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Between the Craters: A Lunar Governance Crisis Simulation

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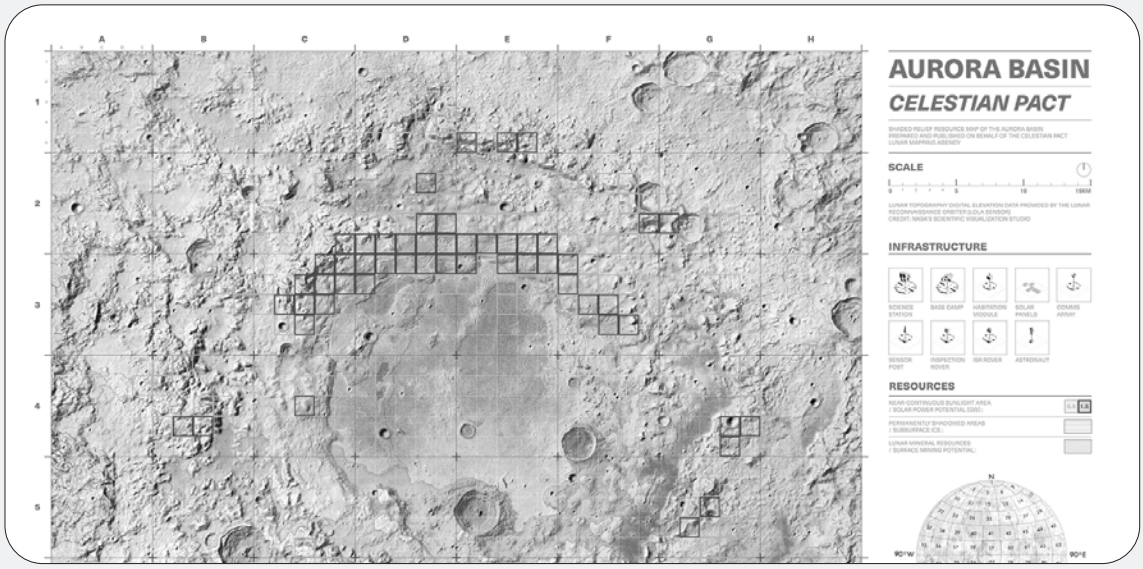

Figure 1. Playable site map of the fictional Aurora Basin. Designed by Ben Pollock and John Cook at Climate Cartographics.

A tabletop foresight simulation exploring how a near-future lunar flashpoint plays out across mistrust, domestic politics, and improvised norms. It exposes how governance falters when coordination depends on actors with incompatible priorities and inherited Earth-bound habits, mirroring the systemic entanglements in "Melting Borders" and the experimental institutional forms imagined in "Amazon Tipping Point Postponed."

Space as the Planetary

The dawn of the space age represented a shift in thinking at the planetary scale. Arguably, the most captivating image from the Apollo missions wasn't of the Moon—it was of Earth. In many ways, our first forays into space led to a turn inwards. This is evidenced by the proliferation of thousands of satellites which now orbit Earth, almost all pointed towards our own planet.

Recently, there's been renewed interest in returning to the Moon—this time to establish a sustained presence. With humanity's expansion into space comes the potential of the first human habitats on other planetary bodies, which presents new opportunities and challenges for the planetary. Perhaps most significantly, it presents a reality which includes new entanglements within our own solar system. Space exploration at the scale envisioned by national space agencies and private corporations depends on the development (or the expansion) of the Earth-based economy into space. These plans include steady transfers of mass and people between planetary bodies[1]—a true paradigm shift for us as a civilization. How this exploration unfolds will require careful stewardship of the planetary bodies in our solar system. We'll have to contend with the governance of humans living in different temporal environments—where months could go by without interactions with people on Earth. We embark then, on developing new ways of understanding and relating to our Earth, our solar system, and ourselves.

This research scope under the Planetary Civics Inquiry seeks to understand how terrestrial issues of governance—including national sovereignty, territoriality, and domestic politics—will be reflected

and interpreted in the space domain. We develop and play out a scenario which simulates a near-term flashpoint in lunar governance.

The space domain is unique in many ways, but inherits many of the challenges we face in terrestrial governance, especially in domains that have been traditionally conceived of as the 'global commons'—such as the Arctic region and the global seas. Space, and the lunar environment in particular, present new challenges for governance. Due to its distance and limited infrastructure, operations on and around the Moon are inherently low-trust and high-risk. Historically space has also presented unique strategic opportunities for nation-states to exercise and amplify their sovereignty in new ways. Being global in nature, the space domain also requires lunar actors to coordinate with other nation-states as well as actors within their terrestrial jurisdictions.

