAE can play a mitigating role in encouraging major other states to contribute to space cooperation, mitigating the risks of space debris and the importance of de-weaponizing outer space. The UAE can also play a role in creating a safety based and regulated environment for the extraction of space resources and settlement of other celestial bodies.

In this regard, the UAE has signed a Memorandum of Understanding (MoU) with Luxembourg in 2017 in regard to space mining and space resources. The MoU is for a period of five years and covers space resource exploration and utilization, as well international space governance. Minister of State for Higher Education and Chairman of the Board of Directors of the UAE Space Agency Dr Ahmad bin Abdullah Humaid Belhoul Al Falasi said:

> Our collaboration with Luxembourg is aligned with the strategic visions of both the Space Agency and the UAE. This includes working towards closer international cooperation, establishing mutually beneficial international partnerships and exchanging scientific knowledge with the rest of the world. The UAE Space Agency recognizes the importance of international collaboration in the field of peaceful exploration of outer space, as this field is considered to be part of humankind's common heritage.[29]

As part of institutional building strategy, the UAE is an integral part of the United Nations Office for Outer Space Affairs (UNOOSA) and during the 50th anniversary celebrations of UNOOSA, the UAE space agency adopted a resolution to develop space as a key driver for the sustainable development of the planet, in tune with the 2030 Agenda for Sustainable Development.[30] In 2017, UNOOSA and the UAE Space agency signed a MoU to work on the legal aspects of space exploration for social and economic benefits, pledging to work for peaceful regional cooperation in space.[31] Then in 2020, UAE space agency and UNOOSA signed another MoU to establish a UNOOSA project office in UAE. The purpose of this further collaboration is to develop UAE as a global hub for developing and fostering concepts like space sustainability, support dialogue, assess the future space trends including the economic development of space capacities and also to develop responsible activities in space. Access to space4all is an initiative UNOOSA is working on and the UAE has agreed to become a key contributor. Former UNOOSA Director Simonetta Di Pippo said: "Through this agreement, UNOOSA and the UAE take a big step towards establishing a new international hub for space sustainability.... The UAE, with its steadfast commitment to the Sustainable Development Goals and significant achievements in the space sector, is the perfect partner for this ambitious plan."[32]

2. UAE National Space Strategy

In March 2019, the UAE adopted its National Space Strategy 2030. The National Space Strategy aims to develop UAE into a space exploration and technology hub, while at the same time build upon the regulatory framework within the country. The space strategy pushes for commercial development of space, raising awareness of the importance of the space sector to Emirati youth, and for the collaboration between the public and private sector, as well as the academia in developing space capabilities. Chaired by His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President, Prime Minister and Ruler of Dubai, the Cabinet meeting adopted the National Space Strategy with a vision to that "the National Space Strategy aims at achieving UAE's vision in the field of space exploration, technologies, and applications. It also constitutes one of the pillars of the regulatory framework for the space sector in the country which consists of four components; National Space Policy, Space Sector Law, Space Regulations, and National Space Strategy."[33]

Conclusion

With the on-going international endeavours for furthering space exploration, the UAE will be able to have a role in this futuristic frontier and the evolving space economy. It should be noted that the UAE's ambitions for space can be crystalized into four distinct categories. Firstly, UAE to become a global hub for space development. Secondly, it could promote regional and international mechanisms to establish space sustainability, encouraging responsible behaviour in space, and mitigate climate change. Thirdly, it could increase internal Emirati space capacity by taking advantage of international collaborations. In that sense, the UAE space program is a unique model of building international partnerships to develop its space sector. Finally, it can advocate the development of space regulation that anticipate commercial development of space and ensure access to space for the use of all.

