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Understanding the Lunar Governance Challenge

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The next decade is likely to witness a surge in human activity on the Moon, creating new challenges for lunar governance. This document provides an overview of the existing treaties, declarations, informal agreements, and legislations that cover lunar activity. It identifies the key challenges and considers scenarios under which these are most likely to be successfully addressed.

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Executive Summary

- Human activity on the Moon is set to spike over the coming decade as spacefaring states pursue ambitious projects for lunar exploration, habitation, and resource utilisation.

- Lunar activity is driven by scientific, political, economic, and even strategic considerations. International competition for prestige and technological supremacy will spur exploration of the Moon.

- The present architecture of lunar governance consists of a mix of ageing treaties and informal agreements that have little to say about pressing issues such as deconfliction, heritage sites, and resource utilisation.

- The Artemis Accords cannot replace the need for a revised multilateral, legally binding treaty governing human activity on the Moon.

- As a spacefaring state with significant lunar ambitions, India's preferred outcome would be to place reasonable restraints on the activities of more advanced spacefarers, while ensuring its own freedom of action.

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I. Introduction

Four developments in 2023 have made the challenge of lunar governance more urgent than before for India. One, in April, the Indian government released an ambitious space policy that allows non-governmental entities (NGEs) to mine asteroids and other celestial bodies including the Moon. Two, in June, India became a signatory to the US-led Artemis Accords, which lay out a series of principles for lunar activity. Three, in August, India's Chandrayaan-3 spacecraft conducted a successful soft-landing near the Moon's south pole. Four, in October, India announced its intention to land one of its nationals on the Moon by 2040.

These developments are part of broader international trends. A combination of new technology, private sector innovation, scientific discovery, and great-power rivalry is driving renewed interest in the Moon. The new technologies lie not only in the realm of semiconductors, electronics, and sensors but also reusable rockets and spacecrafts. Private companies have slashed the costs of both launching space objects and the space objects themselves. The discovery of water-ice on the Moon has triggered interest in exploring the lunar poles. Finally, rivalry between the

US and China is fuelling their plans to set up a sustained presence on the Moon.

In 2020, the US formally announced its Artemis programme, which intends to return humans to the Moon and eventually use the Moon as a springboard for sending crews to Mars and beyond. The following year, China's National Space Administration (CNSA) entered into an agreement with Russia's space agency Roscosmos to build an International Lunar Research Station (ILRS). While Western sanctions have hurt Russia's space capabilities, China continues to pursue its lunar projects. Having already demonstrated impressive capabilities with its Chang'e-4 and Chang'e-5 missions, China plans to conduct extensive lunar surveys and deliver cargo to landing spots before eventually sending humans to the Moon.

Besides the US, China, and Russia, other states, including India, Japan, and the UAE, have multiple uncrewed lunar missions lined up. The once pristine surface of the Moon is likely to witness a sudden influx of human-made objects and junk. For lunar exploration to be sustainable and perhaps profitable one day, states will need to agree on some basic rules at an early stage.

Some of the key issues in lunar governance today include ensuring sustainable operations that minimise harmful contamination, deconflicting

activity, and claims of heritage sites. The largest outstanding issue remains the use of the Moon's resources, whether to support space operations or to return to Earth for commercial purposes.

This document is intended to serve both as a brief and accessible primer on the subject and to act as a springboard for further discussion. The next section of this document looks at the drivers of lunar exploration. The third section provides an overview of lunar governance as it exists. The fourth section looks at the implications for India and the world.

II. Drivers of Lunar Exploration

The Moon's Physical Geography

The Moon is Earth's only natural satellite, orbiting the planet every 27 days at an average distance of 384,000 kilometres.[1] Its equatorial radius is 27% the size of Earth's but its lower density means it exerts only 16% as much gravitational force.[2]

The Moon's total surface area is 7.4% that of Earth's.[3] Much of it is divided into highlands and lowlands. The highlands include both flat expanses and mountains. These regions are pock-marked by ancient impact craters from

asteroids, meteorites and comets.[4] The lowlands are smoother and darker, the result of magma flows from a later geological period and featuring fewer craters. They are often called *mare* or seas.[5]

Conditions on the Moon are radically different from those on Earth, which has a thick atmosphere (to filter solar radiation and burn off small meteors) and a strong magnetic field (to deflect solar winds and cosmic radiation). In contrast, the Moon's atmosphere and magnetic fields are negligible, meaning most of its surface is constantly bombarded by solar winds, radiation, and micrometeoroids. The Moon also undergoes large temperature swings during the lunar day, which lasts 29 Earth days, equally divided between daylight and nighttime. During daylight temperatures can reach as high as 127C only to dip as low as -173C at night.[6]

