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Bright Moon

Creating a Global Registry
of Lunar Activity

Executive Summary - April 2023

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Executive Summary

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This brief summarises the key elements of a more comprehensive white paper found here - [*https://www.openlunar.org/library/bright-moon*](https://www.openlunar.org/library/bright-moon)

Humanity's relationship with the Moon is on the cusp of historic change. Within the next four years, NASA expects to see at least 22 lunar surface missions.[1] An in-space economy is emerging where the coordination of activities between operators will be critical to avoiding threats and challenges,[2] yet there remains no trusted information to coordinate and monitor lunar activity.

International policy efforts, including the Outer Space Treaty[3], the Artemis Accords[4], and The Hague International Space Resources Governance Working Group's Building Blocks[5], have recognized the need for coordination and transparency.

In 2020, the Moon Dialogs, hosted a salon of subject-matter experts that explored registration mechanisms for the moon[6]. The analysis produced policy recommendations, including the development of a standard template to streamline the registration and communication processes for lunar activities and objects. The report highlights that the current mechanism under the Registration Convention falls short of collecting information on the numerous activities expected to occur on the lunar surface or in orbit. To address this gap, the registry white paper explores the creation of a dedicated lunar registry to catalogue critical mission details such as the launching state, operating actor, location, time, and more.

A Global Registry of Lunar Objects and Activities will allow stakeholders to set a baseline for information sharing, promote a clear understanding of past, current and future activities, promote transparency, and enable appropriate coordination to

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reduce risk. It is intended to complement similar efforts by other organizations and promote cooperation and mutual support to avoid monopolizing lunar data sharing.

This registry would enhance and complement data that the current system may lack, and thus be a supportive effort to existing registry projects, such as the UN's Space Objects Registry of Objects Launched into Outer Space.[7] It would provide comprehensive data on lunar activities and objects and a centralized platform for tracking long-term lunar missions and activities. This information is essential in mitigating emerging challenges and building a cooperative lunar environment.

The Evolving Lunar Strategic Landscape

Over the past decade, there has been a significant increase in interest in the economic, political, and security potential of space, particularly in the earth's orbit and increasingly in cislunar space.[8] The space-related economy is predicted to be worth USD 3 trillion in the next 30 years[9], with commercial stakeholders overtaking national governments as key actors in the space sector.

The particular interests in the Moon vary between actors, but persist as the easiest-to-reach celestial object, and so has a significant strategic value from a number of angles:
- Scientific Research.[10]
- A laboratory to experience and test off-earth technologies and policy.
- A place to "offshore" infrastructure.[11]
- Resource potential.[12]
- A future launchpad.[13]

As more actors become interested in the Moon and cislunar space, the domains will become busier and shift away from being the operating domain of a few great power states like the US and China, which are often broadly public about their actions.[14] This may make it difficult to attribute responsibility for Lunar activities, identify who is doing what, and exacerbate astropolitical competition and suspicion. This issue will become more important to address as time goes on.

A Natural Bottleneck: Lunar Landing Sites and Activity Areas

Monitoring the activities of an increasing number of actors will only become more important to address as time goes on, especially when considered alongside the limited number of viable landing sites, and concentrated resource areas where the elements necessary for complex or long-term activity on the Moon might be found for the foreseeable future.[15]

The Outer Space Treaty's (OST) Article II places stringent limitations around the de jure "claiming" of sovereignty over areas on a celestial body.[16] The framework for this was established with state actors staking out sovereign claims in mind. It did not envisage the other ways in which actors can have de facto "claim" areas,[17] nor considered commercial operations where "claiming" was not intended, but that could be positioned in an area for an extended period and so de facto have authority over that area, or at least be perceived by others to be making such a claim in an increasingly sensitive geopolitical context.[18] In the latter's case, there are then significant political, commercial, security, and safety considerations as well as disruption that might befall two actors attempting to operate in the same area.