Endnotes

1. NASA, “Apollo-Soyuz Test Project Overview”, https://www.nasa.gov/apollo-soyuz/overview (Accessed November 11, 2022).
2. Keith L. Nelson, The Making of Détente: Soviet American Relations in the Shadow of Vietnam (Washington D.C; John Hopkins University, 1995).
3. Colin S. Grey, “Détente, Arms Control and Strategy: Perspectives on SALT”, The American Political Science Review, 70/4 (December 1976), pp. 1242-1256.
4. United Nations Office for Outer Space Affairs, “Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies”, at https://bit.ly/3BknqJ9
5. Ibid.
6. Namrata Goswami, “China in Space: Ambitions and Future Conflict”, Strategic Studies Quarterly, 2018, at https://bit.ly/3VfWHFk (Accessed November 11, 2022).
7. Weijie Zhao and Chi Wang, “China’s lunar and deep space exploration: touching the Moon and exploring the Universe”, National Science Review, Vol. 6, No, 6 (November 2019), pp.1274–1278, at https://academic.oup.com/nsr/article/6/6/1274/5550235 (Accessed on November 11, 2022).
8. Cao Siqi, “China Mulls $10 trillion Earth Moon Economic Zone”, The Global Times, November 1, 2019, at https://www.globaltimes.cn/content/1168698.shtml (Accessed November 11, 2022).
9. Varun Godinho, “UAE Space Agency Signs NASA’s Artemis Accords for Cooperation in Space Exploration”, Gulf Business, October 14, 2020, https://bit.ly/3FdTKQ9 (Accessed on November 11, 2022).
10. “NASA Artemis Accords”, at https://go.nasa.gov/3GXGHDt (Accessed November 11, 2022).
11. Ibid.
12. Axiom Space, at https://www.axiomspace.com/ (Accessed on November 9, 2022).
13. Jennifer Hasan and Christian Davenport, “When the International Space Station Retires, it will plunge into the Ocean to Die:, says NASA”, The Washington Post, February 03, 2022, https://wapo.st/3OVDN4f (Accessed November 11, 2022).
14. “Report of the Secretary-General on Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviors (2021) – UNODA.” United Nations. United Nations, 2021. https://www.un.org/disarmament/topics/outerspace-sg-report-outer-space-2021/.
15. Jeff Desjardins, “There’s Big Money to be Made in Asteroid Mining”, Business Insider, November 3, 2016 at https://bit.ly/3UiKzlC (Accessed on June 3, 2019).
16. John Lewis, Asteroid Mining 101: Wealth for the New Space Economy (San Jose, CA: Deep Space Industries, 2014).
17. Marc M. Cohen, et.al., “Robotic Asteroid Prospector (RAP)”, Final Report, July 09, 2013, accessed September 30, 2019, https://www.nasa.gov/sites/default/files/files/Cohen_2012_PhI_RAP.pdf
18. Commercial Space Launch Competitiveness Act 2015, at https://www.congress.gov/

bill/114th-congress/house-bill/2262/text (Accessed November 21, 2022).

19. "Japan: Space Resources Act Enacted", Library of Congress, https://bit.ly/3UiyZHh (Accessed November 10, 2022).

20. Ibid.

21. Doug Messier, " Japanese Government Grants License to ispace to conduct business activity on the Moon", Parabolic Arc, November 09, 2022, https://bit.ly/3VkNBHu (Accessed on November 10, 2022).

22. Jill Stuart, "The Emirates Paves Way for a Middle East Space Program with its Mission to Mars", The Conversation, July 22, 2014, https://bit.ly/3VC8r4F (Accessed on November 10, 2022).

23. Mohammad Bin Rashid Space Center, accessed September 14, 2018, https://bit.ly/2QgOuT8

24. Jeremy Rehm and Meghan Bartels, "UAE Hope Mars Orbiter: The Arab World's First Interplanetary Mission", Space.com, May 03, 2021, https://bit.ly/3u9NN0a (Accessed on November 10, 2022).

25. NASA, "NASA, UAE Mars Mission Agree to Share Science Data", April 12, 2022, https://go.nasa.gov/3OLRlPQ (Accessed on November 10, 2022).

26. Mohammad Bin Rashid Space Center at https://bit.ly/3EMIt7X (Accessed on November 21, 2022).

27. "International Space Exploration Coordination Group, "Annual Report 2015" 2018 at https://bit.ly/2TEEBgZ (Accessed on November 21, 2022).

28. Thamer Al Subaihi, "UAE Space Programme a Conduit for Cooperation", The National, November 28, 2015, https://bit.ly/2TJSOZZ (Accessed on November 21, 2022).

29. "Luxembourg and the United Arab Emirates Sign MoU on Space Resources", Space Resouces.LU, October 10, 2017, https://bit.ly/2ReoCEG (Accessed on November 21, 2022).

30. Ibid.

31. The UNISPACE +50 Process and Space 2030 Agenda", https://www.un-spider.org/sites/default/files/Keynote-LucStPierre-UNOOSA_0.pdf (Accessed on November 21, 2022).

32. Robert.wickramatunga. "United NationsOffice for Outer Space Affairs." Press Release: UNOOSA and UAE Space Agency announce agreement to advance space sustainability, 2020. https://bit.ly/3GUU3QX

33. "UAE Outlines National Space Strategy to 2030", Spacewatch Global, 2019, https://spacewatch.global/2019/03/uae-outlines-national-space-strategy-to-2030/ (Accessed November 11, 2022). Also see United Arab Emirates, "National Space Strategy 2030", https://bit.ly/3itM0Ak (Accessed November 11, 2022).

