“Ensuring Lunar Sustainability: Focus on Collective Decisions”

“Sustainability is a political choice, not a technical one. It’s not a question of whether we can be sustainable, but whether we choose to be.” – Gary Lawrence

We, as members of space programs and industry and as global citizens, must develop routine processes and mechanisms to globally coordinate and cooperate our upcoming activities on the Moon. Our collective, international choices today will decide the far future of humanity’s use of lunar space. When it comes to promoting future cislunar sustainability, this should be society’s prime focus.

Why?

The Moon looms large in the night sky. But, as precious a resource as the Earth’s nearest neighbor is and may be, it is not limitless. Here on Earth, we face the challenges of climate change, desertification, deforestation, and overconsumption. From these, we’ve learned that responsible stewardship of resources is not only necessary for continued growth, but our very future.

Much the same, if the Moon is to be the future home that we anticipate – a place to live, a place of science and economy – it too will need to be deliberately developed in a sustainable manner. We are right now fortunate that, unlike with global climate change, there’s a possible plan ahead that can prevent future challenges.

As quoted above, sustainability is more a political issue than a technical one. “Sustainability” relies on *decisions*: policy, regulatory, cultural, and diplomatic. These are decisions on collective prioritization of opportunities and our choice to use, divide, and coordinate limited resource. That is, do we prolong their use for future generations, or exploit them only for ours; do we act with a long-term vision, or in a short-sighted way?

That question will be critical for our future at the Moon – and defined in our time. Our success as stewards of the cislunar environment depends on choices we make about governance and coordination of the growing lunar economy.

Before going further, let’s ask: what does lunar sustainability entail? In the grand view, it suggests that the cislunar environment, much like our climate, our ecosystem, and Earth’s orbit, be protected (enough) to ensure its long-term use and balanced development by future generations. To that end, meaningful sustainability involves resolving challenges that will soon arise through heightened activity in cislunar space and the lunar surface. Among them:

1. Promoting transparency in lunar operations: As defined, the sustainability of any environment relies on collective decisions about our activities within it. Opaqueness about cislunar operations – lack of communication of the “what, where, and when” of activities – makes it significantly more difficult for society to understand what is “going on;” and to make informed and cooperative decisions about long-term cislunar development.

2. Deconflicting activities among cislunar and lunar surface operators: the Moon is smaller than we may think. There is high demand for “prime real estate” at

resource-rich locations, such as the lunar poles. Activities of one party may affect another. If, as above, we're transparent about what we're doing, we can find ways to minimize interference. After all, all lunar-ambitious actors are still party to Article IV of the Outer Space Treaty.

3. Ensuring the sustainable – and coordinated – utilization of lunar resources: as there is high demand for the "real estate" on the Moon, there is likewise high demand for the limited resources (such as water ice and Helium-3) that are present at those locations. To preserve their use for future generations, mechanisms, legal or normative, will need to be established to prevent types of overconsumption activity like we've seen on Earth – for example, with the oceans' fisheries.

4. Protecting our lunar heritage: the Moon is home to some of humanity's most remarkable achievements, such as the first spacecraft to land on an extraterrestrial body and the first human steps off the Earth. If we wish for future generations to be able to study, observe, and honor those milestones, it's necessary that we protect and preserve the certain parts of the Moon where they exist, much like we do with our national parks and global heritage sites.

Addressing these challenges is made pressing by developments in spaceflight. A focus on the Moon by space programs and private industry has been a key trend for the past several years – alongside the growth of the commercial space sector, and a heightened awareness of the need to sustainably manage space traffic and debris. These trends are interrelated and interwoven when it comes to the future of lunar sustainability; there is a growing number of actors making decisions that will affect the lunar environment in the years to come, and a general receptivity to the need to conduct those actions responsibly.

With this growth in the "lunar community" comes a variety of new perspectives and opinions about how lunar operations should be conducted. This is evident in the various global initiatives that seek to create roadmaps – and rules – for the future use of the Moon. Among others, there are ESA's proposed Moon Village, the Chinese-Russian International Lunar Research Station, the international Lunar Exploration Analysis Group, and – perhaps most notably – NASA's international Artemis Program and its Artemis Accords, which set out to establish internationally accepted sustainable norms of behavior for cislunar space and the lunar surface.

It is deeply encouraging that rigorous thought and analysis, such as NASA's very-recent Lunar Landing and Operations Policy Analysis, is being put into the *types* of choices that we will need to make to ensure future lunar sustainability, and which choices we *should* make. The space agencies of the world, in conjunction and consultation with their private space industries, should "double-down" on the attention their paying to the future of their operations at the Moon.

However, the difficulty remains that these initiatives and analysis are being conducted in a largely disjointed way. Even NASA's Artemis Accords, a deliberately international effort, are only accepted by a few dozen countries, and are seen with skepticism by others. Unfortunately, as we've seen with global climate change, true sustainability will not be achieved if the entire community of lunar users agrees to, and acts on, basic shared

assumptions and responsibilities for sustainable behavior. Again, sustainability relies on *decisions*, and it harms the entire community if *opposite* decisions are being made because of a lack of coordination.

Challenges such as politics, economics, competitiveness, and international equity will, as they do on Earth, invariably get in the way of coordinating lunar activities. But there are historical examples where the global community has been able to transcend them to create mechanisms that ensure sustainability – such as the International Civil Aviation Organization for air travel, or the International Telecommunications Union for communications, including GEO slots. When it comes to the various initiatives underway for creating "rules of the road" for future lunar sustainability, the global community should explore these models to see if there are ways to better enable, establish, and coordinate a collective decision-making process.

Ultimately, the state of lunar sustainability will be a political choice. It is important that we all, today, advocate with our policymakers and communities that activities on the lunar surface must transcend our political squabbles, and that collective *choices* for a sustainable Moon are what's best for a sustainable future.