In this diverse operating regime, current frameworks for coordination are outdated and limited. How operators from national space agencies from China and the US, or commercial actors will coordinate activities, and, for example, govern the use and extraction of lunar resources remains unclear. The Outer Space Treaty,[2] a seminal document ratified in 1967 that has historically formed the basis for international space law offers limited insight into the operational aspects of lunar exploration, such as mining or the use of nuclear power sources. There is an increasing perception among some stakeholder segments that The UN Committee for the Peaceful Uses of Outer Space is seen as slow-moving and ineffective, with calls that new types of institutions are needed, as well as new forms of governance and relational approaches, tools and capabilities.

This tabletop scenario aims to highlight potential gaps in global norms and governance inherent to operations on the lunar surface. The scenario simulates the instability between rivalrous lunar actors, and unfolds in a climate of strategic mistrust and earth-side geopolitical pressure.

We focus this scenario at the Lunar South Pole, where these issues are likely to come to a head. The Lunar South Pole offers key favourable conditions, including potential reserves of water-ice that could be used to support a sustained human presence and strategic lighting conditions known as "peaks of near-eternal light" offering sustained solar energy and thermal stability for hardware. Visibility to Earth depends on which hemisphere the assets are situated: the near-side offers continuous views of Earth—an advantage for communications purposes. Other areas are blocked from Earth visibility, providing favourable conditions for so-called 'radio-quiet' zones that might be beneficial for the radio astronomy community.

The first iteration of this scenario was developed by Open Lunar Foundation with Dark Matter Labs, Berggruen Institute, the Secure World Foundation, the Foresight Institute, and Climate Cartographics. It was first conducted at the International Astronautical Congress in Sydney, Australia, on October 30, 2025.

The Simulation

SCENARIO

By 2038, human activity on the Moon has expanded dramatically. Two rivalrous groups, the Concordium and Celestian Pact have established permanent human-crewed base camps in the Lunar South Pole. From these base camps, they are expanding their activities across the region. In the same region, multiple state and commercial actors, frequently partnering with the Concordium and Celestian Pact, have deployed permanent surface infrastructure, launched extractive operations, and established science bases. Amid this increasingly complex and long-term activity, the rules for coordination remain ambiguous, fragmented, and weakly enforced. What's more, the Moon is increasingly seen as a strategic area, or frontier of competition.

On Earth, strategic competition and great power competition and contestation have continued to be the hallmarks of the 21st-century political landscape. Multilateralism is fragile, and disputes over the nature of global governance are growing. Economic competition has continued to spill over into securitisation and militarisation as states take a "whole of society" approach to geopolitical competition.

This dynamic makes inaction in Lunar events politically dangerous. All states, keen to offer "wins" to their populations in this new political environment to bolster domestic support, utilise achievements in space and on the Moon, which have been framed by all parties as a "race." Perception is key—Earth-based leaders, media, policy elites, parliamentary critics, and domestic constituencies expect firm responses, making de-escalation risky and coordination politically fraught. Each actor also seeks to frame itself as

1 Bernard F. Kutter and George F. Sowers, "Cislunar-1000: Transportation Supporting a Self-Sustaining Space Economy" (*AIAA 2016-5491*), paper presented at the AIAA SPACE 2016 Conference and Exposition, Long Beach, CA, September 2016, https://doi.org/10.2514/6.2016-5491.

2 *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies* (Outer Space Treaty), opened for signature January 27, 1967, 610 U.N.T.S. 205, art. I.

Figure 2. Teams engaged in the simulation.

a norm entrepreneur, casting its own behaviours as lawful, reasonable, and stabilising, while portraying its rival as reckless or illegitimate.

LOCATION

The simulation takes place in 2038 at the fictional Aurora Basin, a shadowed depression near the Lunar South Pole nestled between highland ridges offering regions with near-continuous sunlight. Aurora represents one of the Moon's most geopolitically charged and scientifically significant sites. Its unique geography provides dual advantages: proximity to sunlit ridges for continuous solar power, and access to permanently shadowed craters rich in volatiles such as subsurface water ice. The Basin also holds valuable mineral resources and serves as a key node for understanding lunar geology and potentially radioastronomy.