Bibliography

“ Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty), Jan. 27, 1967 18 UST 2410; 610 UNTS 205; 6 ILM 386 (1967) https://bit.ly/3BiGAiz

“A Scarcity of Rare Metals Is Hindering Green Technologies”, https://bit.ly/3XGAl1p

“Cybersecurity Threats in Space: A Roadmap for Future Policy,” Wilson Center, https://bit.ly/3AUmKKc

“Exploration: Asteroids”, European Space Agency, https://bit.ly/3ONrOG3

“International Space Exploration Coordination Group, “Annual Report 2015” 2018 at https://bit.ly/2TEEBgZ

“Luxembourg and the United Arab Emirates Sign MoU on Space Resources”, Space Resouces.LU, October 10, 2017, https://bit.ly/2ReoCEG

“NASA Artemis Accords”, at https://go.nasa.gov/3GXGHDt

“Psyche, the iron giant of asteroids, may be less iron than researchers thought”, Brown University, 14 February 2022, https://bit.ly/3VFjfzh

“Rare Earth Magnet Market Outlook to 2035”, Adamas Intelligence, April 2022, https://bit.ly/3EFBptK

“Report of the Secretary-General on Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviors (2021) – UNODA.” United Nations. United Nations, 2021. https://www. un.org/disarmament/topics/outerspace-sg-report-outer-space-2021/.

“The first crop of space mining companies didn’t work out, but a new generation is trying again”, CNBC, 9 October 2022, https://cnb.cx/3u8x0e7

“There’s big money to be made in asteroid mining”, Business Insider, 4 November 2016, https://bit.ly/3EMrJh2.

“UAE Outlines National Space Strategy to 2030”, Spacewatch Global, 2019, https://spacewatch.global/2019/03/uae-outlines-national-space-strategy-to-2030/ Also see United Arab Emirates, “National Space Strategy 2030”, https://bit.ly/3itM0Ak

“Water on Asteroid Bennu Could Mean ‹Pay Dirt› for Space Miners”, Space.com, 19 March 2019, https://bit.ly/3iqkuUJ

“Japan: Space Resources Act Enacted”, Library of Congress, https://bit.ly/3UiyZHh

Andrew Jones, “China to launch Tianwen 2 asteroid-sampling mission in 2025”, Space.com, 18 May 2022, https://bit.ly/3OLt9Nj

Andrew Jones, “Russia joins China’s mission to sample an asteroid and study a comet”, Space.com,23 April 2021, https://bit.ly/3GTeqxV

Atkins, Scott, Martyn Taylor , and Holly McAdam. “Governance in Outer Space: The Case for a New Global Order.” Global law firm | Norton Rose Fulbright, 2022. https://www.nortonrosefulbright.com/en/knowledge/publications/e8862684/governance-in-outer-space-the-casefor-a-new-global-order.

Bell, Jennifer. “Arab World’s First Moon Mission Delayed by a Day.” Al Arabiya English, November 30, 2022. https://english.alarabiya.net/News/gulf/2022/11/30/Final-countdownArab-world-s-first- Moon-mission-undergoes-last-preparations.

Cao Siqi, “China Mulls $10 trillion Earth Moon Economic Zone”, The Global Times, November 1, 2019, at https://www.globaltimes.cn/content/1168698.shtml

Chapter 2 22.The United Nations Treaties on Outer Space. New York:United Nations, 1984.

Colin S. Grey, “Détente, Arms Control and Strategy: Perspectives on SALT”, The American Political Science Review, 70/4 (December 1976), pp. 1242-1256.

Commercial Space Launch Competitiveness Act 2015, at https://www.congress.gov/ bill/114th-congress/house-bill/2262/text (Accessed November 21, 2022).

Dolf Gielen and Martina Lyons, “Critical Materials for the Energy Transition: Rare Earth Elements”, IRENA, 2022.

Doug Messier, “Japanese Government Grants License to ispace to conduct business activity on the Moon”, Parabolic Arc, November 09, 2022, https://bit.ly/3VkNBHu

Elizabeth Gamillo, “This Metal-Rich, Potato-Shaped Asteroid Could Be Worth $10 Quintillion”, Smithsonian Magazine, 4 January 2022, https://bit.ly/3AUZcoe

Elizabeth Howell, “China plans asteroid deflection test in 2026: reports”, Space.com, 18 July 2022, https://bit.ly/3ER3MFk

Encyclopædia Britannica, s.v. “Space Law,” https://bit.ly/3UqkjWM 9. P. J. Blount, “Renovating Space: The Future of International Space Law,” Denver Journal of International Law & Policy 40, no. 1 (January 2011). 1

Fabio Tronchetti, “The Outer Space Treaty, the Moon Agreement and the 1996 Declaration on Space Benefits,” in The Exploitation of Natural Resources of the Moon and Other Celestial Bodies: A Proposal for a Legal Regime (Leiden: Martinus Nijhoff, 2009), 12.