Most of the Moon's surface consists of a combination of rocks, stones, and powdery soil that are together referred to as lunar regolith. Unlike the Earth's soil, the lunar regolith is dry and contains no organic matter.[7] Exposure to radiation and solar winds also imparts electrostatic charge to lunar dust causing it to attach itself to equipment and space suits.[8] Astronauts from the Apollo missions found that fine and jagged lunar soil clogged machinery, damaged their suits, and entered their habitation modules.[9] Crews also experienced respiratory symptoms ranging from sneezing to blocked noses.[10]

The Moon is not completely dry. Thanks in part to India's 2009 Chandrayaan-1 mission, scientists now believe the Moon has water in extremely small concentrations across its surface, typically trapped in minerals.[11] However, water concentrations change dramatically in the lunar poles. Due to the Moon's smaller tilt, its poles have several permanently shadowed regions (PSRs) that receive no sunlight and are believed to contain at least 600 million tons of water ice dating back billions of years.[12]

Scientific Drivers

Scientific interest in the Moon stems from three goals. One, to study the Moon itself; two, to conduct scientific experiments in the lunar environment; and three, to use the Moon as a springboard for deep space exploration.

The Moon is regarded as a valuable time capsule to better understand the Earth.[13] Firstly, it is widely believed to have broken away from the Earth 4.5 billion years ago following a planetary collision. Secondly, the Moon's craters retain evidence of primordial bombardment from asteroids and comets. These factors help scientists better understand the Earth's own early history.[14] The Moon also offers clues into volcanic activity, and the Earth's magnetic field.[15]

Furthermore, tests on the Moon would allow scientists to better understand the effects of lunar gravity on the behaviour of materials. The

lunar environment may also provide a conducive environment to conduct experiments in quantum physics.[16]

Finally, and most consequentially for this document, the Moon can serve as a launching pad for both uncrewed and crewed missions to Mars, the asteroid belt and beyond. Refuelling may become a crucial function on the Moon if methods are established to extract water ice in sufficient quantities and separate it into hydrogen and oxygen for fuel and oxidizer respectively. Producing hydrogen and oxygen in-situ on the Moon could drastically reduce the amount of fuel that launchers must carry out of the Earth's gravity well. The Moon's lower gravity and negligible atmosphere mean spacecraft need to expend only about 4% as much energy for launch as they would on Earth.[17] The result, therefore, could be reduced launch costs and increased payloads and range.

The Moon's potential as a deep space launch pad is integral to states' lunar ambitions. Public documents of NASA's Artemis programme repeatedly mention the project's role in preparing for crewed missions to Mars.[18] The planned Lunar Gateway space station is also similarly described as a stepping-stone for longer-range missions.[19] ISRO officials have also at various points characterised the Moon as a step on the way to planetary exploration.[20]

Political & Economic Drivers

Space exploration is expensive and support for it hinges on the perceived political and economic upsides it can bring. Lunar missions demonstrate a state's spacefaring prowess and have the potential to inspire the young to take on careers in science and technology. More tangibly, such complex undertakings provide an opportunity for national space agencies and private enterprises to develop new technologies, gain experience, and retain highly skilled talent. Besides supporting the space sector, lunar exploration can also provide impetus to a wider range of high-technology industries, thus creating lucrative spin-offs and generating economic benefits.

There is ample evidence for these drivers in both the Moon race of the 1960s and the ongoing spurt in lunar projects. The Apollo programme was spurred by an American conviction that it had lost prestige to the Soviets.[21] Indeed, the John F. Kennedy administration, which initiated the Apollo programme, believed that winning the space race would increase international backing for the United States in the Cold War.[22] The US was also determined to reassert its technological superiority after the Soviets beat it at launching the first satellite and the first person into space.[23] Less obviously, the programme helped support the US aerospace industry[24] and was a crucial early customer for the fledgling microchip sector.[25] As Kennedy's speechwriter Ted Sorensen later put it, Apollo "was the making

of America's superiority in space, and all the scientific, diplomatic, and national security benefits that followed".[26]

Recent lunar exploration projects are also politicised and competitive. The Russia-China ILRS project and the US-led Artemis programme are often described as rivals in a 'space race'. Officials from China and the US have also expressed mistrust about the other's intentions. In 2017, the head of China's lunar programme, Ye Peijian argued if China failed to go to the Moon, other states would "take over" and bar the Chinese.[27] In 2023, NASA administrator Bill Nelson mirrored those concerns, warning that it was "not beyond the realm of possibility" that the Chinese say, "Keep out, we're here, this is our territory." He added, "If you doubt that, look at what they did with the Spratly Islands," referring the disputed archipelago in the South China Sea.[28] Even recent uncrewed missions to the Moon's polar regions and their environs like the Chandrayaan-3 are framed as being part of a global race for lunar water ice. While these claims may be overblown, they serve the purpose of bolstering domestic support for costly and risky space exploration programmes.

