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Transparency and Confidence-Building Measures for Lunar Security

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Introduction

Transparency and Confidence-Building Measures or "TCBMs" refer to political tools or mechanisms aimed at stabilizing security. References to the term frequently appear in discussions on space security, with dedicated initiatives to develop TCBMs evident at the multilateral level.[1] TCBMs may also be adopted in unilateral and bilateral forms. This paper proposes specific TCBMs to enhance lunar security. The proposal to adopt TCBMs solely for lunar security is based on the premise that Article IV of the Outer Space Treaty[2] distinguishes between security for outer space in general and security for the Moon, reflected in the mandated use for "exclusively peaceful purposes."[3] This report argues that lunar TCBMs will play a significant role in strengthening relationships between lunar stakeholders and enforce compliance with Article IV of the Outer Space Treaty.

Research Objectives

- Identifying TCBMs that would be a useful starting point to enhance lunar security
- Examining which institutions (new and existing) would be most appropriate to implement said measures

The report is divided into three sections. Part I presents an overview of TCBMs for outer space and substantiates the need for TCBMs specifically for lunar activities. Part II introduces the measures themselves. Part III then considers potential institutions to implement said measures.

The research uses doctrinal and comparative methodology to identify which measures would be most successful. In addition to the space treaties, the author uses the criteria and tests provided by the reports of the United Nations Groups of Governmental Experts (GGEs)[4] on TCBMs for outer space to propose new measures. While these groups are constituted for various topics under the UN, these two GGEs were constituted in 1993 and 2013 respectively to focus exclusively on TCBMs for outer space.

For the study of Rendezvous and Proximity Operations (RPOs), the author analyzes existing State practice relying on data in the Secure World Foundation Global Counter Space Capabilities Assessment of 2020, the CSIS Space Threat Assessment 2020, Space Security Index 20202 and finally, the 2020 study of RPOs, also by Secure World Foundation.

[1] See UNGA, Prevention of arms race in outer space, Study on the application of confidence-building measures in outer space UN Doc A/48/305 (15 October 1993) [GGE Report 1993]; UNGA, Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities UN Doc A/68/189 (29 July 2013) Also see [GGE Report 2013].
[2] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 27 January 1967, 610 UNTS 205, 18 UST 2410, TIAS No 6347, 6 ILM 386 (entered into force on 10 October 1967) [Outer Space Treaty]
[3] Outer Space Treaty, (note 2) Art. IV, para 2; This provision also lays down certain prohibitions on the use of the Moon and other celestial bodies, such as weapons testing.
[4] GGE Report 1993, GGE Report 2013 (note 1).

I. The Need For Lunar TCBMs

Rebuilding trust amid geopolitical tensions

As described by the UN Group of Governmental Experts, TCBMs have the potential to reduce, or even eliminate, misunderstandings, mistrust and miscalculations with regard to the activities and intentions of States in outer space.[5] Therefore, TCBMs will be essential to the future of lunar governance. In times of rising tension, TCBMs are a useful tool to ensure that an actor does not inadvertently escalate a crisis based on limited information of an adversary's actions or capabilities.

Notably, similar concerns during the Cold War led to the proliferation of the international space treaties in the 1960s-1970s.[6] While the United States (US) and the Soviet Union were the dominant space powers at the time, the dynamics of space security have since evolved significantly due to new contenders, including China and India. The nuclear capabilities of India and China have been a key contributing factor to the shift in dynamics between global players, evidenced by stronger US-India relations to balance Chinese power in the South Asian region.[7] This has direct implications for space security, as "counter space" capabilities can be relied on to balance nuclear powers of rivalrous States.[8] The term "counter space" refers to capabilities or techniques that are used to gain space superiority and are comprised of both offensive and defensive elements.[9] Countries with noted counter space capabilities also include Iran and North Korea.[10] With the rise in these capabilities and a surge in planned lunar activities, it is crucial to introduce new mechanisms that preserve the use of the Moon for peaceful purposes.

The first UN Group of Governmental Experts (GGE) noted in their 1993 report that States were hesitant to commit to new TCBMs due to the notion that any increase in transparency would reveal weaknesses in their capabilities and leave them vulnerable.[11] New TCBMs would therefore have to maintain a delicate balance between transparency, and assurance that said transparency does not compromise a State's national security.

[5] GGE Report 1993 (note 1) at 106-107.
[6] "Historical Context", Stephen Hobe, Bernhard Schmidt-Tedd & Kai-Uwe Schrogl (eds), *Cologne Commentary on Space Law*, vol 1 (Cologne: Carl Heymanns Verlag, 2009) at 3 [*Cologne Commentary on Space Law*].
[7] Misbah Arif, "Strategic Landscape of South Asia and Prevention of Arms Race in Outer Space," 17 Astropolitics 1.
[8] This is because counterspace capabilities reside in conventional and nuclear-armed weapon systems, including missiles of various kinds, along with missile defense interceptors. See "Space and Nuclear Deterrence" in Michael Krepon, Julia Thompson (eds) *Anti-satellite Weapons, Deterrence and Sino-American Space Relations* (Stimson Centre: 2013) at 27.
[9] See Weeden, B. and Samson, V. (eds), "Global Counterspace Capabilities: An Open Source Assessment" (Secure World Foundation: Washington, DC, Apr. 2019), <https://swfound.org/media/206408/swf_global_counterspace_april2019_web.pdf>.
[10] Secure World Foundation, "Global Counterspace Capabilities: An Open Source Assessment" (Secure World Foundation: Washington DC, Apr. 2021).
[11] GGE Report 1993 (note 1) at para 305.

The Challenges of Hard Law and Soft Law

A resolution for the Prevention of an Arms Race in Outer Space (PAROS) was adopted at the UN General Assembly in 1981.[12] The resolution has continuously been adopted on an annual basis at the Assembly, although no concrete measures have materialized as yet. The UN Conference on Disarmament has pursued PAROS as an agenda item but failed to achieve progress, since a stalemate emerged. Some countries insisted that a new measure had to be a binding treaty and that this objective had to be pursued at the outset.[13] In contrast, the other dominant view considered only non-binding and voluntary measures.[14] The Russia-China initiative to introduce a treaty on weaponization of space (first presented in 2008 and then revised in 2014) exhibited that the definition-oriented approach to new policies was too divisive.[15] Parallel to the Conference on Disarmament, there have also been efforts through the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) regarding the peaceful uses of outer space,[16] the successful adoption of the Long-Term Sustainability Guidelines in 2018[17] in addition to regional initiatives such as the Hague Code of Conduct[18] and the International Code of Conduct proposed by the EU.[19]

These initiatives have either been too slow or entirely unsuccessful in creating new instruments. However, in 2020, the United Kingdom (UK) proposed a new initiative through the UN General Assembly.[20] This resolution is aimed at developing norms for responsible behaviour in outer space, and adopts a behaviour-oriented approach, rather than using a definitions-based approach to achieve consensus on specific meanings of terms in the Outer Space Treaty. This resolution may provide an avenue for cooperation on lunar security, and can be viewed as a new confidence-building measure through the UN forum (discussed further in Section B below).