Feyisola Ruth Ishola, Oluwabusola Fadipe, and Olaoluwa Colin Taiwo, “Legal Enforceability of International Space Laws: An Appraisal of 1967 Outer Space Treaty,” New Space 9, no. 1 (2021): 33–37, https://doi.org/10.1089/space.2020.0038.

Fiona Nichols-Fleming et al, “Porosity Evolution in Metallic Asteroids: Implications for the Origin and Thermal History of Asteroid 16 Psyche”, JGR Planets, 1 February 2022. https:// bit.ly/3ONppLd

https://bit.ly/3VxXqBy

Ishola, Fadipe, and Taiwo, “Legal Enforceability of International Space Laws: An Appraisal of 1967 Outer Space Treaty,” 33–37.

Jamie Carter, “NASA Will Launch ‘Psyche’ Mission To Explore Asteroid Worth More Than The

Global Economy”, 29 October 2022, https://bit.ly/3FcfVGc 1

Jason Mitchell, “China’s stranglehold of the rare earths supply chain will last another decade”, Mining Technology, 26 April 2022, https://bit.ly/3AXjldv

Jeff Desjardins, “There’s Big Money to be Made in Asteroid Mining”, Business Insider, November 3, 2016 at https://bit.ly/3UiKzlC (Accessed on June 3, 2019).

Jennifer Hasan and Christian Davenport, “When the International Space Station Retires, it will plunge into the Ocean to Die:, says NASA”, The Washington Post, February 03, 2022, https://wapo. st/3OVDN4f

Jeremy Rehm and Meghan Bartels, “UAE Hope Mars Orbiter: The Arab World’s First Interplanetary Mission”, Space.com, May 03, 2021, https://bit.ly/3u9NN0a (Accessed on November 10, 2022).

Jill Stuart, “The Emirates Paves Way for a Middle East Space Program with its Mission to Mars”, The Conversation, July 22, 2014, https://bit.ly/3VC8r4F

Joanne Irene Gabrynowicz, “The ‘Province’ and ‘Heritage’ of Mankind Reconsidered: A New Beginning” (paper presented at the Second Conference on Lunar Bases and Space Activities of the 21st Century, September 1992). https://bit.ly/3VjPlAF

John G. Wrench, “Non-Appropriation, No Problem: The Outer Space Treaty Is Ready for Asteroid Mining,” Case Western Reserve Journal of International Law 51, no. 1 (2019), https:// doi.org/ https://scholarlycommons.law.case.edu/jil/.

John Lewis, Asteroid Mining 101: Wealth for the New Space Economy (San Jose, CA: Deep Space Industries, 2014).

Joris Teer and Mattia Bertolini, “Reaching breaking point: The semiconductor and critical raw material ecosystem at a time of great power rivalry”, HCSS, 19 October 2022.

Kathryn Hambleton, ed., “Around the Moon with NASA’s First Launch of SLS with Orion,” NASA, August 23, 2022, https://go.nasa.gov/3VlpZ5u

Keay Davidson, “Final Frontier for Lawyers – Property Rights in Space / Land Claims, Commercial Schemes and Dreams Have Legal Eagles Hovering,” SFGATE, January 16, 2012, https://bit.ly/3O-PRyBE 17 Rules of Engagement

Keith L. Nelson, The Making of Détente: Soviet American Relations in the Shadow of Vietnam (Wash- ington D.C; John Hopkins University, 1995).

Launius, The Smithsonian History of Space Exploration: From the Ancient World to the Extraterrestrial Future, 13

Marc M. Cohen, et.al., “Robotic Asteroid Prospector (RAP)”, Final Report, July 09, 2013, accessed September 30, 2019, https://www.nasa.gov/sites/default/files/files/Cohen_2012_PhI_RAP.pdf

Michael Beaver, “Current Space Law Limitations and Its Implications on Outer Space Conflicts,” E-International Relations, June 17, 2015, https://bit.ly/3F7XeT9

Muhammad Bin Rashid Space Center, https://bit.ly/3EMIt7X

Namrata Goswami, “China in Space: Ambitions and Future Conflict”, Strategic Studies Quarterly, 2018, at https://bit.ly/3VfWHFk

NASA, “Apollo-Soyuz Test Project Overview”, https://www.nasa.gov/apollo-soyuz/overview

NASA, “NASA, UAE Mars Mission Agree to Share Science Data”, April 12, 2022, https://go.nasa.gov/3OLRlPQ

Nikola Schmidt and Martin Svec, “Breaking the Deadlock in the Space Mining Legal Debate”, New Space, 12 May 2022.