Economics may help sustain lunar exploration in the coming decades. The private sector is more heavily involved in all aspects of lunar exploration from launch services to sensors and spacecraft. This can help encourage efficiency and innovation as well as speed up the diffusion of technology into other sectors. The most optimistic projections envision the creation of

a lunar economy driven by transportation services, lunar data, and resource utilisation.[29] While the future may bring some commercial opportunities like tourism and commercial mining that don't directly involve governments, lunar exploration will be primarily driven by government spending for the next two decades.

Strategic Drivers[30]

The strategic potential of the Moon is, at best, theoretical and speculative. As a remote and desolate geography, the Moon could offer opportunities to conceal military capabilities or station them out of the reach of adversaries. This was the logic underpinning Project Horizon, a 1959 US Army study that proposed setting up a base on the Moon operated by a crew of 12.[31] The aims of the proposal included scientific research and deep space exploration. However, it also viewed the base as an observation post, a place "where future military deterrent forces could be located", and a location for the exploitation of lunar resources to "enhance the potential for strategic space operations" in cislunar space.[32]

A future military facility on the Moon could achieve any of four objectives. One, to serve as a base for future military platforms in cislunar or translunar space. Two, to act as a redundant or last-strike platform that can launch Earth-attack munitions, especially nuclear weapons. Three, given the relative ease of launching from the Moon, such a base could provide

responsive launch services to replace adversary-disabled Earth-orbit satellites or to deploy counterspace capabilities that can target adversary satellites. Four, a military base could protect civilian assets on the Moon from adversaries.

There are good reasons to be sceptical of such proposals. For one, any such base would be in violation of foundational provisions in the Outer Space Treaty that prohibit military bases and the permanent stationing of weapons of mass destruction.[33] Two, while future cislunar or translunar platforms may provide useful counterspace or Earth-attack capabilities, their prospects remain highly speculative. Three, the distance between the Earth and Moon means any object launched from the lunar surface towards Earth, will take about three Earth days to reach its objective, a geographical reality that limits its potential use cases. Four, any facility on the Moon will be highly vulnerable to attack, even from simple kinetic munitions. Concealment, hardening, mobility, and deception are all possible countermeasures, but will be especially difficult to achieve on a distant celestial body.

In summary, while the Moon has dubious strategic value at present, major spacefaring states will continue to hedge their bets and plan for potential military undertakings on the lunar surface.

III. The Architecture of Lunar Governance

Human activity on the Moon is governed by treaties, informal agreements, and domestic legislation and policy. These can be organised under five heads. The first, and most important, is foundational space law which came into effect between 1963 and 1975. The second is the Moon Treaty of 1979. Third, there are the US-led Artemis Accords which first came into effect in 2020. Four, there are UN declarations and guidelines. Finally, there are national laws and declared policies. We consider each of these below.

Foundational Space Law (1963 – 1975)

These refer to five treaties agreed upon during the period roughly coinciding with the Cold War détente. While none of them exclusively deals with the Moon, they have major implications for human conduct on celestial bodies.

1. **The Partial Test Ban Treaty (1963)**: Formally, the Treaty banning nuclear weapon tests in the atmosphere, in outer space and under water. Usually shortened to PTBT, it prohibited nuclear tests in outer space, thereby prohibiting them on the Moon as well.[34]

2. **The Outer Space Treaty (1967)**: Formally, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies. Usually shortened to OST, it has 17 articles, the first 12 of which contain core principles governing human activity beyond the Earth's atmosphere.[35] These are summarised below:

   Article I: Keeps outer space including the Moon and other celestial bodies free for exploration and use by all states.

   Article II: Prohibits "national appropriation" in outer space, including the Moon and other celestial bodies, whether by claims of sovereignty or occupation.

   Article III: Commits signatories to following the UN Charter and other international law in outer space.

   Article IV: Prohibits the placement of weapons of mass destruction in outer space. The Moon and other celestial bodies are only to be used for peaceful purposes. Military bases, military manoeuvres and weapons testing are prohibited.