Strategically, Aurora represents a critical launchpad for sustained operations deeper into the South Pole and beyond, positioning it as a cornerstone for long-term commercial and scientific permanence. A leading presence in Aurora confers not only operational and strategic leverage but also symbolic authority in shaping the emerging norms of lunar and broader space activity.

OPENING POSITION

Both Concordium and Celestian Pact have placed key infrastructure in and around the Basin, including a reactor, mining extractors, and a dual-use science station. Both have unilaterally declared safety zones/operational areas around their activities—zones that are not internationally recognised, poorly defined, and mutually distrusted. A separate power, the Cradle Space Cooperative, represents a newcomer coalition advocating for equity, access, and benefit-sharing. Although it lacks infrastructure on the lunar surface, it seeks to force legitimacy debates and test the willingness of others to include "Global South" actors.

The Players

CONCORDIUM

Populist-led democratic state seeking to secure lunar leadership, defend its critical infrastructure, and prevent Celestian norm-setting.

CELESTIAN PACT

A centralised, non-democratic state asserting strategic autonomy and scientific legitimacy.

CRADLE SPACE COOPERATIVE

A coalition of emerging spacefaring states, Global South stakeholders, and small non-aligned actors. Motivated by powerful diplomatic and moral claims grounded in the Outer Space Treaty Article I, that outer space should be used "for the benefit and in the interests of all countries".[3]

NATIONAL AND WORLD MEDIA

Each actor has its own domestic media team. This team monitors and reacts to each team's actions, or their portrayal of events, through a media lens. They shape public perception and determine the Reputation Meters for each faction, based not only on what happens, but how it is spun or perceived.

POPULIST POLITICIANS

Amid domestic pressures driven by economic instability and security concerns, both governments rely on populist politics to maintain support. In this context, foreign policy—especially lunar activity—

becomes a tool for scoring quick political wins. Space achievements are framed as victories for national pride, while de-escalation or compromise can appear weak.

Game Play

Gameplay took place over the course of two consecutive hours, representing one turn of the scenario. Each turn was structured into distinct phases, described below.

In **Phase 1**, facilitators shared the opening scenario, which centred around the Concordium Prospecting Deployment (2033–2034).

Concordium was established as the first actor to land hardware in the Aurora Basin, deploying a robotic rover (operated by Polaris Extractives—a commercial company) to conduct regolith assays, volatile prospecting, and terrain mapping. Concordium filed a public statement regarding the planned activities, but only included the rover's landing area, with no information about the subsequent operational footprint. As part of its stated commitment to the principle of benefit-sharing, Concordium published selected findings from the mission. While framed as a knowledge-sharing contribution to global lunar science, it withheld commercially sensitive data, citing dual-use concerns and intellectual property protections. Concordium framed this "first" as a win for its government leadership, with the administration utilising this to bolster domestic approval ratings.

In **Phase 2** groups deliberated a response to the opening framing and issued a public statement.

Concordium immediately saw Celestian Pact as a competitor. Even engagement with the Cradle Space Cooperative team was framed as potential leverage to be used against Celestian Pact. In their statement, they publicly declared that they would make use of the optional shared registry to declare an operating zone for their assets. This 'safety' zone was extended around Concordium's nuclear reactor and mining area. While framed as an act of goodwill and transparency, especially as the 'first' actors to the region, the declaration of a safety zone around a mobile asset was viewed suspiciously by the Cradle Space Cooperative and Celestian Pact teams.

Cradle Space Cooperative demonstrated suspicion of both 'space powers'. In a move that aimed to secure Cradle Space Cooperative's legitimacy as a negotiating power and lunar actor, the team announced plans for a mission at the end of the decade to place a gravitational wave detector on the lunar surface, while announcing the development of a sovereign space programme over the long-term. Their stated goal was to support capacity development centred around scientific advancement for Cradle Space Cooperative member states. Members of the Cradle Space Cooperative made extensive use of bilateral treaties and multilateral fora to achieve their aims.

Celestian Pact issued a public statement reaffirming their claim to the longest continuous presence on the lunar surface (as a contrast to Concordium's claims of being first in the region). The team designated an extensive safety zone around their surface assets, which extended far beyond anticipated operations. This move was viewed contentiously by the other teams and media participants. In order to buffer their position on the international stage, they announced an engagement plan designed to share the data gathered through their scientific research base. They also announced hosted payload opportunities and plans to train a Cradle Space Cooperative astronaut.