While a binding international treaty may be desirable in terms of compelling lunar stakeholders to follow international rules, the likelihood of such a treaty is low, due to slow progress at the multilateral level.

[12] UNGA, Prevention *of arms race in outer space*, UN Doc. A/RES/36/97C (9 December 1981).
[13] See *Draft Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects (PPWT),* introduced by the Russian Federation and China, UN Doc CD/1839 (29 February 2008) [*Draft PPWT*].
[14] See Council of the European Union, Draft Code of Conduct for Outer Space Activities (31 March 2014) [EU Code of Conduct].
[15] See "weapon in space", *Draft PPWT* (note 11), Art. 1(a).
[16] UNGA, *Report of the Committee on the Peaceful Uses of Outer Space, 62nd Session,* UN Doc A/74/20 (June 2019).
[17] UNGA, Committee on the Peaceful Uses of Outer Space, *Guidelines for the Long-term Sustainability of Outer Space Activities*, UN Doc A/AC.105/2018/CRP.20, (27 June 2018).
[18] Hague Code of Conduct against Ballistic Missile Proliferation, online: https://www.hcoc.at/?tab=what_is_hcoc&page=text_of_the_hcoc. [Hague Code of Conduct]
[19] EU Code of Conduct (note 12).
[20] UNGA, 'Reducing space threats through norms, rules and principles of responsible behaviours', A/C.1/75/L.45/Rev.1, 23 Oct. 2020.

II. The Development of New Measures

UN Groups of Governmental Experts on TCBMs

According to the UN GGE, TCBMs must have the following characteristics:

A. "Be clear, practical and proven, meaning that both the application and the efficacy of the proposed measure have been demonstrated by one or more actors;
B. Be able to be effectively confirmed by other parties in its application, either independently or collectively;
C. Reduce or even eliminate the causes of mistrust, misunderstanding and miscalculation with regard to the activities and intentions of States."[21]

Additionally, the UN GGE proposed tests for implementation and demonstration that would validate the measure in the form of the following table:

	Implementation	Demonstration
Who	Who should implement the measure?	Who should demonstrate the measure?
What	What is the measure that should be implemented? Is it clearly identified and understood?	What should be demonstrated to confirm implementation?
Why	What is the value or benefit of performing the measure?	Does a clear understanding of why it is important to be able to confirm or demonstrate implementation exist?
When	When should the measure be implemented?	At what point is demonstration or confirmation performed?
How	How should the measure be implemented?	How is implementation of the measure validated, demonstrated or confirmed?

[21] GGE Report 2013 (note 1) at 15.

The UN GGE also proposed the following categories of TCBMs in their 2013 report:
"(a) General transparency and confidence-building measures aimed at enhancing the availability of information on the space policy of States involved in outer space activities;
(b) Information exchange about development programmes for new space systems, as well as information about operational space-based systems providing widely used services such as meteorological observations or global positioning, navigation and timing;
(c) The articulation of a State's principles and goals relating to their exploration and use of outer space for peaceful purposes;
(d) Specific information-exchange measures aimed at expanding the availability of information on objects in outer space and their general function, particularly those objects in Earth orbits;
(e) Measures related to establishing norms of behaviour for promoting spaceflight safety such as launch notifications and consultations that aim at avoiding potentially harmful interference, limiting orbital debris and minimizing the risk of collisions with other space objects;
(f) International cooperation measures in outer space activities, including measures aimed at promoting capacity-building and disseminating data for sustainable economic and social development, that are consistent with existing international commitments and obligations."[22]

Potential new TCBMs

In developing new TCBMs, the following were considered: (i) registration (ii) space situational awareness (SSA) data-sharing (iii) space traffic management (STM) (iv) notifications for rendezvous and proximity operations (RPOs) (v) notifications for risk of contamination (vi) public repository of information for lunar discoveries and (vii) impact assessments. Among these, 4 measures were selected, namely registration, SSA data-sharing, STM and notifications for RPOs.[23] The UN GGE criteria and tests for TCBMs informed the selection process.

Registration, SSA data-sharing and space traffic management were grouped under one category of TCBMs, i.e. category (d) for "specific information-exchange measures", although the proposed measures focus on lunar orbit rather than Earth orbit. Notifications for RPOs would fall under category (e) relating to "norms of behaviour".

[22] Id. at 13.
[23] There is further scope to explore these other measures as TCBMs as well.

A. Registration

Issues under international law

The registration of space objects introduces transparency by clearly communicating the intent and particulars behind launch activity. The Convention on Registration of Objects launched into Outer Space[24] (Registration Convention) provides two types of registration. The first is the obligation to record launches in the national registry. Article II(1) of the Registration Convention states that, "[w]hen a space object is launched into Earth orbit or beyond, the launching State shall register the space object by means of an entry in an appropriate registry which it shall maintain. Each launching State shall inform the Secretary-General of the United Nations of the establishment of such a registry."[25]

Article II(3) additionally states that "[t]he contents of each registry and the conditions under which it is maintained shall be determined by the State of registry concerned."[26]

Article II therefore gives States the freedom to list launch information in the manner they deem fit. This results in different information being disclosed as per each country's preference. For instance, some nations, such as the United Kingdom, simply require particulars to be listed as considered appropriate by the Secretary of State.[27] The UK national registry then lists date and location of launch, designation and catalogue number, nodal period, inclination, apogee, perigee, orbital position, general function, whether the launch was notified to the UN, whether disposed of or decayed, such disposal or notification was notified to the UN and also whether a licence was issued under the Outer Space Act.[28] This indicates that each State has absolute discretion over what information should be shared, which results in a patchwork of information about countries' space activities. Other countries, such as Sweden, have adopted national legislation that expressly determines which information should be listed in the national registry.[29]

Article IV then provides for registration in the UN register. Article IV(1) states that "[e]ach State of registry shall furnish to the Secretary-General of the United Nations, as soon as practicable, the following information concerning each space object carried on its registry: (a) Name of launching State or States; (b) An appropriate designator of the space object or its registration number; (c) Date and territory or location of launch; (d) Basic orbital parameters, including: (i) Nodal period; (ii) Inclination; (iii) Apogee; (iv) Perigee; (e) General function of the space object."

