

Employing a Shared Space Information Sharing Ecosystem as a Mechanism for Promoting Constructive U.S. China Space Relations

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ABSTRACT

In November of 2021, The Peoples Republic of China issued a *note verbale*¹ to the United Nations Secretary General citing Outer Space Treaty obligations to inform the Secretary-General of U.S. company, Starlink activities regarding “phenomena which constituted dangers to the life or health of astronauts aboard the China Space Station.” In January of 2022 the United States responded with their *note verbal*² to the UN Secretary General stating that measures to reduce the risk of collision between United States space objects and the human spaceflight activities of other nations should be conducted directly, to facilitate efficient and timely sharing of information and coordination of potentially urgent responses. A week later, the PRC issued a press statement³ that the “Chinese government is open to establishing formal lines of communication with the United States on space safety issues after a pair of alleged close calls of Starlink satellites with China’s space station.” China operated under the premise that the United Nations Outer Space Treaty obligates nations to fulfill the international obligation by informing the U.N. of dangerous approaches to the national space assets that threatened the safety of in-orbit human. The United States “believes that detailed consultations on measures to reduce the risk of collision between United States space objects and the human spaceflight activities of other nations should be conducted directly, through bilateral channels, to facilitate efficient and timely sharing of information and coordination of potentially urgent responses.”

This paper seeks to compare two perspective interpretations of international obligations stemming from the Outer Space Treaty and timely information sharing mechanisms for coordinative communication that preempt hazards in space operations. Further, this paper will explore the nature of what appears to be an opportunity to establish formal lines of communication for U.S. China space relations that may serve as a model for more constructive engagement that informs the advancement of the state of practice for an international space information sharing ecosystem. A Space Information Sharing Ecosystem is a polycentric design or decentralized approach to share applicable space information in ways that mitigate uncertainty of intent and a spiral of tensions. It also improves the viability of a multinational sustainable space economy enabled by enhanced transparency and confidence building measures among a wide set of stakeholders versus the predominate pattern today of many narrow bi-lateral information sharing systems and agreements. While bilateral agreements are necessary, they are sometimes problematic, especially in situations that benefit from open and transparent data sharing, such as safety. This paper postulates that a safety-focused global space traffic coordination system, informed by a space information sharing ecosystem can constructively contribute to fostering U.S.-China (and others) space relations. A model for doing so relies on decision making by sovereign, commercial, and non-profit actors all of whom rely on transparent space domain awareness information. Example types of information to be examined for sharing in a trusted and symmetric manner include Initial lifecycle events (launch, orbit insertion, maneuvers), present observed orbit (awareness), intention to maneuver, or park in a graveyard

¹ A/AC.105/1262

² A/AC.105/1265

³ <https://spacenews.com/china-proposes-formal-lines-of-communication-with-u-s-on-space-safety/>

orbit (awareness), computed possible conjunctions (collision prediction) ongoing and terminal lifecycle events (collision detection, decommission).

1. CHINA PERSPECTIVES

China's space program is the fifth oldest in the world, with its Dong Fang Hong 1 satellite launching just months after Japan's own first in April 1970. Since then, the People's Republic of China has invested extensively in its orbital capacity. As of today, China has one of the most sophisticated space programs in the world. The launch of Tianhe, a core modular component of its future space station, is perhaps one of the country's most powerful symbols of its position as a leading space power.ⁱ Ambitiously, the country's latest Five-Year Plan announced China's intention to develop a plan to create a research station on the Moon and engage in further interplanetary exploration. Not limited to scientific attainment, this same plan also calls upon China to expand its "space environment governance system," allowing for China to avoid collision in space, monitor space debris, keep tabs on the Earth's climate, and "study plans for building a near-earth object defense system."ⁱⁱ

Though China's celestial ambitions are maturing, it is clear that Beijing remains bound to their terrestrial geopolitical concerns. On May 9th, during the Open-Ended Working Group meeting on reducing space threats, Ambassador Li Song – as part of a general exchange of views – took issue with United States' space policy. Li raised a number of concerns, claiming that the superpower clings to "cold war mentality," whereby the US pursues unilateral strategic advantage, openly pursues a "strategy of 'space dominance,'" and "declares outer space as a warfighting domain." These, along with other comments, are meant to convey the growing risk of the "weaponization of" space, including the real possibility of an arms race. Indeed, Ambassador Li states that "the root cause of such an arms race is that the superpower attempts to dominate outer space." The solution to this potential for escalation is multilateralism, consensus, disarmament, and the abandonment of any nation's desire for "hegemony or dominance in outer space." These remarks were accompanied by two documents, both of which reinforced Ambassador Li's comments. Some, indeed, went further.