In **Phase 3**, the team decisions took effect, with action injects seeded by the facilitators to stimulate activity and response.

Concordium conducted a geological reactor suite operation with their recently reactivated prospecting rover. They also announced a Memorandum of Understanding with the Cradle Space Cooperative to support capacity-building efforts. In their public statement, they announced that safety zones should not be used to establish appropriation—perhaps as a response to the activities of the Celestian Pact.

Cradle Space Cooperative continued to bolster their position as a trusted scientific authority. They announced a fellowship programme across their constituents centred around training in science, technology, and mathematics, while stating a broad aim to set and influence data standards for lunar science. They also announced their intention of being a regional data host for lunar science to bring cooperative transparency to other regions of the world. They registered their gravitational wave mission on

3 The Outer Space Treaty (1967). Article I. Reflected a philosophy of equity and justice in commons governance emerging during the mid-1960s. Developing nations, frustrated by the perceived neglect of institutions like the International Monetary Fund and World Bank, leveraged their collective weight in the United Nations (UN) to push for a New International Economic Order (NIEO). The NIEO reflected a desire for greater access to land, resources, and power after centuries of subordination. These same countries saw an opportunity to correct patterns of inequality by proactively developing a system of governance for the newly emerging global commons—the deep seabed, ocean floor, and outer space—that aimed to place these regimes beyond the limits of national jurisdiction.

the public registry.

Upon discovering Concordium's rover operating in their region, Celestian Pact viewed it as a surveillance operation. In their public statement, they advised Concordium to remove the rover as soon as possible. They expressed discontent, claiming they should have been consulted before the rover was moved—especially having the longest standing base in the region. Simultaneously, they announced a fellowship programme for the Cradle Space Cooperative. In announcing safety zone expansions around their assets, they characterized the move as in direct contrast to Concordium's—framing it as a move for expanding their region of operation to improve scientific return, which they shared publicly.

Scoring, Results, and Reflections

Team performance was evaluated through two lenses: (1) perceived reputation based on domestic and international media coverage, and (2) points earned by completing both public and hidden objectives.

Team Outcomes

Cradle Space Cooperative (CSC) emerged as the overall leader. While all teams made unilateral use of the shared lunar registry, declarations of expansive "safety" or "operational" zones were viewed unfavourably by participants and the media alike. They succeeded in two of their primary objectives:

1. Expose exclusion: Ensure both Concordium and Celestian Pact were portrayed by international media as having experienced at least one catastrophic turn. Partially achieved, as Celestian Pact received a negative international score.

2. Secure a governance foothold: Obtain one visible concession (e.g., joint statement, Lunar Registry filing, or multilateral agreement) acknowledging CSC as a driving or equal partner. Fully achieved, with both rival blocs signing MoUs referencing CSC as a key partner.

Concordium performed marginally better than the Celestian Pact in both domestic and international reputation, earning a positive overall score. However, they failed their hidden objective to "Prevent rivals from being seen as leaders: Ensure neither the Celestian Pact nor CSC ends up more internationally influential than you."

Celestian Pact also failed the same hidden objective. However, they successfully completed a portion of their intelligence-gathering objective by conducting an "active" scan of Concordium's assets using military-grade surveillance equipment mounted on their rover.

Team Dynamics and Behavioral Patterns

Although teams were assigned arbitrarily, internal cohesion developed rapidly. Players were not explicitly required to compete, yet competition emerged organically as each sought to advance its objectives.

Ambiguity about other teams' activities bred mutual suspicion—particularly due to the reliance on self-reported data about asset locations. CSC, notably more transparent (in part because they had fewer physical assets), leveraged diplomacy and "soft power" to build influence as a bridging actor. Their openness enhanced their legitimacy and negotiation leverage.