Patricia Lewis, “Create a Global Code of Conduct for Outer Space – Chatham House,” Final Legal Frontier, October 14, 2020, https://bit.ly/3AUu3Se

Rene Kleijn, “The energy transition: a monumental shift in resources and policies”, Leiden-Delft-Erasmus White Paper, 21 June 2022, https://bit.ly/3AWJIQV

Robert.Wickramatunga. “United NationsOffice for Outer Space Affairs.” Press Release: UNOO- SA and UAE Space Agency announce agreement to advance space sustainability, 2020. https://bit.ly/3GUU3QX

Roger D. Launius, The Smithsonian History of Space Exploration: From the Ancient World to the Extraterrestrial Future (Washington, DC: Smithsonian Books, 2018), 13

Scott Atkins and Kai Luck, “Outer Space: The New Frontier for Restructuring and Insolvency,” International Corporate Rescue 18, no. 5 (September 2021).

Sharma, Anoushka. “Russian Cosmonauts Spacewalk Outside Space Station Orbiting above Brazil.” NDTV.com. NDTV, November 19, 2022. https://www.ndtv.com/world-news/russian-cosmonauts-spacewalk-outside-space-station-orbiting-above-brazil-3536498.

Shoma Bhattacharjee, ed., “A Look at Countries with Commercial Space Missions and Their Private Players,” cnbctv18.com, November 18, 2022, https://bit.ly/3ARj8sg

Shriya Yarlagadda “Economics of the Stars: The Future of Asteroid Mining and the Global Economy”, Harvard International Review, 8 April 2022, https://bit.ly/3GULqpw

Shriya Yarlagadda “Economics of the Stars: The Future of Asteroid Mining and the Global Economy”

Tanja L. Masson-Zwaan and Mahulena Hofmann, “Space Resources Activities,” Essay, in Introduction to Space Law (Alphen aan den Rijn, the Netherlands: Wolters Kluwer, 2019), 7–8.

Tasmin Lockwood, “Asteroid mining startup founded by ex-SpaceX and Virgin Orbit engineers' books first test mission with SpaceX”, Business Insider, 2 June 2022, https://bit.ly/3VBoik1

Thamer Al Subaihi, “UAE Space Programme a Conduit for Cooperation”, The National, November 28, 2015, https://bit.ly/2TJSOZZ (Accessed on November 21, 2022).

The Space Foundation, “The Space Report 2022”, 27 July 2022 https://bit.ly/3EIgN42

The UNISPACE +50 Process and Space 2030 Agenda”, https://www.un-spider.org/sites/default/files/Keynote-LucStPierre-UNOOSA_0.pdf

Tosaporn Leepuengtham, “International Space Law and Its Implications for Outer Space Activities,” The Protection of Intellectual Property Rights in Outer Space Activities (2017): 8–31, https://doi.org/10.4337/9781785369629.00005.

United Nations Office for Outer Space Affairs, “Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies”, at https://bit.ly/3BknqJ9

Varun Godinho, “UAE Space Agency Signs NASA’s Artemis Accords for Cooperation in Space Explo- ration”, Gulf Business, October 14, 2020, https://bit.ly/3FdTKQ9

Vicky Stark, “South Africa Poised to Exploit Growing Demand for Platinum Group Metals”, VOA, 10 May 2022. https://bit.ly/3gIwwIk

Weijie Zhao and Chi Wang, “China’s lunar and deep space exploration: touching the Moon and exploring the Universe”, National Science Review, Vol. 6, No, 6 (November 2019), pp.1274–1278, at https://academic.oup.com/nsr/article/6/6/1274/5550235

Weinzierl , Matthew, and Mehak Sarang. “The Commercial Space Age Is Here.” Harvard Business Review, February 12, 2021. https://bit.ly/3OOdhcQ

Ishola, Fadipe, and Taiwo, “Legal Enforceability of International Space Laws: An Appraisal of 1967 Outer Space Treaty,” 33–37.

Woo, Ryan, and Liangping Gao. “Chinese Astronauts Board Space Station in Historic Mission.” Reuters. Thomson Reuters, November 30, 2022. https://www.reuters.com/lifestyle/science/ china-launches-crewed-spacecraft-chinese-space-station-state-television-2022-11-29/.

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