Astropolitical Tensions

The limited number of viable landing sites and concentrated resource areas on the Moon could potentially lead to tensions between actors, especially given the Outer Space Treaty's limitations on claiming sovereignty. Recently, NASA warned China to be more transparent regarding its lunar mission details, as both countries are potentially eyeing overlapping areas of interest.[19]

To try to ease such issues, attempts to update or circumvent the OST have been made, given as further legally binding treaties for space are not on the cards due to differing perspectives, exacerbated by the current increasing geopolitical competition on Earth[20]. The currently most successful, and concurrently controversial, of these efforts, is the US-led Artemis Accords, which establish "safety zones" for temporary state operations and regulate access to prevent "harmful interference".[21]

The Artemis Accords so far have had a somewhat polarising effect, being perceived by some actors to directly contravene the OST[22] and an attempt to establish the US as the leading arbiter on space governance.[23] Major space-faring states like China and Russia are opposed to it and are developing their own programs and frameworks.[24] While the US has clarified that the safety zones of non-Accord members will be respected[25], it remains unclear if critics and competitor states will agree to the legitimacy of the Accords.[26]

This comes in the context of the Administrator of NASA very publicly warning of China's lunar ambitions, something which highlights both the escalating geopolitical tensions and the potential of a US-China "race" to secure and control lunar access.[27] This underscores the need for universally shared norms and regulations[28] to prevent fragmentation and "bloc-ification" of the lunar political and regulatory environment. Without such safeguards, commercial and scientific stakeholders will find it more

difficult to operate, while state actors will face potential political flashpoints when different regulatory regimes operate in proximity.[29]

Lessons from the Antarctic

The geopolitical competition over Antarctica from 1942 to 1959 highlights how countries such as Britain, Argentina, Chile, the United States, and Russia invested significantly in establishing bases and making overlapping sovereign claims[30] and were willing to imperil key relationships and escalate toward military confrontation[31] despite the continent's unknown resource and strategic value.

After the establishment of the Antarctic Treaty System (ATS), the competition continued[32], but the framework and transparency of the treaty mechanisms limited excessive and militarized confrontation. However, the ATS has become politicized, with traditional ATS proponents and those wishing to open the region towards commercial activity forming two emerging blocs.[33]

Emerging Risks: A Contested Political Environment

The current geopolitical competition on earth, explored in the full Registry White Paper, is the most crucial aspect directly informing the development of the emerging Lunar environment. An increasingly multipolar world,[34] shaped particularly by a US-China rivalry,[35] but joined by a growing array of influential powers,[36] are competing over differing interpretations of global governance. Specifically, the ability to shape international frameworks toward best suiting their self-identified interests.[37]

This competition between actors has seen them marry traditional conflict and security/proxy operations,[38] including the potential for near-peer warfare as in Ukraine,[39] to revitalised concepts such as civil-military fusion,[40] "grey zone" strategies,[41] dual-use, and the politicization of economic and multilateral relationships.[42] These are employed by all competing states to varying degrees,[43] and mean that potentially any area of international life is "on the table" where competition is concerned.

A Lack of Trust Between Competitors

Trust between competing states is low, with governments becoming highly sensitive to their national interests, and the need to guard against the full spectrum of competitive actions (real or perceived) when engaging in diplomacy or activity with competitors. This increases the risk of competitive escalation or flashpoints courtesy of misunderstandings or false perceptions. [44]
Creating multilateral legally binding agreements, including for space, has become extremely difficult due to the current environment. Even on areas of fundamental

mutual interest, such as limiting anti-satellite (ASAT) weapon systems and capabilities. Despite this, all participants refuse to compromise in their UN submissions in order to protect their own agency of action regarding these systems. As a result, a legally binding multilateral restriction or ban on ASAT systems remains contested and has not been achieved.[45]

Politicization of Global Governance and Cooperation

More than treaties becoming difficult, global governance frameworks have become vulnerable to being politicized and wielded by states for their own competition-related ends. For example, the US simply ignoring World Trade Organization rulings against it on the basis of national interest,[46] while at the same time utilising the WTO as a mechanism to hold China to account.[47]