   Article V: Astronauts are 'envoys of mankind' and must be offered full assistance during emergencies. Astronauts who land in the territory

of another state must be returned to the state in which their space vehicle is registered.

Article VI: States bear ultimate responsibility for the activities of national agencies and non-governmental entities and must authorise and regulate them.

Article VII: State parties that launch or procure the launch of any space object are liable for any damages caused as a result of space activity.

Article VIII: State parties retain jurisdiction over any space object (and any personnel in the space object) registered with them.

Article IX: All space activity must be guided by the principles of cooperation and mutual assistance. States must pursue exploration such that they do not cause 'harmful contamination' on Earth through the introduction of extraterrestrial material. States are also to avoid 'harmful interference' that hinders another state's ability to use space peacefully.

Article X: States may agree to observe the flight of each other's space objects.

Article XI: States agree to inform the UN Secretary-General and the wider public of their space activity, including the purposes of these activities and the locations involved.

Article XII: All facilities and equipment on the Moon and other celestial bodies will be open to representatives of other OST signatories, though these should be reciprocal and involve prior notice.

3. Articles V-VIII of the OST are supplemented by three other treaties, the **Rescue and Return Agreement (1968)**, the **Liability Convention (1972)**, and the **Registration Conventions (1975)**.

4. **Analysis:** The PTBT, and the OST were products of rapidly expanding space activity in the 1960s, a time when both the US and the USSR were launching uncrewed satellites, experimenting with human spaceflight, and aiming to land people on the Moon. The treaties became achievable, in part, because of a conscious effort by both superpowers to manage their rivalry in the aftermath of the 1962 Cuban Missile Crisis.[36]

   The task of making the OST a reality was further eased by the fact that it could draw on developments from the preceding decade. The OST strengthened the provisions of the PTBT, effectively banning not

just nuclear tests in space but also the permanent placement of nuclear weapons beyond the Earth's atmosphere.

The OST also built on existing work done in the UN, most notably a 1962 Declaration of Legal Principles that contained some of the most important provisions carried forward in the OST, including the peaceful use of outer space, the prohibition on "national appropriation", assigning national liability for space activities, and mutual assistance.[37]

Finally, the OST could draw on the 1959 Antarctic Treaty, which was especially instructive for the Moon and other celestial bodies. The Antarctic Treaty banned nuclear testing on the continent. It put all territorial claims on hold and allowed any state to freely explore the Antarctic and build bases on it. Much like the later OST, the treaty also made provision for states to conduct mutual inspections of each other's facilities.[38]

The OST remains the basis for all space law and its universal character has prompted some scholars to suggest it is now customary international law, meaning that even a state that has not signed the treaty is bound by it.[39] However, this has also meant that instances of vague language in the OST continue to spark acrimonious debate. In particular, some terms in Article IX such as "harmful

contamination," "harmful interference," and "due regard," remain contested. The OST also has little to say on mining for lunar resources, whether for use in-situ or to be despatched elsewhere. All of these shortcomings have potential implications for lunar governance.

The Moon Treaty (1984)

Formally known as the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, the Moon Treaty was negotiated between 1972 and 1979. Though the treaty was adopted in 1979, there were few takers.[40] The treaty only came into effect after Austria became its fifth signatory in 1984.[41] At present, 17 states have ratified the treaty and four, including India and France, who have only affixed their signatures.[42] Indeed, besides India and France, no major spacefaring states are parties to the treaty. In January 2023, Saudi Arabia withdrew from the treaty and went on to sign the Artemis Accords.[43] While no reasons were provided for the withdrawal, it is possible the Saudis had concluded the treaty was incompatible with the Artemis Accords.

Much of the Moon Treaty's text supplements existing provisions in the OST.[44] The treaty restricts the use of the Moon (and other celestial bodies) to peaceful purposes and prohibits the placement of weapons on celestial bodies or in orbit. Adherents are free to move around the Moon so long as

they don't interfere with activities of other states. States are also allowed to extract samples for scientific studies but must take care not to cause environmental damage.[45] This provision for sample extraction remains vague since it provides no guidelines on the quantities of samples or what constitutes scientific purposes. As one analysis pointed out in 1993, Japan has exploited a similar legal loophole to get around a whaling ban.[46]

Despite this ambiguity, most of the opposition to the Moon Treaty comes from the other end of the spectrum. Developed, spacefaring states see the treaty as an attempt by less capable states to constrain their lunar ambitions. In particular, three components in Article XI of the Moon Treaty have made it unacceptable to these detractors. These are:

- The description of the Moon as the "common heritage of mankind".
- The prohibition against states, NGOs, and non-governmental entities claiming ownership of any natural resources (barring small quantities collected for scientific purposes).
- The creation of an "international regime" that will overlook the "orderly and safe development" of natural resources, their "rational management", the "expansion of opportunities" in the use of resources as well as "equitable sharing" that accounts for "the interests and needs of the developing countries, as well as the efforts

> of those countries that have contributed either directly or indirectly to the exploration of the moon".[47]

The idea of the "common heritage of mankind" first garnered international attention in 1967 when Malta's ambassador to the UN addressed the General Assembly. In his speech, the ambassador argued that seabeds in international waters must be considered the "common heritage of mankind," and hence protected from any unilateral appropriation.[48] Following much discussion and negotiation,[49] the principle was eventually incorporated into the UN Convention on the Law of the Sea (UNCLOS), which was adopted in 1982.[50] It also found its way into Article XI of the Moon Treaty.

Negotiations for the Moon Treaty were initiated in 1970, with the Argentinian representative to the UN Committee for the Peaceful Uses of Outer Space (UNCOPUOS) presenting a first draft.[51] Driving the sense of urgency were the Apollo Moon landings, which had begun in 1969 and would conclude in 1972. The Soviets produced their own draft in 1971 that removed the reference to "common heritage of mankind," while an America revision in 1972 reinstated it.[52]

Once the Apollo missions ended, and it also became clear that the USSR did not have tangible plans for placing humans on the Moon, negotiations slowed down, concluding only in 1979. During that period, developing

states pushed for what eventually became the provisions of Article XI. India played a significant role in these talks, presenting important working papers (one by itself and one with Egypt), that laid out the principle of the "international regime" and called for parties to take into "particular consideration the interests and needs of the developing countries."[53]

The impulse to heavily regulate lunar activity was partly driven by the so-called New International Economic Order (NIEO), an initiative by developing states to create a fresh system for international governance and trade that would cater to their needs. Among the NIEO's priorities were fair prices for raw materials, regulation of transnational corporations, and preferential treatment of developing states where feasible.[54] However, while NIEO concepts made their way into UNCLOS, the spacefaring states achieved some success by delinking the definition of "common heritage of mankind" in the Moon Treaty from its appearance in other documents such as UNCLOS.[55]

Despite this compromise, the spacefaring superpowers stayed away from the Moon Treaty. Even the US, which had earlier supported the treaty, turned against it under the new administration of President Ronald Reagan.[56] With just 17 ratifications and four other signatures, the Moon Treaty represents a failure in international efforts to build a stronger framework for lunar governance.

Treaty	Ratifications	Signature Only
Partial Test Ban Treaty (1963)	185	0
Outer Space Treaty (1967)	105	25
Rescue and Return Agreement (1968)	95	24
Liability Convention (1972)	94	20
Registration Convention (1975)	63	4
Moon Treaty (1984)	17	4

Figure 1: State Parties to the six treaties governing outer space.

The Artemis Accords (2020)

Formally known as "Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes,"' the Artemis Accords are a set of non-binding guidelines for conduct on celestial bodies.[57] The Accords were launched in October 2020 by eight states: the US, the United Kingdom, Australia, Canada, Italy, Japan, Luxembourg, and the UAE.[58] As of September 2023, there were a total of 29 signatories including India.[59]

The accords lay out ten principles for activity on celestial bodies. Six of these essentially restate core provisions of the OST and its three supplementary treaties: cooperating for peaceful purposes, transparency, interoperability, emergency assistance, registration of space objects, and the release of scientific data.

Another provision calls for managing orbital debris and ensuring the safe disposal of spacecraft. While this is not explicitly codified in international law, debris mitigation is part of the practices being consciously adopted by most spacefaring states.

However, it is the three remaining provisions of the accords that have been the source of controversy. These are: protecting heritage in space, deconflicting activities, and allowing the extraction and use of resources.[60] We consider these below.

Protecting Heritage: The provision for protecting heritage is primarily intended to preserve the historic Apollo landing sites from harm. However, this seemingly innocuous provision could lead to de facto claims of national territory, since there are no clear definitions of what constitutes heritage, and there are no time limits prescribed.