Unfortunately, these specifications have not resulted in uniformity of practice for two reasons. First, an assessment of State practice reveals that the phrase "as soon as

[24] *Convention on Registration of Objects Launched into Outer Space*, 6 June 1975, 28 UST 695, 1023 UNTS 15 (entered into force 15 September 1976).
[25] Id., Art II(I).
[26] Id., Art. II(3).
[27] United Kingdom, *Outer Space Act 1986*, Sec. 7.
[28] United Kingdom Space Agency, Registry of Outer Space Objects, January 2021, online: <https://www.gov.uk/government/publications/uk-registry-outer-space-objects >.
[29] Sweden, *Decree on Space Activities 1982*, Sec. 4.

practicable" has been leniently interpreted by most nations. If a satellite is registered at all, this is usually done within one to two years of launch, although some 140 objects have been registered after a 10 year period or an even longer delay.[30] Second, there are different interpretations of when the launch occurred. For example, Canada and the US consider the initial launch for date of launch (Canadarm-2 on 19 April 2001)[31] but India and Russia consider the date of deployment into space (Indian payload on Challenger on 30 August 1983; Russian launches of Progress M-41 on 2 April 1999 and ISZ on 16 April 1999).[32]

Critical to lunar security is the fact that there is no requirement to register any interaction between objects on the lunar surface, or in cis-lunar space. There is thus no incentive to document for instance, the deployment of objects from the surface of the Moon. Indeed, the reports of the UN Groups of Governmental Experts on TCBMs too, focus on Earth orbit, rather than lunar orbit.

Proposed TCBM: Crowd-Sourced Registry for Lunar Activities

The envisioned TCBM is a crowd-sourced registry exclusively for lunar activities that covers objects orbiting the Moon, interacting in cislunar space and on the surface of the Moon. The registry would be implemented and maintained by a group of like-minded non-State actors, including commercial entities, civil society organizations (CSOs) and individuals. The entity intending to engage in an activity would have to register the particulars in the registry, and the particulars would then be verified by the group collectively, as elaborated below.

Applying the UN GGE tests to validate registration as a suitable TCBM:

	Implementation	Demonstration
Who	Who should implement the measure? By critical mass of agreement, a group of non-state actors, collectively implement registration and verification for joint benefit.	Who should demonstrate the measure? The group of participating entities collectively, as crowd-sourced information will ensure accuracy of data.
What	What is the measure that should be implemented? Is it clearly identified and understood?	What should be demonstrated to confirm implementation? The participating entities would have to enter into an agreement that reflects the commitment to register

[30] Ram Jakhu, Bhupendra Jasani, Jonathan McDowell, "Critical Issues Related to Registration of Space Objects and Transparency of Space Activities" at 11.
[31] UNCOPUOS, *Note verbale dated 16 March 2006 from the Permanent Mission of Canada to the United Nations (Vienna) addressed to the Secretary-General*, UN Doc. ST/SG/SER.E/489 (11 October 2006).
[32] UNCOPUOS, Letter dated 14 October 1983 from the Permanent Representative of India to the United Nations addressed to the Secretary-General, UN Doc. ST/SG/SER.E/91 (25 October 1983); UNCOPUOS, *Note verbale dated 8 October 1999 from the Permanent Mission of the Russian Federation to the United Nations (Vienna) addressed to the Secretary-General*, UN Doc. ST/SG/SER.E/363 (19 October 1999).

	A registry of crowd-sourced data exclusively for lunar activities by a group of lunar stakeholders.	prior to the activity and also commit to verification of entries in the register on a daily basis.
Why	What is the value or benefit of performing the measure? This registry will cover activities on the surface of the Moon as well as cislunar space. In introducing registration for lunar activities, other stakeholders can be assured of transparency on behalf of the acting entities and additionally provide for collective verification of particulars submitted by the group as a whole.	Does a clear understanding of why it is important to be able to confirm or demonstrate implementation exist? Yes, verification of the registration particulars by the group will ensure that the data is accurate and assure stakeholders of transparency.
When	When should the measure be implemented? Before a planned maneuver in lunar orbit or surface occurs. Stakeholders to decide appropriate windows.	At what point is demonstration or confirmation performed? Immediately after the activity takes place, the group can begin verifying particulars.
How	How should the measure be implemented? Implementation comprises three stages: 1) Identify which non-State actors can form the group. Hold informal meetings inviting like-minded non-State stakeholders interested in transparency for lunar activities. 2) Entities to draft and enter into a Memorandum of Understanding (MoU). The MoU should reflect the commitment to register prior to an activity and additionally contain a clause on the obligation to verify entries on a regular basis. 3) Final stage would require activation of the registry with protocols for day-to-day verification.	How is implementation of the measure validated, demonstrated or confirmed? Collective verification by all members of the group ensures that there is more than one source of verifying whether particulars of a registered activity are accurate.

Registration of the particulars of lunar activities (rather than “launches” alone) which are verified by a group of non-State actors can introduce a much-needed element of transparency to future activities on the Moon. While this registry would be introduced by a

small group of actors, there is considerable scope for registration of lunar activities to eventually crystallize into a customary norm in the future.[33]

B. Notifications for Rendezvous and Proximity Operations (RPOs)

Rendezvous is a process wherein two space objects (artificial or natural) are intentionally brought close together through a series of orbital maneuvers at a planned time and place.[34] Meanwhile, proximity operations are a series of orbital maneuvers executed to place and maintain a spacecraft in the vicinity of another space object on a relative planned path for a specific time duration to accomplish mission objectives.[35] Rendezvous and proximity operations together (RPOs) thus refer to activities involving two or more space objects that are intentionally maneuvered towards each other, whether they make physical contact or not.

RPOs have been used since the beginning of the space age and currently have multiple uses for military and civilian purposes. A prominent use of RPOs today is that they are used for on-orbit satellite servicing and Active Debris Removal.[36] However, RPOs being dual-use can cause tension to build between countries as RPOs can be misinterpreted as hostile. This was most recently evidenced by the Russian incident in 2020.[37] In February, 2020, the US reported that Russian satellite Cosmos 2542 had ejected a sub-satellite Cosmos 2543 to spy on US military satellite USA-245.[38] The US satellite responded by putting more distance between itself and the Russian satellites, but the maneuver was viewed as "unusual and disturbing" by the Chief of the US Space Force.[39] This incident is a resounding call for some thresholds for RPOs, particularly with the foreseeable rise in space activities involving the Moon which will involve multiple entities in cislunar space.