Geopolitical Spill-Over

The ongoing geopolitical competition is pervasive and largely revolves around competing visions of global governance. This has resulted in the politicization of international cooperation, de-hyperglobalization[48], and the fragmentation of globalization, with the possibility of deglobalization.[49] It has seen even areas that were previously seen as "exceptional" to geopolitical competition[50], such as the Arctic and Antarctic, have become arenas of competition.[51] The governance models for cooperation in these areas have been placed under severe pressure, and their rigid frameworks have shown a lack of resilience in adapting to newer competing perspectives and interests.[52] The collapse of the "one Arctic" approach after the post-Ukraine invasion illustrates this issue.[53]

Orbital space is increasingly framed as a battleground for geopolitical competition, where cooperation between competing states is proving difficult,[54] and the lunar environment is likely to become another frontier for earth-based multipolar competition. NASA and China are already airing tensions regarding proposed Lunar operating zones, and concerns over monopolization by a single actor. Flexible mechanisms for trust and confidence-building are necessary for multilateral cooperation in advance of significant lunar activity, or universally accepted regulations and parameters must be agreed upon for competition to occur.

Emerging Opportunities- Space for a Registry

While the geopolitically-informed Lunar environment may seem on track to becoming another arena of pervasive multipolar competition, this situation also presents a unique opportunity and space for future governance collaboration due to;

Decentralization is not Fragmentation (Yet)

Current geopolitical competition is not intended to result in the fragmentation of international multilateralism into competing multipolar-based blocs, though it may become a consequence of the competition. Instead, the competition has decentralized globalization and refocused on national interests, sovereignty, and different conceptions of what international governance should look like.[55] While the US and China may ignore or manipulate decisions at the WTO or UN, neither is currently willing to walk away from them, even if just because it would mean a loss of influence. Cooperation is still possible in "low-risk" deemed areas that do not compromise actors' interests and security and can circumvent the lack of trust between competitors.

Rise of Norms

While legally binding multilateral treaties are difficult to achieve due to politicization concerns and states' sensitivity to their interests, space provides an opportunity for "normative behaviours" to guide appropriate behaviour in a community of actors.[56] Norms are non-binding frameworks that attempt to guide "desirable behaviour" through community expectations and "buy-in"[57], making them more resilient and adaptable than legally binding treaties. Norms can be flexible and incremental in adaptation, avoiding the all-or-nothing approach of binding treaties like ATS, which can lead to politicization.[58]

Democratization of Governance-making Efforts

The use of norms as a basis for creating cooperation between competing actors in a decentralized environment allows for non-state actors to shape governance frameworks, which may have been ignored in favour of state-led solutions. The Additional Protocol of the International Atomic Energy Agency (IAEA) is an example of this, promoting the norm of transparency between actors in nuclear energy politics. Signatories agree to provide the IAEA with samples to verify their peaceful use of nuclear material[59], which has helped to develop and diffuse civilian nuclear technology without triggering significant security escalations and arms races between states.[60] The transparency created by the protocol has acted as a trust-building mechanism, despite the easily blurred lines between civilian and military applications of nuclear technology.

The success of the IAEA in creating norms-based governance frameworks for nuclear energy in a competitive environment highlights the potential for non-state actors to create similar frameworks in the less security-related field of lunar governance. As state actors struggle to compromise in the current geopolitical competition, non-state actors can offer solutions that do not impede their competitiveness.[61]

Enter the Registry - Fostering Transparency as a Restraint on Excessive Escalation

There is space in a still-emerging lunar environment for a non-state apolitical actor to start the process of establishing a baseline from which normative behaviours can develop incrementally among the wider community of lunar actors which will help constrain developing astropolitical competition through confidence and trust building mechanisms.[62]

The Key: Transparency as a Baseline Building Block

The pursuit of transparency is a key normative behaviour that aids in restraining competition and escalation[63] by sharing specific information regarding a state's activity or intent, which helps avoid misunderstandings and loss of mutual confidence between participants.[64] This behaviour is desired by both democratic and authoritarian-leaning states in most areas, even in the context of competitive activity.[65]

A Lunar Objects and Activities Registry

The creation of a multi-stakeholder activities registry for the lunar environment, which publicizes the self-provided activities of lunar actors, can help establish a norm of transparency among the lunar community, building trust and limiting the scope for escalatory flashpoints. By providing information on who is operating where, why, and at which times on the lunar surface, the registry can help prevent the bloc-ification of the lunar political and regulatory environment, and even signal a contentious political issue[66] to be addressed among those affected. This could kick-start community-based cooperation to resolve problems.