The Artemis Accords simply defines outer space heritage "to comprise historically significant human or robotic landing sites, artefacts, spacecraft,

and other evidence of activity on celestial bodies".[61] This definition would, for instance, cover the landing site of India's Chandrayaan-3 mission. However, it should be noted that the Accords clearly indicate that such declarations should not be unilateral and must be carried out in "accordance with mutually developed standards and practices."[62] Artemis signatories are also to use their experience "to contribute to multilateral efforts to further develop international practices and rules".[63]

Deconflicting: This provision cites Article IX of the OST, which covers "harmful interference". Artemis signatories are to avoid acts that constitute harmful interference with the activities of other signatories. If one signatory believes that the activities of another signatory constitute harmful interference, they are "to provide each other with necessary information regarding the location and nature of space-based activities".[64]

To avoid harmful interference, signatories can declare safety zones based on four principles for safety zones:

- The size and scope of the safety zone must be based on the activity being undertaken.
- The size and scope must be "determined in a reasonable manner leveraging commonly accepted scientific and engineering principles".

- Signatories must change the size and scope of the safety zone as their activities change. It adds that safety zones "will ultimately be temporary, ending when the relevant operation ceases".
- Signatories are to keep the UN Secretary-General informed of "establishment, alteration, or end of any safety zone, consistent with Article XI of the Outer Space Treaty".

The deconfliction provision emphasises its adherence to the OST, arguing that its primary purpose is to avoid harmful interference. The principle also emphasises the temporary nature of safety zones, without prescribing actual time limits. Therefore, a safety zone declared around a Moon base may last indefinitely, for decades or even longer.

Space Resources: For something that has attracted much controversy, the provision on resource extraction is brief, making only four points:

- Space resource utilisation "can benefit humankind by providing critical support for safe and sustainable operations".
- Extraction and utilisation must comply with the OST and must be "in support of safe and sustainable space activities".
- In accordance with the OST, signatories must keep the UN Secretary-General informed of these activities.

- Signatories will use the experience gained to contribute to multilateral efforts on "international practices and rules" in this regard.

The most significant aspect of this provision is the statement that resource utilisation must be "in support of safe and sustainable space activities". This statement is naturally open to interpretation, in particular since a wide range of undertakings can fall under the rubric of "space activities". If "space activities" means supporting and sustaining human presence on the Moon or beyond, this provision strongly suggests in-situ resource utilisation (ISRU) rather than commercial mining of lunar minerals.

Lunar regolith could be used to build human habitation on the Moon, either by processing it into construction material or by simply using regolith to cover up human-made structures and thus provide an additional layer of protection from radiation and temperature variations. More crucial than regolith is water. If lunar water ice can be accessed and purified in-situ, it could be used to sustain humans as well as provide hydrogen and oxygen to power rockets. In theory, other lunar resources including metal ores could be mined for use on the Moon. However, such applications are unlikely to be feasible before mid-century.

The broad term "space activities" can also cover commercial mining for return-to-Earth (RTE) applications. The challenges with mining on celestial

bodies for RTE are not just technological, but also economic. Space transport costs alone dwarf the inherent value that minerals like platinum, gold, or rare earths hold. However, lunar mining for RTE can make sense if what is being mined barely exists on Earth. One potential example is Helium-3, which could have potential in future nuclear fusion technology.[65] However, even if they become feasible, any such applications are likely to take decades to become reality.

Artemis in Context: The Artemis Accords were launched in 2020, the same year that the Artemis lunar exploration programme was announced. The accords and programme are distinct but connected. Signing the accords are a prerequisite for joining the multinational Artemis programme. However, merely signing the accords does not mean a state has become part of the programme. For instance, India signed the Artemis Accords in June 2023, but has not shown any public interest in joining the US-led Artemis project.

The Artemis Accords also grew out of a series of moves to secure America's freedom of action on the Moon. These began with a 2015 legislation that authorised Americans to mine celestial bodies.[66] On 6 April 2020, Trump issued an executive order on "Encouraging International Support for the Recovery and Use of Space Resources".[67]

The executive order made it clear that the US does not believe the Moon Treaty to be an "to be an effective or necessary instrument to guide" to

lunar exploration. The order then authorised the US secretary of state to oppose any efforts to treat the Moon Treaty "as reflecting or otherwise expressing customary international law."[68]

The order also gave the secretary of state 180 days to build international support for the use of space resources. This could be achieved through "joint statements and bilateral and multilateral arrangements with foreign states".[69] The result was the Artemis Accords, first signed by eight founding member states in October of the same year.