Issues under international law

RPOs do not receive any express regulation under the international space treaties. Furthermore, State practice varies and there is no uniformity in maneuvers conducted, both between objects of different States and between objects of the same State. In the absence of express provisions, the conduct of RPOs would therefore be considered as an activity that falls within the general right to use and explore outer space under Article I of the Outer Space Treaty.[40]

RPOs have to comply with Article IX regarding harmful interference. The provision states that "[i]f a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the Moon and other celestial bodies,

[33] See Nivedita Raju, Heloise Vertadier, "The Role of Customary International Law in Future Lunar Activities," Journal of Space Law, Vol. 45 (2021) (*forthcoming*).
[34] Kaila Pfrang, Brian Weeden, "Russian Military and Intelligence Rendezvous and Proximity Operations" Secure World Foundation (August 2020).
[35] Id.
[36] See Astroscale, "Astroscale Celebrates Successful Launch of ELSA-d," (23 March 2021) online: https://astroscale.com/astroscale-celebrates-successful-launch-of-elsa-d/.
[37] WJ Hennigan, "Strange Russian spacecraft shadowing U.S. spy satellite, general says", *Time*, 10 February 2020, <https://time.com/5779315/russian-spacecraft-spy-satellite-space-force/>.
[38] Id.; Also see SpaceWatch.Global, "U.S. alleges two Russian satellites are stalking one of its satellites" February 2020, <https://spacewatch.global/2020/02/u-s-alleges-two-russian-satellites-are-stalking-one-of-its-satellites/>.
[39] Id.
[40] Outer Space Treaty, (note 2) Art. I.

would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment."[41] However, the subjective wording of this article allows RPOs, even for military purposes such as reconnaissance, to continue uninhibited.

RPOs additionally have to comply with general international law, including the UN Charter[42] through Article III of the Outer Space Treaty. This implies that the lawfulness of an RPO (and the subsequent response by another State, if any) would be determined based on whether it was a legitimate exercise of the use of force under the UN Charter.[43] Since this is highly circumstantial, the question then arises – how standards can be developed for RPOs to clarify underlying intent? The primary challenge to regulating RPOs is defining the distance at which an object may be considered a threat to another object, as State practice is inconsistent.[44] Section 11 of the Artemis Accords introduces "safety zones'' as a possible precursor to regulations for RPOs. However due to the lack of clarity regarding appropriation or exclusionary status of these zones, this report does not inquire into this proposal. Instead, the report considers a baseline notification mechanism for RPOs as a TCBM.

Proposed TCBM: Prior notifications for RPOs

The proposed notification mechanism applies to interactions between space objects in cislunar space and is loosely modelled on the Hague Code of Conduct (HCOC) clause for pre-launch notifications. The provision encourages States to "...exchange pre-launch notifications on their Ballistic Missile and Space Launch Vehicle launches and test flights. These notifications should include such information as the generic class of the Ballistic Missile or Space Launch Vehicle, the planned launch notification window, the launch area and the planned direction."[45]

This TCBM draws from this clause in communicating the purpose behind a planned maneuver prior to the RPO taking place. The entity conducting the maneuver would be obligated to notify the owner of the space object once it is within a range of 25 km (suggested example distance). This distance of 25km can be further subject to change among the stakeholders committing to the measure, in light of the ability of these objects to traverse hundreds of kilometers to approach each other within hours. It is challenging to achieve consensus, or even critical mass of agreement on the precise distance, as interactions between space objects are highly subjective (depending on the orbit, the objects and their functions). The objective of this TCBM is primarily to create a practice for communication of intent for such maneuvers. This report additionally proposes capturing

[41] Outer Space Treaty, (note 2) Art. IX.
[42] *Charter of the United Nations*, 26 June 1945, Can TS 1945 No 7, 59 Stat 1031, 145 UKTS 805, 24 UST 2225, TIAS No 7739 (entered into force 24 October 1945) [*UN Charter*].
[43] Id., See exception for self-defence under Art. 51 of the UN Charter; exception for collective action authorized by the Security Council under Art. 42 of the UN Charter.
[44] See Centre for Strategic and International Studies, "Space Threat Assessment 2020", March 2020; Also see Secure World Foundation Fact Sheets on Chinese, Russian and US Military and Intelligence Rendezvous and Proximity Operations, 25 August 2020.
[45] Hague Code of Conduct (note 16), Sec. 4(a)(iii).

this measure for notification in the form of a declaration. The report specifically recommends a declaration, due to the potential for this to eventually form binding legal obligations on States in the future.

Unilateral Declarations under International Law

In the Nuclear Tests case[46] the International Court of Justice considered a statement made by France to be a unilateral declaration with binding legal effect. The Court held that, "[i]t is well recognized that declarations made by way of unilateral acts, concerning legal or factual situations, may have the effect of creating legal obligations."[47] Such undertakings do not require any subsequent acceptance of the declaration, nor any reply or reaction from other States, only that they are given publicly with an intention to be bound.[48] The International Law Commission (ILC) recommended the criteria necessary for such unilateral declarations to have legal effect in its Guiding Principles, as adopted in 2006.[49] In these principles, the ILC clearly requires that the declaration must be made by or on behalf of a State.[50] It is therefore questionable whether non-state actors acting in individual capacity would be considered bound under international law. However, the TCBM has the capacity to create a practice for notification that States also engage in, thereby creating potential for future legal obligations. In the space context, there is some evidence to support the effectiveness of unilateral declarations made by States. In 1983, Yuri Andropov — General Secretary of the USSR — declared that the USSR commits "....itself not to be the first to put into outer space any type of anti-satellite weapon, that is, imposes a unilateral moratorium..."[51] This declaration has not been formally withdrawn and Russia has since continued to advocate against placing weapons in outer space.[52]

Applying the GGE tests to validate notifications for RPOs as a TCBM:

	Implementation	Demonstration
Who	Who should implement the measure? A group of non-State actors who agree to submit a notification justifying the maneuver to the satellite owners they are approaching.	Who should demonstrate the measure? The entity conducting the maneuver.
What	What is the measure that should be implemented? Is it clearly identified and understood?	What should be demonstrated to confirm implementation?

[46] *Nuclear Tests (Australia and New Zealand v. France)* 1974, I.C.J. Rep. 253, 268 (Dec. 20).
[47] Id.
[48] Id.
[49] International Law Commission, *Guiding Principles applicable to unilateral declarations of States capable of creating international obligations*, U.N. GAOR, 58th Sess., Supp. No. 10, U.N. Doc. A/CN.4/L.703 (2006) *[ILC Guiding Principles]*.
[50] Id., Principle I.
[51] Bhupendra Jasani, ed, *Space Weapons and International Security* (Oxford University Press) at 19.
[52] Russia announced a policy of "no first deployment of weapons in outer space" supported by Brazil, Indonesia, Sri Lanka, Argentina, Cuba and more recently Pakistan. See Jinyuan Su, "Space Arms Control: Lex Lata and Currently Active Proposals" Asian Journal of International Law (2015); Also see General Assembly resolution adopted in 2016, UNGA, *No first placement of weapons in outer space,* UN Doc A/C.1/71/L.18 (14 October 2018).