Despite visible strains, multilateralism remained

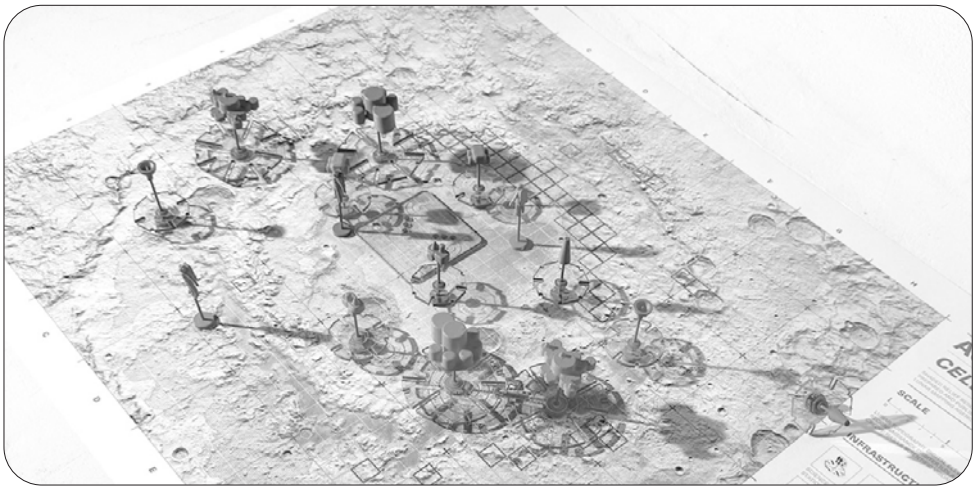

Figure 3. A close-up of the playable map designed by Climate Cartographics.

a baseline norm. Teams recognised the reputational value of framing their actions as responsible and cooperative, highlighting how civil society, domestic media, and public opinion can shape behaviour even in decentralized governance environments.

Insights on Governance and Territoriality

The exercise revealed how, even under explicit prohibitions on national appropriation, de facto appropriation still emerged within existing legal boundaries. Territorial framing—such as Celestian Pact's repeated use of "our region"—was viewed negatively but demonstrated that resource exploitation implicitly requires some form of physical presence or claim.

A central tension emerged: ensuring that all actors have a stake ("skin in the game") in the lunar commons while preventing monopolization. Scarcity—whether of resources or favourable landing sites—appears to be a key driver of territorial behaviour. The introduction of a benefit-sharing regime could offer one path to balancing access, participation, and legitimacy.

Power, Legitimacy, and the Emergence of Governance

Contrary to conventional theories of first-mover advantage, the simulation showed that emergent players can convert limited material power into strategic leverage. Influence arose not from dominance but from legitimacy—anchored in coalition-building, transparency, and narrative framing.

CSC demonstrated that multilateralism, not technological superiority, can be the decisive factor in shaping governance outcomes. Their success illustrated that defining operational protocols through agreements and shared norms can subtly steer behaviour and establish precedent for cislunar governance.

Through dialogue with Concordium, CSC emphasized responsible behaviour consistent with the Outer Space Treaty; with Celestian Pact, they opened new avenues for scientific collaboration. These interactions underscored how bilateral and multilateral agreements function as iterative norm-building processes, where procedural experimentation becomes a form of governance innovation.

Across all negotiations, CSC positioned its concentration of researchers and commitment to stewardship as sources of moral legitimacy. The key insight: emergent actors gain influence not by replicating incumbent power, but by reframing their assets—technical, epistemic, and ethical—as foundations of legitimacy.

Mechanisms and Future Implications

A core feature of gameplay was the **Lunar Ledger,** a prototype registry of lunar objects and activities developed by Open Lunar Foundation. The simulation served as an early testbed to observe how such a mechanism might be used in real-world contexts.

In an environment dominated by robotic missions, new coordination tools, such as the Ledger, will be essential for conflict reduction and trust-building. Accurate awareness of asset positions will depend heavily on voluntary self-reporting until shared Positioning, Navigation, and Timing (PNT) systems exist. Future scenarios may require "intelligent treaties" to facilitate automated coordination protocols between robotic assets.

In conclusion, Between the Craters demonstrated that even in a future marked by strategic rivalry and fragile multilateralism, governance on the Moon will not be defined solely by technological capacity or territorial control, but by the ability to cultivate legitimacy through cooperation, transparency, and narrative power. The simulation revealed that emergent actors can leverage moral and diplomatic capital to shape outcomes and norms, highlighting how soft power and multilateral coordination may become decisive tools in cislunar governance. As lunar activity intensifies, mechanisms like the Lunar Ledger and iterative, trust-based agreements could serve as critical infrastructures for maintaining stability, ensuring equitable participation, and preventing the consolidation of lunar authority in the hands of a few. Ultimately, the exercise underscores that stewardship of the Moon—and by extension, of the planetary commons—will depend on our collective capacity to design governance that privileges cooperation over competition.