While the Artemis Accords are not formal law, they are, in some ways, a mirror image of the Moon Treaty. Like the Moon Treaty, the accords build on the foundation of the OST. However, while the Moon Treaty sought to regulate lunar activity through a new international regime, the Artemis Accords seek to provide American lunar explorers more freedom of action while simultaneously seeking to build best practices. The Artemis Accords are also focused on supporting the Artemis programme, which explains the accords' emphasis on safe disposal of spacecraft, debris mitigations, safety zones, and ISRU.

Other Initiatives

Two developments under the auspices of the UN have some connection to lunar governance, though their implications are far from clear. One is the 1996 Declaration on Space Benefits adopted by the UN General Assembly.

Its full title was the "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".[70]

The resolution is generally considered to have two achievements.[71] One, it built on Article I of the OST, to stress the need for spacefaring states to foster " international cooperation on an equitable and mutually acceptable basis".[72] Two, unlike some interpretations of "common heritage on mankind," it emphasised voluntary cooperation on technology, including the protection of intellectual property.[73] The 1996 declaration has had little discernible impact on space activity and its main utility lies in being cited as a precedent in future negotiations.

The other development is the Guidelines for the Long-term Sustainability of Outer Space Activities, developed under the auspices of UNCOPUOS in 2018.[74] Commonly referred to as the LTS guidelines, these voluntary recommendations are largely concerned with space activity in Earth-orbit. However, the guidelines under Section C cover international cooperation, capacity building, and awareness, all of which are applicable to lunar exploration.[75] More significantly, the other guidelines on enhancing registration, sharing information on orbital events and space weather are useful templates to adopt for cis-lunar space.[76]

Domestic Legislation & Policies

As part of their broader efforts to encourage the space industry, some states have sought to create a legal or administrative basis for private sector mining by passing legislation or publishing official policies. The US, Luxembourg, the UAE, and Japan have passed formal laws, while India has released an official policy.

The United States: As mentioned above, in 2015, the US passed the Commercial Space Launch Competitiveness Act (CSLCA). Title IV of the law, "Space Resource Exploration and Utilization," entitles US citizens to own and sell any space resources they obtain. The law also directs the executive branch to facilitate and promote the commercial recovery of space resources in accordance with America's international obligations.[77]

Luxembourg: This small European state has been particularly active in encouraging space resource exploration. Starting in the 1980s, Luxembourg began creating a conducive regulatory environment for space companies, especially those offering telecommunications services.[78] In 2016, the Luxembourg Space Agency set up a Space Resource Initiative with the stated intention of making Luxembourg a "pioneer in the exploration and utilisation of space resources." [79] The following year, Luxembourg passed a law laying down the rules for authorisation of space mining.[80]

Japan: Adopted in December 2021, Japan's space resources law requires applicants to provide full mission details including their business plan. The applications are to be reviewed by top leaders including the prime minister.[81] The law was put into practice in 2022 to authorise the uncrewed Hakuto-R mission by Japanese company ispace to extract samples of lunar regolith for commercial purposes.[82] The Hakuto-R spacecraft failed to make a soft landing on the lunar surface in May 2023.

The UAE: In 2023, the monarchy's cabinet passed a resolution pertaining to a 2019 space law. According to Article 7 of the resolution, any party involved in authorised space resources activity can own, trade, transport, store or otherwise use the extracted resources.[83]

India: In April 2023, India released a landmark space policy document that explicitly allowed 'non-governmental entities' (NGEs - a term borrowed from the OST) to engage in a wide range of space activities. The policy allows NGEs to "engage in the commercial recovery of an asteroid resource or a space resource."[84] NGEs can also "use, and sell any such asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of India." The Indian government is also widely expected to introduce a related Space Activities Bill in parliament in 2024.[85]

The laws and policy discussed above all seek to provide assurance to entrepreneurs and investors while simultaneously ensuring states can regulate such activity and ensure compliance with their interpretation of their international obligations. However, the primary challenge with any such domestic legislation is its interface with international law. All spacefaring states are members of the OST and cannot use domestic laws as pretext for skirting their obligations.[86]

IV. India's Options[87]

Identifying Indian Interests

India's decision to sign the Artemis Accords was a surprise to seasoned observers who have been critical of the US-led initiative.[88] The signature is best understood as a high-level political decision that may have involved quid pro quos with the US.[89] Nevertheless, India's choice makes two things clear. One, India sees other Artemis signatories as its most important partners for space exploration rather than its traditional partner, Russia. Two, India sees few downsides in signing the Artemis Accords since it considers the immediate prospects for a new multilateral lunar treaty to be poor.