A norms-based approach for Lunar governance can be established through a "buy-in" approach,[67] starting with a Lunar Objects and Activities Registry that creates a transparency and trust-building expectation baseline. As more actors become involved in the Lunar environment, a shared set of community values and vision can emerge, which is adaptable to geopolitical shifts and can accommodate diverse interests. This creates a resilient foundation for future Lunar governance frameworks and prevents deadlock and politicization seen in other agreements.[68]

Incentives and Barriers of Participation

Space Stakeholder's Coordination Efforts

The diversification of emerging and established space actors has led to a multitude of segmented mutually beneficial partnerships. Currently, there are over 100 space

information-sharing agreements and temporary exchanges between actors,[69] including the recent NASA - Chinese exchange for conjunction analysis around Mars.[70] These public, private, and scientific stakeholders work collaboratively to collect and share critical information.

Lunar Registry Incentives and Barriers

A global registry is only as effective as the information it acquires. Global registries have revolutionized the way actors access and disseminate information, with such impact easily identifiable by registries like the Internet's domain name system, governed by the Internet Community through the Internet Corporation for Assigned Names and Numbers (ICANN).[71] Voluntary international cooperation takes place through independent contributions from actors and requires strong incentives for productive engagement.

Incentives to Stakeholder Engagement

Increased Safety and Decreased Risk of Collision: As traffic on the moon increases, space stakeholders must be encouraged to adopt the practice of sharing mission situational information to minimize risks, promote mission success and safety, and sustain a collaborative environment. Failure to do so may result in accidental collisions and the creation of debris, which could potentially cause more collisions in the future. The space domain has already seen evidence of such collisions, such as the 2009 collision between the U.S. Iridium satellite and a dead Russian Cosmos satellite, creating nearly 2,000 pieces of known orbital debris.[72] The amount of conjunction events in low-Earth-orbit space is increasing rapidly, as shown in Figure 1 below.[73]

Figure 1 : ESA Report: Number of possible conjunction events at various altitudes[74]
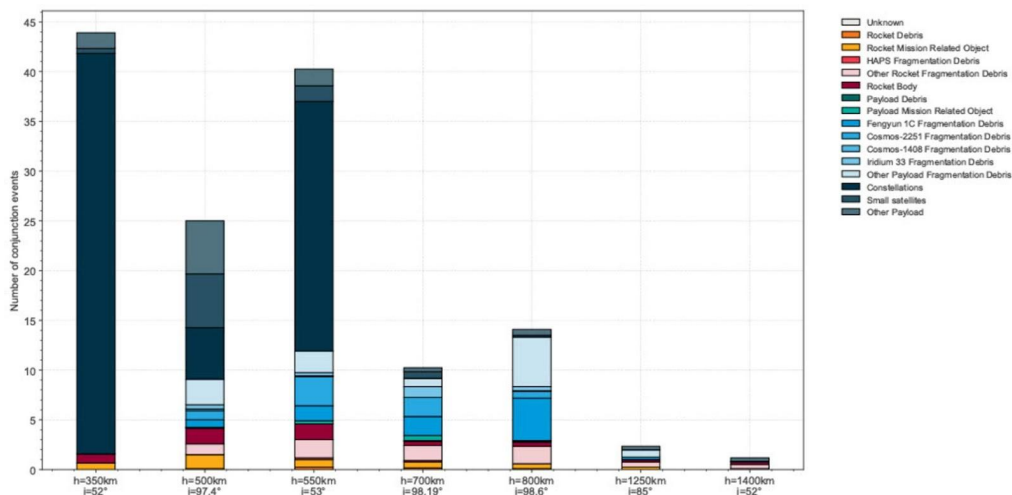
Increases Operational Success Through Automation: The current lunar operating environment relies on outdated manual activities for space situational awareness, using processes that aren't adequate for the rapid growth planned. Ensuring that the registry is accessible to both machines and humans will make it useful for both coordination and planning purposes. For example, a Lunar rover could query the registry and then notify other objects when it enters or leaves specific areas. By uploading notification requests to the registry, that information is automatically shared with the appropriate parties, saving coordination time and making it possible to see intersections and overlapping considerations.