	A notification submitted by the maneuvering entity to the satellite owner, clearly stating the reason for the maneuver.	The notification itself, confirmed by the receiving entity.
Why	What is the value or benefit of performing the measure? Clarifying the purpose of the maneuver to reduce misperceptions to owners in the vicinity.	Does a clear understanding of why it is important to be able to confirm or demonstrate implementation exist? Yes, due to lack of regulations on RPOs and the need to develop starting points for norms of behaviour
When	When should the measure be implemented? Since objects can approach each other within hours, the measure should be implemented well in advance, before the RPO is conducted.	At what point is demonstration or confirmation performed? Before the RPO takes place, there should be receipt of the notification from the other entity.
How	How should the measure be implemented? Implementation can be executed in three stages: 1) The first step would be to identify which non-State actors would be willing to commit to a notification mechanism 2) The second stage would involve drafting a declaration where each of these entities commit to notification prior to an RPO. 3) Prior to an RPO, the responsible entity would have to send a notification to the owner of the object in proximity, substantiating why the maneuver is taking place.	How is implementation of the measure validated, demonstrated or confirmed? The declarations provided by each entity reflect a commitment to the measure. The notifications relayed will demonstrate whether the measure has been implemented successfully.

Prior notifications can therefore provide a non-binding method of clarifying intent behind RPOs for lunar stakeholders that are non-State actors. In addition, the practice of notifications has the capacity to develop into an obligation under international law, should States consistently adopt the practice in the future.

C. Sharing Space Situational Awareness (SSA) Data

SSA has been succinctly defined in the US Space Policy Directive – National Space Traffic Management Policy 2018 – as "the knowledge and characterization of space objects and their operational environment to support safe, stable, and sustainable space activities."[53] SSA has a number of uses, as summarized by ESA "to autonomously detect, predict and assess the risk to life and property due to man-made space debris objects, reentries, in-orbit explosions, in-orbit collisions, disruption of missions and satellite-based service capabilities, potential impacts of Near-Earth Objects (NEOs), and the effects of space weather phenomena on space-based and ground-based infrastructure."[54] From the perspective of enhancing lunar security, SSA is a clear step towards transparency and confidence-building, as it enables participants to pool resources and collaborate to share information that ultimately enables protection of space-based assets. It will enable the provision of detailed information about the health of satellites to their operators, identified location of space objects, including satellites and debris, and, if possible, who operates them, which can mitigate some of the risks of misunderstanding and mis-judgement.[55]

There have been visible attempts to introduce data-sharing on a bilateral and multilateral basis, such as the Chinese Asia-Pacific Ground-based Optical Space Objects Observation System (APOSOS).[56] This system is based on a linked space observation network using optical trackers to observe interactions between space objects in LEO.[57] Another form of a partnership for SSA is visible in the EU Space Surveillance and Tracking project (EU-SST), which provides SSA data to a consortium of eight member States.[58] Alternative forms of collaboration include the European Southern Observatory (ESO) partnership with other States, including the government of Chile, to promote astronomy and increase observation capabilities.[59]

The most sophisticated SSA capabilities have been attributed to governments. The US, Russia and the European Space Agency possess sophisticated networks to identify civilian and military space objects.[60] Certainly, the publicly-available data on US-run space-track is a valuable asset in identifying and sharing such information. However, there are several gaps in SSA data-sharing today, including palpable tension and internal competition between State and non-State SSA providers, which has been criticized as curbing the growth of the SSA industry.[61]

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[53] US Space Policy Directive-3, National Space Traffic Management Policy, 18 June 2018 [Space Policy Directive-3], Sec. 2.
[54] European Space Agency, About SSA, online: https://www.esa.int/Our_Activities/Operations/Space_Situational_Awareness/About_SSA.
[55] Laura Grego, "Outer Space and Crisis Risk" in Cassandra Steer and Matthew Hersch (eds) *War and Peace in Outer Space: Law, Policy and Ethics* (Oxford University Press) at 66.
[56] Asia-Pacific Space Cooperation Organization, Ground-Based Space Object Observation Network, online: <http://www.apsco.int/html/comp1/content/APOSOS/2019-03-01/59-261-1.shtml>
[57] Id.
[58] European Union Space Surveillance and Tracking, online: <https://www.eusst.eu/>
[59] European Southern Observatory, Partnerships, online: <https://www.eso.org/public/outreach/partnerships/#:~:text=Collaborations%20in%20Chile%20%E2%80%94%20the%20constant,promote%20astronomy%2C%20science%20and%20education.>
[60] Francis Lyall, Paul Larsen, Space Law: A Treatise (Routledge: 2017) at 269; Also see space-track.org, a catalog of space objects made available to the public by the US Space Command – online: < https://www.space-track.org/>
[61] Testimony of Dr. Brian Weeden, Hearing of the Subcommittee on Space and Aeronautics, 11 February 2020, online: <https://swfound.org/media/206932/weeden_house_ssa_testimony_written_feb2020.pdf>

The technical aspects surrounding SSA data-sharing are equally pertinent. The expression "SSA" can be construed widely and includes different categories of data. SSA data can therefore refer to observational data obtained using sensors (optical, radar, radiofrequency) and also refer to data regarding the individual parameters of individual space objects.[62] For this reason, launch particulars can also be considered a type of SSA data.

There is a noted increase in the capabilities of collection of SSA data, including a surge in sensors among individual entities.[63] Similarly, the processing of SSA data into an actionable SSA product proves challenging, although there is a noted growth towards the development of systems that can create catalogs and produce such products.[64] Most significantly, reliance on a singular State or entity to provide SSA data will lead to concealment of certain information deemed sensitive for security purposes, and can also result in biased information that is questioned by other stakeholders. These challenges thus indicate that a new measure aimed at SSA data-sharing will have to be both international and interoperable.

Issues under international law

Article IX of the Treaty places an obligation on States to "...conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty."[65] As stated above, the provision additionally introduces the duty to consult in case of "potentially harmful interference".[66] Under international space law, this provision requires that States conduct their space activities with a certain standard of care and ensure the prevention of harmful acts which are reasonably foreseeable.[67] Engaging in protocols to enable SSA data-sharing for the Moon would fall squarely within this provision.

Data sharing for SSA also complies with Article XI of the Outer Space Treaty, which states, "[i]n order to promote international cooperation in the peaceful exploration and use of outer space, States Parties to the Treaty conducting activities in outer space, including the Moon and other celestial bodies, agree to inform the Secretary- General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities."[68] In this clause, the expression "public" can be construed widely to include all lunar stakeholders, including individuals, civil society organizations (CSOs), international organizations (IOs) and commercial entities. Some argue that this provision only applies to

[62] Robert Rovetto, T.S. Kelso, "Preliminaries of a Space Situational Ontology" Advances in the Astronautical Sciences, 2016 at 6; Also see Bhavya Lal et al, "Global Trends in Space Situational Awareness (SSA) and Space Traffic Management (STM)" Institute of Defence Analysis, April 2018 at vi [*IDA Report*].
[63] See IDA Report at 53.
[64] Id., at 55.
[65] Outer Space Treaty, (note 2), Art IX.
[66] Id.
[67] See *Corfu Channel case (United Kingdom of Great Britain and Northern Ireland v. Albania),* [1949] ICJ Reports 4; Also see Chagos Marine Protected Area Arbitration (Mauritius v. United Kingdom) [2015].
[68] Outer Space Treaty, (note 2), Art. IX.