It is also clear that India's interests have changed since it helped negotiate the Moon Treaty. As a fledgling spacefarer in the 1970s, it was in India's interest to constrain the actions of major spacefaring states. Indeed, this is the expected strategy for states with more limited capabilities that nevertheless have their own independent space ambitions.[90] However, as an ambitious middling spacefarer in the 2020s, India will have to adopt a more calibrated approach. Since India is likely to achieve its lunar goals later than the US and China, it's primary goals will be to:

1. Retain freedom of action for its own ambitions, which include uncrewed and crewed lunar exploration as well as resource extraction.
2. Place reasonable restraints on leading spacefarers to ensure a conducive environment for the newcomers to lunar exploration.

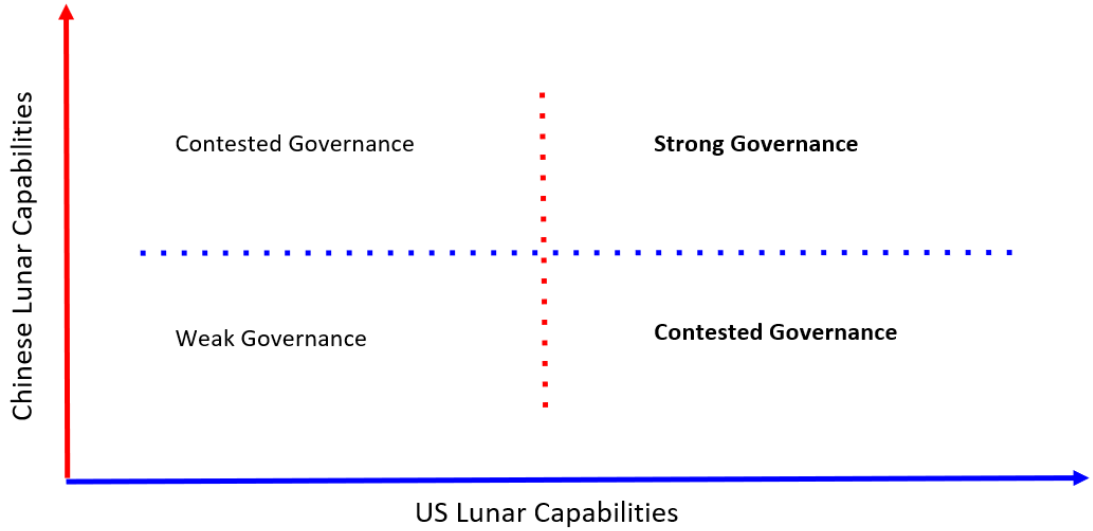
How India achieves these goals will depend on how US and Chinese lunar capabilities evolve.

Navigating a Path Towards Lunar Governance

There are four potential scenarios for US and Chinese lunar capabilities:

1. Neither the US nor China make much progress in lunar exploration.
2. US capabilities evolve faster than Chinese.

3. Chinese capabilities evolve faster than those of the US.
4. Both US and Chinese capabilities evolve rapidly.



In the figure above, we see that mutually weak capabilities result in weak governance, since there are few incentives to create a new legal architecture for the Moon. On the other hand, major disparities in capabilities lead to contested governance, making it harder to reach a widely accepted agreement. Finally, when capabilities of both the US and China are strong, there is greater incentive to accept mutual restraints.

While it is far from certain that strong capabilities will result in strong governance, it is the scenario in which such an outcome is most likely.

Two out of the four scenarios mentioned can be dismissed as low probability: mutually weak capabilities and China gaining a lead over the US in the next two decades. That leaves us with either (1) strong US-China competition for lunar exploration creating the potential for strong governance or (2) a US lead in lunar exploration creating the potential for contested governance.

In both these scenarios, India must adopt a strategy of 'friendly restraint', meant primarily to ensure that the US is encouraged to act responsibly. To create conditions for friendly restraint to work, India must do the following:

1. Publicly acknowledge India's preference for a new, widely accepted, and legally binding multilateral treaty for lunar governance.
2. Support the creation of a consultative mechanism among Artemis signatories, to enable open discussion on key issues such as deconfliction, heritage sites, and ISRU.
3. Support the creation of new UNCOPUOS working groups to create concrete proposals on lunar governance.

The Artemis Accords cannot solve fundamental problems of lunar governance. By themselves, the Artemis guidelines remain vague, and some

are contested. Indeed, governing lunar activity will be about more than a new law. It will require norms, guidelines, and best practices to supplement a formal legal architecture. As a state that plans to put its nationals on the Moon, India is well positioned to initiate the development of a new framework for human activity on our only satellite.

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