Increased Emergency Coordination: Situational information on objects and activities can increase coordination between actors in critical or emergency events and empower decision-making. Field inclusion, such as contacts, location, and dimensions, among others will work to prevent catastrophic impact on existing or planned activities with threats and warnings, such as when a rogue rocket crashed into the moon in 2021, devastating the area of impact. [75]

Conflict Avoidance and Prevention: The role of openness in reducing conflict through space situational data can be traced back to 1962 with the establishment of the UN Registration Convention, which was created to reduce tensions and by making statements about the purposes of launch.[76] With contentious positions on lunar ownership, concentrated resources, and exploration, political competition and tension have the potential to rise.[77] Transparency can increase international political safety and can aid in decreasing or preventing conflict among stakeholders.

Open and Equal Access: Providing open, transparent, translated, and free data lowers the barrier to participation to include all stakeholders. Inclusion challenges are often experienced by actors from low-and middle-income countries (LICs and LMICs), whose financial resources and technical capacity are usually not on par with those of higher-income countries.[78]

Multi-Stakeholder Representation: Key stakeholders include governments, the private sector, civil society organizations, academia, and individual producers and users of data. Multi-Stakeholder governance models require input and design from stakeholders, which incentives participation by allowing a variety of stakeholders to have a say in decision-making.[79]

Social Responsibility: Stakeholders' desire to achieve good-faith reputational status can be achieved by adhering to international norms and investing in social responsibility demands from civil society and corporate social movements.[80]

Barriers to Stakeholder Participation

Political Competition: Political and economic competition since the Cold War has created barriers to international collaboration within the space industry,[81] with policies such as The Wolf Amendment which prevents NASA and relevant agencies from pursuing bilateral projects and information sharing with China without congressional approval,[82] resulting in the exclusion of China from the International Space Station and the development of a separate effort.[83] While successful instances of collaboration exist, barriers to international collaboration between competing countries remain present.[84]

Political competition also comes with specific risks, such as;

- **Transparency can sometimes escalate competition and remove an "off-ramp" for actors:** In some instances, open and transparent access to information can see political escalation deepen. Particularly as this information can be taken and shaped by actors or disseminated to the public, whose opinion can be influenced by various interest groups to pressure policymakers into escalatory action that they may be reluctant to pursue.[85] It is for this reason that highly inflammatory incidents, like the 1952 Hope Bay incident in the Antarctic, were kept out of the public eye by both sides lest public pressure force an escalation into conflict.[86] The loss of such an off-ramp in the lunar context might be deemed a fair trade though if the Registry is able to help have a wider impact in building trust and helping alleviate the excesses and risks of competition.

Differing conceptions regarding the role of "civil society" between state governments: Some states may view non-governmental organizations (NGOs) and civil society efforts as a threat to their authority, which could affect cooperation in the Lunar context. It cannot be assumed that non-state actors' efforts in the lunar registry will be welcomed by all states, especially those with a different perspective. Additionally, there may be areas of potential cooperation that some states may consider unacceptable from a "Western" perspective.

Economic Competition: Intellectual property protection issues may also act as a barrier to stakeholders sharing activity and object data, specifically from corporate entities. Issues concerning patent, copyright, and trade secret protection for the products of human creativity are currently a growing concern in the industry, as intellectual property (IP) is not currently protected in outer space.[87] In the absence of a unified legal framework for protecting intellectual property in outer space, stakeholders may prefer to keep their information and assets private, which can limit the effectiveness of a lunar registry in fostering collaboration and cooperation among space actors.

Liability in Space: The United Nations Liability Convention, which came into force in 1972, is an important international treaty that governs the legal responsibilities of actors in space.[88] However, despite its significance, the Liability Convention has been criticized for its lack of clarity and precision. The absence of clear definitions and guidelines for determining responsibility can make it difficult for private entities to assess their potential liability and exposure to risks associated with their space activities.