China's A/AC.294/2022/WP.10 document calls for a legally binding international instrument through the United Nations for the "prevention of an arms race in outer space" or PAROS. The instrument is necessary not only to prevent an arms race. China, according to this document, believes that the "peaceful uses of outer space would be out of the question" should the weaponization of outer space and an arms race not be avoided. This is a strong signal that China would be unwilling to allow parallel developments of space as a domain for scientific and commercial activity, should it simultaneously see the United States take advantage of its current leading position to ensure some form of hegemonic advantage. This document casts the United States as a barrier to peace, stating that it has been "unwilling to subject the development of its military capabilities in outer space to any substantive constraint" and "long stood in the way of outer space arms control process[es]."

China, for its part, appears the hero. Though the United States is currently in good standing with the preexisting legal regime which bans nuclear and other weapons of mass destruction from space, China considers established international convention as inadequate. Other weapons must be banned in order to prevent the militarization of outer space. China considers this to be in alignment with longstanding UN consensus, as in 1981, "the United Nations General Assembly has adopted, by an overwhelming majority, resolutions on a yearly basis, demanding the Conference of Disarmament to negotiate a new international legal instrument on PAROS." This was, according to Ambassador Li, meant to "fundamentally [address] the immediate risks of an arms race and threats of weaponization in outer space." China has since partnered with Russia to accomplish this objective by "jointly submitting to the Conference of Disarmament a draft treaty" in line with PAROS in 2008. This treaty was then updated in 2014, and in 2018 the UN established a group proposed by the two countries to "conduct in-depth and substantive discussions on the elements of relevant international legally binding instrument."ⁱⁱⁱ These developments, the document claims, were stymied by the US.

Manichean framing aside, the core idea behind the proposal is rather alluring. Nations should put aside their ambitions to turn the space domain into one of competition and confrontation and embrace the possibility for win-win cooperation. Calling for in-depth discussions on the technical dimensions of a PAROS instrument is also quite sensible. China also did not reject transparency and confidence-building measures, and suggested that they have an important supplementary role even if they are not considered sufficient. The call to regulate private industry in space may also be amenable to some countries as well, particularly as the document notes that “commercial space institutions have participated in military space activities on a large scale.” In a perfect world, those objectives appear quite laudable. It is less so for the world as it is today.

China, for all its claims that the United States is the principal roadblock to peace in outer space, is nowhere near innocent with regards to the militarization of space. China’s last ASAT test occurred just one year before its joint proposal with Russia on a draft treaty, and it is highly likely they carried out another years later.^{iv} Russia, its erstwhile partner, carried out an ASAT test as recently as last year.^v That alone would signal a lack of seriousness on PAROS, but both countries appear to be stockpiling anti-satellite weapons.^{vi} Though China has accused the US of declaring space a warfighting domain, according to the April 2022 Secure World Foundation Report, China has also “designated space as a military domain.” Even though China’s public comments’ content remains focused on peaceful purposes, privately China has been reorganizing its military structure, and “likely has significant electronic warfare counterspace capabilities.”^{vii}

The suspiciously minded analyst would be concerned that the PAROS framework is merely a tool to erode the current advantage the United States currently possesses, enabling greater room for China and Russia to maneuver until the US’s advantages diminish. When China says its previous draft treaties were dismissed on technical grounds, it appears as though something more was happening underneath the surface. Document’s A/AC.294/2022/WP.9 statement that “space-based missile interceptors in space” are among those technologies that could be “diverted to offensive military use,” so one may wonder if this is merely a mechanism to safeguard the effectiveness of their growing ASAT stockpiles. Even China’s complaint about the Starlink satellite constellation taking up space and constituting a danger to “the life or health of astronauts aboard the China Space Station” rings somewhat hollow given Space X’s rather dramatic later display of counter-electronic warfare capabilities during the Russian invasion of Ukraine.^{viii} Might this be the reference to commercial space institutions participating “in military space activities”?