States, while others counter-argue that Article VI of the treaty clearly facilitates the inclusion of non-governmental entities in this provision.[69]

Regardless of the interpretation, it is undeniable that non-State entities, particularly commercial SSA companies, have begun to play a significant role in SSA. LeoLabs, AGI and ExoAnalytics are key examples of this growing movement. Most prominent among relevant actors is the Space Data Association (SDA).[70] The SDA is a non-profit organization of satellite operators which shares information of operational data while promoting best practices in the industry.[71] The following measure draws on this organizational model in proposing a new mechanism for SSA-data sharing.

Proposed TCBM: SSA Data-sharing

The proposed TCBM therefore considers a measure that is coordinated by non-State actors only, but also encourages participation of international organizations, such as ESO, to ensure accuracy of data. Unfortunately, there are no concrete regulations that make SSA data-sharing an obligation under the Outer Space Treaty. However, this TCBM nonetheless aligns with certain provisions of the Outer Space Treaty, which encourage such information-sharing.

The database would be coordinated by a group of non-State actors, including commercial entities, CSOs and IOs which would guarantee an element of impartiality to this SSA information. This mechanism requires a data-sharing agreement to be drafted that provides the obligation to collect, process and share the SSA data. The final database would only be accessible to group members, thereby encouraging additional lunar stakeholders to join.

Applying the GGE tests to validate SSA Data Sharing as a TCBM:

	Implementation	Demonstration
Who	Who should implement the measure? Lunar stakeholders specifically non-State actors, including international organizations.	Who should demonstrate the measure? These entities would be responsible for coordinating information in the form of a database.
What	What is the measure that should be implemented? Is it clearly identified and understood? A database of SSA information exclusively for objects on the Moon and	What should be demonstrated to confirm implementation? These entities would have to enter into a data-sharing agreement that

[69] Cologne Commentary on Space Law (note 5) at 112-114.
[70] Space Data Association, online: <https://www.space-data.org/sda/>
[71] Id.

	in cislunar space. Data will be contributed and verified by group members collectively, but only accessible and communicated to the stakeholders that join.	captures the commitment to collect, process and share data.
Why	What is the value or benefit of performing the measure? Firstly, this SSA database can build cooperation between lunar stakeholders by sharing information and encouraging other entities to join. Secondly, this database could form a precursor to a space traffic management mechanism for lunar activities.	Does a clear understanding of why it is important to be able to confirm or demonstrate implementation exist? Yes, the data-sharing agreement will ensure that the collection, processing and sharing of SSA data is a legal obligation. Similarly, if the dataset is crowd-sourced, this will ensure contribution of data from different sources and enable verification of information as an additional benefit.
When	When should the measure be implemented? There is no specified time limit for the introduction of a database, therefore even a smaller group of lunar stakeholders can initiate this measure.	At what point is demonstration or confirmation performed? The data-sharing agreement should precede the collection and sharing of information.
How	How should the measure be implemented? 1) The first step is for the stakeholders to enter into a data-sharing agreement regarding objects on the Moon and in cislunar space. 2) The actual SSA data-sharing process involves three steps: (i) data collection, (ii) data processing and (iii) data-sharing between participants. The agreement would have to incorporate clauses on the types of data being contributed by each participant, standards to ensure quality of data contributed and additionally list protocols for data-processing. 3) A functional SSA database would then be activated and information-sharing between participants commences.	How is implementation of the measure validated, demonstrated or confirmed? Following activation of the database, the information contributed by each entity is subsequently collectively verified by the other participants.

D. Space Traffic Management (STM)

SSA and STM are two separate, yet closely linked concepts. While SSA refers to the collection of information about space objects, STM refers to a comprehensive mechanism that uses this data to coordinate interactions between space objects. The difference between the two concepts is reflected in US National Space Policy - Directive 3 which defines space traffic management as "planning, coordination, and on-orbit synchronization of activities to enhance the safety, stability, and sustainability of operations in the space environment."[72] The policy essentially clarifies which domestic authorities are responsible for coordination of SSA data for space traffic management and aims to include more entities from the US private sector, particularly satellite operators.[73] The policy also directs the Departments of Commerce and Transportation to develop standards for STM including technical guidelines, minimum safety standards, behavioral norms, and orbital conjunction prevention protocols related to pre-launch risk assessment and on-orbit collision avoidance support services.[74] However, as reflected in the policy, this is an initiative aimed at streamlining national STM and the US State Department will have to work with international partners to develop regulation for international STM.[75] National attempts to monitor space traffic for lunar activity have also increased, as evidenced by the US Air Force awarding a team of start-up companies a contract for the collection and analysis of objects in cislunar space.[76]

Domestic attempts to regulate STM are laudable, but will require global participation to ensure that the purpose behind lunar activities is clearly communicated to all stakeholders. STM can therefore be viewed as a vital TCBM that encourages entities to communicate information about their activities in advance. Indeed, the introduction of an international space traffic management regime has been recognized as an urgent need.[77] This is attributed to the significant increase in the number of launches and intended launches into outer space, and the subsequent coordination of these activities to avoid collisions with active or inactive objects. Notably, STM has, thus far, largely focused on coordination within Earth orbit.[78] This is owed to the unresolved questions surrounding the delimitation of airspace and outer space, and legal regimes applicable to new technologies such as suborbital flights.[79] While these debates are legitimate, coordination mechanisms specifically for objects in cislunar space, in consideration of the unique lunar environment, have received little attention on multilateral platforms.

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[72] Space Policy Directive-3 (note 50), Sec 2(b).
[73] Id., Sec. 4-6.
[74] Id., Sec. 6(f).
[75] Id., Sec. 5(iii).
[76] Sandra Erwin, "Air Force eyeing technology to monitor space traffic near the moon" Space News 14 April 2020, online: <https://spacenews.com/air-force-eyeing-technology-to-monitor-space-traffic-near-the-moon/>
[77] See "Space Traffic Management and Coordinated Controls for Near-space" in Ram Jakhu, Joseph Pelton, (eds), *Global Space Governance: An International Study* (Springer International Publishing: New York, 2017).
[78] Id.; See Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space, UN Doc A/AC.105/890 (2007) online: UNOOSA <www.unoosa.org/pdf/bst/COPUOS_SPACE_DEBRIS_MITIGATION_GUIDELINES.pdf>.
[79] Aram Daniel Kerkonian & Nivedita Raju, "The Legal Challenges of International Suborbital Flights: A Bilateral Solution" (2020) 85:3 J Air L & Com 387 at 85.