Assertion Opposition: International treaties and agreements not globally accepted yet leveraged heavily in the lunar registration can be a barrier to participation from opposed actors.[89] For these actors, the creation of a lunar registry which legitimized opposing assertions could disincentive participation. For example, if the Lunar Registry were designed to declare safety zones, validating the Artemis Accords, the registry could be perceived as endorsing these principles and recognizing the US-led initiative as the standard for outer space activities.

Collaboration through Cooperative Design

The development of a lunar registry is a complex task that requires the engagement of stakeholders in the design process to incentivize support, as stakeholders are more likely to participate in the registry if they see tangible benefits for doing so. Trust can be achieved by involving stakeholders in the decision-making process and by ensuring that the registry is governed by clear and equitable rules and regulations. Through cooperative design approaches, it is possible to create a registry that promotes cooperation and collaboration in the exploration and use of lunar resources among differing stakeholders.

Current Landscape

Existing Efforts

No current system exists to present a unified and utilized system for tracking lunar objects and activities. Until a unified registry is established, the knowledge surrounding lunar activities and objects will continue to be inadequate and the ability to effectively regulate, coordinate, and monitor exploration and activity. Table 1 in the white paper outlines an inventory of related databases.

Perspectives on a Lunar Registry

To gather insights and perspectives from industry experts on the need, benefits, and challenges of establishing a lunar registry, Open Lunar conducted a series of

interviews with experts in the field. The insights and ideas gleaned from these interviews explain the potential role a lunar registry could play in ensuring the responsible and sustainable use of lunar resources and space activities.

Filling the Regulation Gap

Juliana Suess, Research Analyst and Policy Lead on Space at RUSI, acknowledges that in the build-up of activities in new spaces like lunar exploration, regulation is often met with resistance or delay. "In space, actors operate in an environment that is at times very little regulated, which can lead to gaps in the safety of assets and increases the risk of operating in that sphere. Tools like the Lunar Registry can provide a sort of onboarding regulation in the interim to reduce risk without halting progress, as well as build confidence and trust among actors that future initiatives can build on." Suess emphasizes that regulation and security do not have to be an all-or-nothing approach.

Verification and Conflict

It is crucial to ensure the trust and usability of the data housed in the Lunar Registry. Jonathan McDowell, Harvard-Smithsonian Center for Astrophysics astronomer, stresses the need for multi-stakeholder reported data verification. According to Jonathan, "A Lunar Registry has intrinsic value and could be an extremely valuable asset. With all registries, traceability is trust. The ability for sources to annotate and comment is trust. Retaining original information is crucial in building a registry, but allowing a complementary verifiable mechanism is key."

"A lunar registry could work as an essential tool for coveted locations where we will see increased activities, such as the Peak of Eternal Light or the Lunar South Pole," notes McDowell. The tool would not only establish precedent and history, but would also serve as a trusted source of information in case of conflicts among stakeholders. It could also provide an early warning to understand certain trends from countries or governments, such as resource competition, and inform on situational awareness to prevent or avoid conflict.

Lessons from the Internet's Open Registry

Maria Farrell, a writer and speaker on technology policy and the future, emphasizes the importance of diverse cooperative norms on the moon. According to Farrell, "Norms aren't just semi-formal expectations of how other entities will behave. They're the distilled wisdom of a specific field of human endeavour about what works." Thus, it is critical to involve entities beyond those steeped in national security, military, and humanitarian cultures.

To achieve this, Farrell suggests taking lessons from the internet's open registry. She notes that "humans in every kind of activity have learnt the hard way what works. On the moon, we need to leave space for different kinds of cooperative norms to flourish, bringing the full diversity of human wisdom to bear." Some of the lessons from the internet's open registries that could be useful on the moon include being flexible, using simple, low-tech and non-proprietary methods, maintaining a single authoritative source of updated information, and keeping it simple and open.