Though the suspicious view is increasingly common among the most fervent proponents of establishing and safeguarding US advantages in the space domain, it is too often a mechanism to close debate and discussion. It is clear that China has a complicated relationship with its international obligations regarding the outer space treaty. It may loudly call for the safeguarding of the peaceful use of outer space, but it is clear that it has prepared for the possibility of conflict and warfare in that same domain. Though its space station is named after the concept of heavenly peace, the Chinese military has moved towards establishing a contingency should that peace fail.

2. UNITED STATES PERSPECTIVE

The United States, for its part, believes itself to be in full compliance with the Outer Space Treaty. The US’ December 2020 National Space Policy states that “[a]ll nations have the right to explore and to use space for peaceful purposes and for the benefit of all humanity, in accordance with applicable law.” The laws that the US is in compliance with and supports include the following: “In particular, the Charter of the United Nations, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (1967); the Agreement on the Rescue of Astronauts, the Return of Astronauts, and Return of Objects Launched into Outer Space (1968); the Convention on International Liability for Damage Caused by Space Objects (1972); and the Convention on Registration of Objects Launched into Outer Space (1975) provide the foundation of the space international legal framework for outer space.” The US and other states “will comply with their obligations under

international law” and considers “[reaffirming] commitment to international law, including the Charter of the United Nations and relevant outer space treaties” a “starting point” for the generation of norms of responsible behavior.^{ix}

The US, thusly, has established its space policy in accordance with preexisting jurisprudence. China’s position is that the legal status quo enables the continual build-up of military assets in space, increasingly likely to risk leading to an arms race. The US is likely unwilling to surrender the strategic advantages it has cumulated over time in accordance with the law as it stands today, while China’s comment that the peaceful use of space would be out of the question should an arms race occur is difficult to work around. Though China referred to the US as the first to employ an ASAT test, as well as the country to generate the most space debris, the US has refrained from such activity for decades. Indeed, avoiding ASAT tests and generating space debris is often called for by US leadership, most recently by Vice President Kamala Harris in April of this year. China’s focus, however, is on the existence of weapons, not their use. The mantra present throughout the May documents is the call for legally mandating an end to those weapon’s existence. This is the impasse at which the two governments currently stand.

And yet, there is still progress. Though China has approached the problem of dealing with outer space concerns through the United Nations, its recent diplomatic exchange over the potential risk Starlink constellations posed to the Chinese space station led to a direct Chinese proposal for a clear line of communication between the United States and China for the purposes of space safety. It seems that prior to this exchange, China did not alert the United States of potential near collisions, nor of its need to maneuver its space station. The relevant parties involved noted the difficulties of establishing clear points of contact.^x Making the process of alerting the other party of the movement of space assets less opaque is intuitive and reasonable, which is why this could very well be the foundation that enables the avoidance of an arms race.

3. THE DE-ESCALATORY POWER OF CLEAR LINES OF COMMUNICATION

At no point in human history was the need for clear, reliable, and direct contact between two governments made more apparent than during the Cuban Missile Crisis. It was revealed during that short moment in time the true extent of the Cold War’s existential nature. Less than a year after that crisis was concluded, a telephone connection was set up tying the White House directly to the Kremlin.^{xi} Though this channel of communication was only meant to be used in emergencies, it has entered into the collective consciousness of crisis diplomacy as the historical metaphor for the necessity of direct leader-to-leader mechanisms to alert one another in case of an active or potential catastrophe. Its first official use was to alert Russian leadership of the assassination of President Kennedy just months after it was established.

Though the ability to engage in immediate communication among the world’s most powerful country’s leaders in case of emergency is necessary and vital, this is not a particularly optimal situation, particularly in peacetime conditions. The need for steady communication among multiple levels of government is readily regarded as a superior method to ensure ease of inter-governmental communication. The more layers of government and the more agencies of government there are in active communication, the lower the risk of escalation or misunderstanding.