Proposed TCBM: Space Traffic Management

The proposed Space Traffic Management (STM) mechanism incorporates elements of the previous TCBMs as building blocks for comprehensive coordination. The particulars of a planned activity should be registered in advance in a lunar registry. If the planned activity intends to reach another owner's space object, stakeholders can use the notification mechanism to communicate the maneuver and reason for said maneuver to the owner. Most critical to this STM measure is the SSA database proposed above, which will form the basis for coordination, as this TCBM would use the SSA database to provide conjunction assessments, collision avoidance warnings and initiate a channel of communication between entities involved. This measure is therefore composed of several layers.

Applying the tests of the GGE Report below:

	Implementation	Demonstration
What	What is the measure that should be implemented? Is it clearly identified and understood? This TCBM for STM purposes is comprised of four layers: 1) This group of stakeholders commits to registering particulars of a planned activity. 2) In case of planned RPOs involving another entity's object, member's commit to the notification measure above. 3) The group uses the SSA database to identify the locations of objects, predict possible collisions and future interactions between objects in cis-lunar space. 2) When possibly damaging interactions are predicted, a channel of communication exclusively between the entities concerned is initiated through this group. The members themselves have to negotiate and decide who has right of way, or how to maneuver to avoid collision.	What should be demonstrated to confirm implementation? Since this STM measure consists of several smaller measures, in addition to a forum for communication, entities would have to enter into a joint venture agreement where they agree to pool resources and commit to developing a communication forum for STM.
Why	What is the value or benefit of performing the measure?	Does a clear understanding of why it is important to be able to

	STM as a TCBM will encourage a practice of frequent communication and data sharing for lunar activities.	confirm or demonstrate implementation exist? Yes, as STM will involve multiple procedures and resources for coordination purposes.
When	When should the measure be implemented? This measure can only be implemented after a number of stakeholders agree to collaborate on an SSA database, as this forms the backbone of this measure.	At what point is demonstration or confirmation performed? Demonstration can only occur after the STM communication channel is activated.
How	How should the measure be implemented? This measure involves three stages: 1) The group of SSA-data users reach an agreement on the fundamental aspects of this STM mechanism 2) Draft a joint venture agreement where clauses reflect pooling of resources by these entities and commitment to develop the STM communication platform. 3) Linking the SSA database and activating the STM platform.	How is implementation of the measure validated, demonstrated or confirmed? Demonstration can occur only after the SSA database shares predictions/ issues collision avoidance warnings to members and the communication channel for concerned entities is activated.

The proposed STM mechanism is multi-layered and interlinked with the success of the aforementioned SSA database. Introducing an international STM mechanism as a TCBM is desirable, but unlikely at present until the preceding measures are agreed to by a group of stakeholders. These can each form constituent units of an STM system.

The second section of this report focuses on the implementation of TCBMs. Indeed, the implementation of the measure is often considered while designing the measure itself, as States have been reluctant to enter into new bilateral or multilateral mechanisms. For this reason, the following section considers both new and existing ways to implement TCBMs, particularly from the perspective of non-State lunar stakeholders.

Part III – Implementation of TCBMs: Exploring New and Existing Institutions

Past proposals for institutional frameworks on TCBMs were submitted by various States and recorded in the 1993 UN GGE report on TCBMs. These proposals for institutions range from an international Satellite Image-Processing Agency for satellite monitoring by France in 1989 which would be open on a voluntary basis, to all States possessing or using satellites.[80] The Soviet Union had also proposed introducing an International Space Monitoring Agency to collect information about monitoring space, providing information to the United Nations and Governments that could be useful in controlling local conflicts and crisis situations.[81] To enhance verification, the Soviet Union recommended the creation of an International Space Inspectorate, based on their argument that "On-site inspection directly before launch is the simplest and most effective method of making sure that objects to be launched into and stationed in space are not weapons and are not equipped with weapons of any kind."[82] Measures to provide detailed launch information were also pursued by Pakistan, who suggested that, in addition to providing detailed information in advance of a launch concerning the nature of the payload, that this information should be verified "at the launch site by an international agency."[83] While these proposals did not come to fruition, the interest in TCBMs and supporting institutions to verify information surrounding space activities were unmistakable. However, these proposals considered a traditional top-down State-to-State approach to implementing TCBMs. The rise in non-State actors in the past few decades, coupled with the ability of some of these entities to define behaviour and influence activity in space, implies that other approaches to implementation should also be considered.

In addition, developing countries have questioned the fairness of traditional international law and its supporting institutions.[84] With most GGEs comprising 15 seats of member countries, where 5 seats are reserved for the P5, developing countries, particularly those with nascent space capabilities tend to view these fora as inequitable.[85] Another crucial issue is the inclusion of non-state actors in existing institutions. These institutions are State-centric with traditional models of regulating behaviour and view non-State actors only as representatives of countries. However, the boom in commercialization today indicates that commercial entities and CSOs are stakeholders as well and must be included in the making of new policies, due to their ability to influence behaviour. For example, companies such as EUTELSAT have asserted that any conversation about new space security norms would require their inputs as well.[86]

[80] GGE Report 1993 (note 1) at 54.
[81] Id.
[82] Id. at 69-70.
[83] Id.
[84] Rajeswari Pillai Rajagopalan, "Achieving global cooperation in space security: Settling for less than the ideal", *Space Security Index 2018* at 153 [*Rajagopalan*].
[85] Id.
[86] Sandra Erwin, "Satellite operators want a seat at the table in space security discussions," Space News (16 March 2021) online: <https://spacenews.com/satellite-operators-want-a-seat-at-the-table-in-space-security-discussions/>.

There is noticeable resistance to creating new institutions for space policies, particularly in the context of TCBMs and security in general.[87] However the TCBMs proposed above provide new avenues of introducing accountability to lunar activities– first by nudging these actors into collectively providing data and verifying activities as a group, and second by encouraging that they too engage in norm-setting by initiating best practices. This would overall contribute to reducing misperceptions and ensuring that activities are being conducted with transparency. Furthermore, these measures recommend beginning with a group of non-State actors who introduce the mechanisms, and eventually nudge States into engaging in the practices as well.

A Polycentric Approach to Implementing Lunar TCBMs

The fundamentals of polycentricity lie in (1) multiple governance centers, (2) a system of rules, and (3) spontaneity in the emergence of order and institutions which results from the exchange between coexisting and competing ideas, practices, and methods.[88] The theory assumes that there is no single authority to rule, but rather that all rulers are constrained and limited under a "rule of law".[89] Adoption of a polycentric approach for lunar TCBMs is ideal, as it can further enable the inclusion of additional actors and assure stakeholders of a horizontal relationship.[90]

A polycentric approach would empower the self-organization and self-governance of stakeholders within a set of procedural rules and principles.[91] In the case of TCBMs, these entities would include various non-State actors, who would then proceed to adopt mutually agreed regulations (termed as their own Collective-Choice Rules).[92]

From a polycentric perspective, the implementation of a registry, notification exchange and SSA-STM protocols each envision independent units implementing the proposed measures in accordance with this overarching system of rules that empowers self-governance. This eliminates the requirement of a concentration of power in a singular entity and can incentivize non-State actors to join them without being subjected to a central authority.