Responsibility and Sustainability

As an astrodynamicist, engineer, and space environmentalist, Moriba Jah is a vocal advocate for responsible and sustainable space exploration. He believes that "A Lunar Registry could aid in the sustainable development and stewardship of the moon, as transparency and accessibility of data and information are a requirement in achieving peace and conflict resolution in space". Jah also recognizes that "Access to space is not equitable. Those who have assets in space have an upper hand economically and geopolitically, and the data and information that we get from these space-based assets are unique". In order to create a more equitable space environment, Jah draws inspiration from collaborative Traditional Ecological Knowledge (TEK) and suggests that inviting all stakeholders, especially indigenous, to the table is important. By promoting equitable access and transparency, a Lunar Registry could create a more sustainable and just future for space exploration and exploitation.

Cooperative Design Mechanisms

Cooperation from stakeholders is critical for the development of an effective lunar registry to ensure the legitimacy and fairness of the registry. The Lunar Registry could be designed with a variety of different consensus-building models, and organizational structures, and facilitated participation from stakeholder groups to promote cooperation and utilization.

Multi-Stakeholder Advisory Groups

A Multi-stakeholder Advisory Group (MAG) is a collaborative forum that brings together representatives from different stakeholder groups to develop solutions to complex issues.[90] MAGs can be used to build consensus and enhance participation and cooperation in the design and maintenance of a Lunar Registry. Studies have shown that MAGs can increase stakeholder engagement, and cooperation through inclusiveness and collaboration, and reduce the time to reach an agreement by up to 50%.[91]

Consensus and Trust Building

The process of reaching a common understanding among stakeholders is crucial in order to ensure the effectiveness, legitimacy, and fairness of the registry. The use of consensus-building models greatly increases stakeholder participation and the likelihood of success,[92] A recent study found that consensus-building models may lead to a 20% increase in stakeholder engagement and a 25% reduction in conflicts among participants.[93]

Third-Party Organizations and Multi-Stakeholder Groups

Examples of successful multi-stakeholder consensus building in third-party organizations include:

- **Internet Corporation for Assigned Names and Numbers (ICANN)**: ICANN is an international non-profit organization responsible for managing the global domain name system (DNS). The organization has successfully implemented a multi-stakeholder model, where stakeholders from governments, businesses, technical communities, and civil society participate in decision-making processes.[94] This model has helped ICANN make informed and inclusive decisions that benefit the global community.
- **The Blackfoot Challenge (BFC):** BFC is a private non-profit organization which addresses rural values through a community consensus-building approach, they address issues where roughly 80 per cent of stakeholders agree, build trust, and then use that trust to work on the other 20 per cent where disagreement is found.[95] Through this approach, they have facilitated numerous conservation, restoration, and stewardship initiatives between governments, companies, and indigenous communities.

Proposal for a Lunar Registry

The white paper proposes a registry with a specific focus on lunar objects and activity. The mission of the registry will be to foster coordination and transparency with the goal of reducing the risk associated with lunar exploration and development.

Information Characteristics

The registry will recognize that there is a cost to disclosing and maintaining accurate information. It will not collect unnecessary information. It will maintain a high bar for the inclusion of new fields, working to ensure that information deemed necessary to disclose will be simple, static, relevant, comparable and verifiable.

The registry will not collect information that is confidential or that could cause confusion, conflict or otherwise undermine the registry's purpose. It will display information using a simple, accessible interface that can be easily understood and navigated on most devices and bandwidths, prioritizing the speed of the platform and using standardized visual hierarchies. A comprehensive table of information characteristics is in the larger white paper.

Guiding Principles

The effective design of a registry requires a holistic approach to instil confidence in the systems that enable the collection, evaluation, and dissemination of information. Trust signalling should be incorporated in all aspects of the Registry, including technical, institutional, policy, and governance. Guiding principles for the development of the registry could include neutrality, independence, voluntary participation, accessibility, reliability, and accountability. The registry should function as a neutral platform, maintain strict financial and political independence, be accessible to all without mandating participation or charging for access, provide reliable service, and implement mechanisms for accountability and dispute resolution. By articulating the characteristics of the information that will be included in the Registry as well as the principles that will guide how information is collected and disseminated, the Registry will achieve the stability and reliability necessary to engender trust. This in turn will foster the adoption and use of the platform.