Indeed, it is when communication and exchange is cancelled among lower levels of government that the international community begins to become concerned about the potential for miscalculation. When the domain is purely commercial or jurisprudential, the international stakes may not be all that remarkable. But when the breakdown in communications is linked to military domains and political leadership, it is only natural that some may become apprehensive or fearful about the future relationship between the two countries. Most recently, a breakdown in communication between different levels of governmental and military leadership in the US-China relationship was cause for deep concern. The tenor of the resumed communication is often hostile and unproductive, but that is not really the point. Indeed, according to Paul Haenle of the Carnegie-Tsinghua Center, “the White House has stressed that it is not pursuing dialogue with Beijing for its own sake, but rather to ‘set terms for responsible management of the U.S.-China

relationship.”^{xii} Allowing communications to break down is, by its very nature, irresponsible. Indeed, it would not be going too far to suggest that steady talks across all levels of government is the very hallmark of peacetime diplomatic relations.

One should not think that communication is unnecessary because conflict will not occur unless it is instigated by either one or both countries involved. It is when communication is absent that intent becomes fungible to the political insecurities and fears of the less powerful of the two countries. In the 1990s, the Chinese government believed that the United States had one of the most capable and advanced militaries in the world, backed by a superior intelligence apparatus. As a result, its leadership could not believe that the bombing of their embassy during the breaking apart of Yugoslavia was an accident.^{xiii} It is entirely plausible that something similar could occur in the space domain today, as the United States is by far and away the more advanced and capable actor in the earth’s orbit. Without clear and effective lines of communication, a satellite malfunction, an accident, or an unintended signal could be wildly misconstrued by the opposing side. In fact, recently the Kosmos-2558 satellite was launched from the Plesetsk Cosmodrome in Russia as a payload on the Soyuz-2.1v rocket. The Russian Ministry of Defense said Kosmos-2558 is a military satellite deployed into a Sun-Synchronous Orbit (SSO). Its exact purpose is unknown at present but has been described as an "inspector" satellite.” [1]

“Initial data dictates that, in its current orbital path, Kosmos-2558 will pass within 80 km of the NRO's USA-326 satellite at about 14:50 UTC on Thursday, August 4 if neither of the satellites maneuver away from or closer to each other before then. McDowell does not expect that Kosmos-2558 will maneuver within 50 km of USA 326 as an observational mission can be accomplished from outside that distance, but that doesn't change the fact that the threat to U.S. orbital systems is growing very quickly” [1]

While it is an often-held truism that wars do not happen unless one or both sides want it to happen, the many near-misses to utter catastrophe the world faced in the Cold War should disabuse the policy maker of that notion.

It is with that in mind that a basic framework for information sharing and communication can be put forward regarding China and the United States in the space domain.

Table 1. Tiered Approach to Sino-American Communication Political Infrastructure

Routine contact across all relevant levels of government and multiple agencies regarding both security and peacetime uses of outer space, including permanent positions dedicated to maintaining the relationship and explaining misunderstandings.
Routine contact across limited levels of government and only a handful of agencies regarding both security and peacetime uses of outer space. Individuals may be designated as points of contact, but no institutionalized roles are present.
Limited and infrequent contact between the US and Chinese government regarding the security and/or peacetime uses of outer space. A point of contact may be specified, but the exact nature of the communication will be unclear and informal.
Communication limited specific occasions, likely instigated by a particular action or event that mandates a meeting. Communication limited to most senior government or military officials.
Only informal communication occurs, and only on an as needed basis. Increased difficulty in communication is likely.
Emergency lines of communication only, perhaps limited to heads of state.

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No lines of communication permanently open. This is the most dangerous tier.

Though clear and regular communication on a bilateral basis is an important way to ensuring unnecessary and unintended escalations are avoided, this can only get us so far. Formalized lines of communication need not be limited to two countries. While a core bilateral relationship is vital to ensuring the ongoing strategic stability of outer space is not overturned, it will be more optimal to encourage a greater degree of multilateralism. When China railed against the military alliances and a political bloc of countries, it was criticizing the multilateral framework the United States has established and is working to establish with its core allies and partners. The incorporation of those partners would be beneficial to the cohesiveness and stability of the international communicative body. While China is suspicious of US alliances, China has often viewed Europe as a balancing force and restraint for the United States. China would likely be amenable to their incorporation in the framework, but it is unlikely that China would be satisfied with just this arrangement.