An 'Extitutional' Lens for Implementation of Lunar TCBMs

The theoretical framework of extitutional theory can also provide guidance on managing the dynamics of the aforementioned mechanisms. Extitutional scholars suggest that institutional theory and extitutional theory are two distinct perspectives or "lenses'' on the same set of social phenomena or "assemblage".[93] Thus, while an institutional lens focuses

[87] See IDA Report (note 59).
[88] Lukas Kuhn, "Introduction to Polycentricity" 11 December 2020, online: <https://www.openlunar.org/library/introduction-to-polycentricity>
[89] Id.
[90] Lukas Kuhn, "Polycentricity for Governance of the Moon as a Commons" 2 February 2021, online: <https://www.openlunar.org/library/polycentricity-for-governance-of-the-moon-as-a-commons>
[91] Id.
[92] Id.
[93] See "About Extitutions," online: <https://extitutions.org/about>

on the roles and rules that shape and influence social interactions, the extitutional lens focuses on individuals and the relationships amongst them.[94] Specifically, the extitutional lens focuses on the ways in which participation and mutual recognition pull people into alignment through local interactions.[95] Since the focus of extitutions is on these relationships, and how to influence them, an extitutional lens can provide an avenue for influencing the behaviour of the groups of stakeholders that implement these TCBMs. Each group of stakeholders identified for each TCBM can themselves develop the rules that should govern them. This is reflected both in the crowd-sourced registry and the SSA-database, where the group members are responsible for the contribution and verification of the information.

An additional advantage of extitutional theory lies in the lack of rigidity or formal procedures.[96] Applying this to the above mechanisms would indicate that the groups are open to the entry and exit of members to the mechanism. This attribute of extitutional theory is particularly relevant for the notification for RPOs proposed above, so as to provide an opportunity for States to eventually adopt the same practice.

Influencing the behaviour of these groups of stakeholders to implement the TCBMs may be accomplished through creating incentives or imposing sanctions. An example of incentives to induce desirable behaviour is reflected in the Space Sustainability Rating initiative.[97] This rating system provides incentives to industry to design missions that support sustainable space operations with minimal impact.[98] In the context of the aforementioned TCBMs, both the crowd-sourced registry and the SSA database have significant incentives in terms of providing access to the information exclusively to the contributing participants. The participation in the mechanism is incumbent upon each entity fulfilling their obligation to verify information on a mutually agreed basis.

An extitutional lens can therefore provide new avenues to ordering the social dynamics between these particular stakeholders, particularly by providing incentives that are only available to participants.

Continued Efforts with Existing Institutions

While the Conference on Disarmament continues to be deadlocked, the UN General Assembly provides an optimistic view towards adopting new measures on space security. The UK resolution has invited States to submit national perspectives on space security and the reports will be submitted to the Secretary-General by May 2021. The UK resolution in itself is a TCBM that looks to move past a definitions-oriented approach and instead evolve

[94] Id.
[95] Id.
[96] Jessy-Kate Schingler, Primavera de Filippi, "Extitutional Theory", 2021 (forthcoming); Also see Jessy-Kate Schingler, Primavera de Filippi, "An Introduction to Extitutional Theory", online: < https://medium.com/berkman-klein-center/an-introduction-to-extitutional-theory-e74b5a49ea53>
[97] See generally, Minoo Rathnasabapathy et al, "Space Sustainability Rating: Designing a Composite Indicator to Incentivise Satellite Operators to Pursue Long-Term Sustainability of the Space Environment," International Astronautical Congress 2020.
[98] Id.

norms of behaviour for outer space. This new perspective is therefore likely to generate more interest in developing standards of acceptable behaviour.

The GGE process has been criticized for its exclusionary[99] and "closed-door" nature.[100] However, UN GGEs can also be made more transparent by conducting open-ended consultations hosted by concerned States or nongovernmental organizations to permit discussion of the important factors of definitions, scope, and verification that have not had a thorough or transparent airing in a multilateral context.[101] The 2013 GGE report on TCBMs can be examined by a new GGE that adopts such an approach towards other stakeholders, and ensures that the process is not limited to a select group of States, but also CSOs.

The UNCOPUOS continues to provide an opportunity for States to engage in multilateral discussions on TCBMs. The developments in 2020 of the Artemis Accords, purchase of lunar regolith and the Russia-China lunar research station all indicate that confidence-building between the dominant space powers is the need of the hour. Pursuing the introduction of new TCBMs through UNCOPUOS where these issues will be debated is crucial.

[99] See Rajagopalan (note 81).
[100] Paul Meyer, "Diplomacy: The Missing Ingredient in Space Security" in Cassandra Steer and Matthew Hersch (eds) War and Peace in Outer Space: Law, Policy and Ethics (Oxford University Press) at 299.
[101] Id.

Conclusion

This report has highlighted the role of TCBMs in lunar activities. Eliminating mistrust and building confidence between states is crucial now more than ever, with lunar ambitions emerging from different nations simultaneously.[102] TCBMs will be critical to preserve security on the Moon and ensure that activities continue to be conducted "exclusively for peaceful purposes". This report proposed several TCBMs with supporting mechanisms for implementation, namely: a crowd-sourced registry for lunar activities, prior notifications for rendezvous and proximity operations, a shared database for SSA and finally, a space traffic management system that incorporates elements of the previous measures.

As a starting point, the development and implementation of one particular TCBM can be pursued, ie, the SSA database. This measure is likely to generate a positive response from stakeholders, as there is a dearth of a comprehensive database with input verified by multiple sources. Furthermore, such a database would benefit both states and non-state actors, by providing information about the locations and potential collisions of space objects, thereby affording more protection to space assets. This TCBM can be pursued by one or two CSOs in collaboration, by issuing a public call for interest among lunar stakeholders.

As TCBMs can generate much-needed certainty and predictability in lunar activities, it is imperative that they are no longer viewed as policy recommendations, but actively pursued. Paragraph 2 of Article IV of the Outer Space Treaty distinguishes between space security in general and lunar security in particular, with specific restrictions on activities on the Moon. Initiating development of specific lunar TCBMs by emphasizing this difference, and opening TCBMs to lunar stakeholders, particularly non-state actors, can result in tangible action.

[102] Namrata Goswami, "The Strategic Implications of the China-Russia Lunar Base Cooperation Agreement" The Diplomat, 19 March 2021, online: <https://thediplomat.com/2021/03/the-strategic-implications-of-the-china-russia-lunar-base-cooperation-agreement/>