Legal and Operational Structure

The legal and operational structure of the registry will affect its perceived neutrality and independence, and it should reflect the registry's guiding principles. The registry can be a non-profit organization or a project within an existing non-profit and must be independent of private and government sector oversight. It can accept funding, but donor agreements must affirm the registry's neutrality and independence. The registry should be based in a jurisdiction that can provide assurances of non-intervention. It should have accountability processes, including term limits for board members and executive directors (if any), independent financial and salary reviews, and dispute resolution procedures. The registry should not require significant staff or financial resources to achieve its objectives. The Internet Assigned Numbers Authority, which acts as the registry for the Internet's top-level domain names, among other technical Internet standards, has a staff of less than ten[116]. A small team providing high-quality service, projects stability and continuity.

Field Inclusion and Design

Activity and Object Definition

A Lunar Registry provides the opportunity to concurrently log information about both lunar objects and activities. The registration of objects relates to articles or items in space, which could include spacecraft, landers, satellites, and technology, among others. The registration of activities relates to occurrences, such as manoeuvres, experiments, and collisions, among others. By including the opportunity for both activities and objects, stakeholders will have more insight into what occupies the moon in what regions, along with past, present, and planned activities, increasing coordination and planning.

Update Protocol and Design

As data in the registry changes, an update protocol which prompts, collects and sends updated records will be established. Data like ownership, changes in mass, and object status will be important to update to maintain the integrity of the registry. The fields of information in the Lunar Registry will be designed preferentially to collect standardized answers in order to serve as a useful and automated tool for technology to query and upload instantaneously.

Prototype Form Fields

Through a consultative process with industry experts and stakeholders, Open Lunar has included a number of fields that are perceived as being important for inclusion in an effective and useful registry. Fields included in the white paper are drafts and, as such, are likely to change and evolve with implementation and additional consultation. For continuity, the fields have been organized into three categories: Entity and Submission Information; Coordination Contacts; and Object and Activity Data Fields. Refer to white paper for a more comprehensive list of draft fields.

Category	Purpose	Draft Fields Content
Entity and Submission Fields	Collects information on submitting and involved actors, organizations and collaborators.	Contact Collection for Submission; Ownership Details; Operators, organizations, and collaborators involved.
Coordination Fields	Collects information, requests, and assertions for collaborative efforts among stakeholders.	Point of Contacts for collaboration; General Requests; Assertions.
Object and Activity	Collects and maintains	Status;

Data Fields	detailed technical information on Objects and Activities.	Launching State; Primary Purpose; General description; Past, current, or upcoming manoeuvres or historical information; Notable dates; Location; Regional Occupancy; Dimensions; Estimated Duration; General Observations.

Conclusions and Next Steps

As activity increases, the lunar environment presents a complex challenge for global commons management and multi-stakeholder coordination among competing values. As we have learned from experiences on Earth, centralized control systems often lead to under-representation and politicization, creating potential risks in governance and management. To address these challenges, a Lunar Registry designed to encourage global multi-stakeholder participation and representation, based on consensus-building and inclusion, offers a tool to foster openness, trust, transparency, representation and social responsibility for all. With this opportunity to design governance and commons management cooperatively, we can create a model for a more sustainable and equitable lunar environment.

The Registry White Paper has been developed as an open proposal. The publication of the white paper and follow-on open consultations with stakeholders at the end of Q1 / Q2, 2023 marks the first important step towards developing a collaborative and multi-stakeholder approach to managing the lunar environment. The feedback received during the consultation phase will be carefully considered and integrated into a revised draft, which will be published by 2023. From there, the development of the registry itself will begin, with the goal of an initial launch in the near future. As the registry is being developed, it will be important to continue engaging with stakeholders and incorporating their feedback to ensure that the registry is designed to be truly collaborative, inclusive, and consensus-built. Ongoing communication and collaboration will be critical in achieving the goal of sustainable and responsible management of the lunar environment.

Endnotes

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