The international space communication framework would need to be expanded to include neutral countries, such as India, and other countries that are more likely to side with China, such as Russia. While their incorporation will make consensus making more difficult, it is important to understand that the primary need for consistent engagement is not that it will enable sweeping international laws and policies to be passed that fundamentally solve all problems in cislunar space, but rather that steady communication at all levels of government is necessary to responsible statecraft in outer space. The need for this will only grow as the number of satellites proliferate in orbit, the rate of tourist and manned missions grow exponentially, and, perhaps multiple, stations are established on the moon. The relative fragility of space assets mandates extraordinary caution and highlights the need to ensure that information is shared across all governments, not just the two most likely to come to confrontation in the years ahead. It can be expected that in its most fully realized form, all countries with substantial stake and ownership in the space domain will be included in this communicative framework.

Democratic peace theory dates to at least 1795, to the philosopher Immanuel Kant, saying if rulers needed the consent of the governed to go to war, they'd weigh the decision more carefully. It is the closest thing we have in international relations to an empirical law. When scholars have done their statistical analyses, they've found that democracies almost never attack one another. When they do go to war, it's against autocracies (and even then, the democracies rarely initiate the fighting). While we call it the democratic peace, it is the polycentricity in these instances that matters, not just the elections or form of polity a nation chooses. All criticism of democratic peace theory aside, fundamentally most people think accountability comes from above or below and forget it can come from beside. "It arises from being flanked by many "piecemeal engineers", spreading out the ability to experiment and iterate." [2] Elinor Ostrom⁴ called this system polycentric—decision-making with many centers. For Ostrom the focus was about effective government. However, the same checks and balances that promote peace can also make governance more adaptive and functional.

"The goal of (applying) this research is to use Ostrom's theoretical framework for sustainable polycentric governance of CPRs to identify gaps in the current space governance structures and inform both current initiatives and potential future initiatives that foster the long-term sustainable use of outer space." [3] – Brian Weeden

⁴ It was long unanimously held among economists that natural resources that were collectively used by their users would be over-exploited and destroyed in the long-term. Elinor Ostrom disproved this idea by conducting field studies on how people in small, local communities manage shared natural resources, such as pastures, fishing waters, and forests. She showed that when natural resources are jointly used by their users, in time, rules are established for how these are to be cared for and used in a way that is both economically and ecologically sustainable. Ref: <https://www.nobelprize.org/prizes/economic-sciences/2009/ostrom/facts/>

More specifically, of the 8 recommendations from Ostrom's work is to, "develop a system, carried out by community members, for monitoring members' behavior" directly relates to the concept for SISE.

A legitimate worry is that empowering other levels of government and civil society makes states weaker, not stronger. Thus, "polycentric" often heard in many circles. But people tend to grant the state, governments, nonprofits, foreign agencies, and experts more power when they trust these authorities. Such trust comes from knowing they are limited and controlled. Making the center strong and making it more accountable run congruently. Thus, holding power and desiring peace and stability involves a paradox: wield influence responsibly while also trying to give it away. [2] In the context of applying polycentricism to outer space information sharing however, it is ironic and advantageous that no such centralized power exists in the first place.

4. CONCLUSION

Not all communication needs to be through human intermediaries. At a certain point, a transition to a complete Space Information Sharing Ecosystem should be made. Such an ecosystem would include regular and routine multilateral communication among nations, but it should also include the proliferation of sensory capabilities in space. The purpose of this network of interconnected sensors would be that it is under no one country's control and the ability to access its data is publicly available for all to see. The deployment of thousands of such platforms will enable greater domain awareness, allowing for the easier identification and removal of debris.

SISE is a socio-technical foundational for sharing trusted and symmetric information of interest to an ecosystem of stakeholders. SISE can be implemented using emerging permissioned blockchain and decentralized file storage technologies. SISE may have multiple instantiations for different interests, such as safety, and in-orbit manufacturing and repair. SISE develops systems for capturing, sharing, storing, and making derived knowledge available across the global space community for such purposes as preserving a safe and sustainable space domain.

Once an ecosystem of interested stakeholders have a trusted and symmetric means to exchange information, this in turn can be the foundation for improving operations, coordination among independent operators, and overall space traffic management.

Further, once a trusted and symmetric information sharing capability is in use, stakeholders can then create shared language and metrics to describe risk characterization, which in turn can enable (but not drive) norms-based rules in the space domain. The driver for norms-based rules must be from a need to improve mission outcomes and avoid negative scenarios. SISE can be the socio-technological enabler.

A SISE prototype can validate the means of construction, testing, and operation by multiple stakeholders. This last point is critical in that a mechanism can only be trusted in an international environment if: (1) international stakeholders can operate the permissioned blockchain nodes themselves, (2) have access to the data on the nodes, (3) and have a demonstrable understanding of how the information sharing capability behaves under attack.

More than that, it would allow for the immediate identification of suspicious activity. The United States considers a lack of transparency and predictability as a major contributing factor that "affects the potential for misinterpretation and miscommunication," to the point that "unpredictable or non-transparent operations conducted in deliberate proximity to other spacecraft may be viewed as posing a safety risk or a threat." In an information sharing ecosystem where all space platforms are easily locatable, aberrant behavior will be noticed almost right away. Suspicious platforms acting in a way inconsistent with past use could be raised for comment with the platform's controlling country long before any potentially hostile activity takes place. And, should such hostility occur, it would be immediately apparent whether this was one platform acting out of the norm or a coordinated effort on the part of a constellation of satellites. It can be hoped that radical transparency would make bad behavior significantly less likely. Barring that, it will at least allow everyone with access to the data the ability to track in real time the aggression of the

state ordering the activity, thereby damaging their credibility when it comes to self-justifying narrative construction to explain their hostile acts.

This could become even more readily apparent through the adoption of transparency and confidence-building measures related to platform activities. Namely, it could become routine that a state announces that a platform will be taking an action. As noted earlier, when a platform acts in a way that is unpredictable, it can be viewed as a safety risk. One way to erase routine or ordinary causes of unpredictability would be to ensure that ordinary and routine announcements are made regarding the future or current activity of a space-based platform. Should all nations adopt this mechanism, then any platform acting in a way that was not announced will be viewed with suspicion, even before there is an opportunity for it to engage in a hostile act.

Transparency can also be shifted to the ground as well. If China fears an arms race, then it is important to stress that one of the main drivers of the nuclear missile build up during the Cold War was a lack of adequate understanding of just how strong the opposing side was. If a norm of launch-site, third-party verification and limited inspection of civilian and non-military satellites can be inculcated, then the range of reasonable suspicion regarding which platforms are potentially hostile or threatening will rapidly shrink. If the penumbra of suspicion and fear cannot be entirely lifted, then at least it can be isolated to a fraction of the whole. Given the vast rates of platform proliferation with the commercialization of space, this could become an important part of the information sharing ecosystem that prevents the rise of an uncontrolled and uncontrollable situation in low-earth orbit.

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ⁱ <https://www.space.com/china-launches-core-module-tianhe-space-station>

ⁱⁱ <http://www.cnsa.gov.cn/english/n6465652/n6465653/c6813088/content.html>

ⁱⁱⁱ A/AC.294/2022/WP.9 has even more on page 6

^{iv} <https://spacenews.com/41413us-state-department-china-tested-anti-satellite-weapon/>
<https://thediplomat.com/2014/03/china-secretly-tested-an-anti-satellite-missile/>

^v <https://carnegieendowment.org/2021/11/17/dangerous-fallout-of-russia-s-anti-satellite-missile-test-pub-85804>

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^{vii} 17-18/xvii-xviii

^{viii} <https://www.defensenews.com/air/2022/04/20/spacex-shut-down-a-russian-electromagnetic-warfare-attack-in-ukraine-last-month-and-the-pentagon-is-taking-notes/>

^{ix} US submission

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^{xi} <https://www.politico.com/story/2016/08/white-house-and-kremlin-linked-on-hotline-aug-30-1963-227447>

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