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**Committee on the Peaceful**

**Uses of Outer Space**

**Sixty-seventh session**

Vienna, 19 - 28 June 2024

Item 15 of the provisional agenda\*

**Space exploration and innovation**

**Reports by the Moon Village Association**

**Paper submitted by the Moon Village Association**

The present conference room paper contains:

1. Report of the Moon Village Association on Lunar Exploration and Climate Change Interaction;
2. Report of the Moon Village Association on the International Moon Day 2023 and Outlook for 2024; and
3. Report of the Moon Village Association on the Global Expert Group on Sustainable Lunar Activities – Status/Plan

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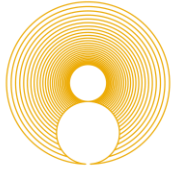
## **Report of the Moon Village Association on Lunar Exploration and Climate Change Interaction**

### **Introduction**

1. Traditionally, the Earth and Moon environments have been considered in isolation, with the Moon viewed as an inert body. However, scientific models clearly indicate that Earth exists as part of an inseparable system that includes the Moon, the orbital space between them with its radiation, electromagnetic and gravitational features, and the Sun. The “Earth’s environment” and the biosphere cannot be defined without including these components.
2. The Moon Village Association signed with the Human Space Program a Memorandum of Understanding (MoU) to assess the interaction between Earth and Lunar environment. This is the first time that this topic is studied in detail and this confirms that MVA is approaching new topics to inform delegations in COPUOS when they are considered important.
3. The first joint activity in this field has been a webcast held on April 22, UN Earth Day, bringing together Lunar and Earth scientists to start the assessment of the interaction between lunar exploration and climate change. This initiative is called Moon for Earth. A technical presentation will be held on June 25 where details will be presented.
4. The summary report of what has been learned thus far is attached in the Annex with details included. The recordings of the event can be found at <https://moonvillageassociation.org/earth-day-2024-climate-action-lunar-exploration/>
5. The Moon for Earth Initiative is in a nascent phase and we would like to invite Delegations in COPUOS to join this important activity that is aiming to ensure that sustainable lunar activities mitigate Earth climate change as the biggest challenge to humanity.

# ANNEX

## Climate Change + Lunar Exploration Interaction



Report by Cristina Star, Cosmic Citizen Trainings, USA  
with Dr. Giuseppe Reibaldi, Moon Village Association, Vienna  
and Frank White, The Human Space Program, USA

Prepared for the 67th Session United Nations Committee on Peaceful Uses of Outer Space  
19-28 June 2024

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In this era of accelerating climate change, it is imperative to consider the environmental and social interactions necessary for sustainable Lunar exploration, utilization, and potential development.

- **What challenges arise when Lunar exploration plans are examined against the backdrop of climate change models?**
- **What considerations must emerging governance structures take into account to ensure sustainable progress in the Earth-Moon environment?**
- **Is there a pathway by which Lunar exploration helps mitigate climate change?**

### Summary

A collaboration between the Moon Village Association (MVA), the Human Space Program (HSP) and Cosmic Citizen Trainings is assessing the interplay between the Moon and Earth's environment, as part of a Memorandum of Understanding signed between MVA and HSP. This investigation focuses on the prospective benefits and potential impacts that Lunar exploration and utilization might contribute to climate change.

MVA is involved in several Lunar related activities. In particular, the Global Expert Group on Sustainable Lunar Activities (GEGSLA) operating since 2021, has a Working Group related to Lunar Environmental Protection that has provided important contribution to this report.<sup>1</sup> HSP has initiated the project "Making Space for the Environment"<sup>2</sup> that seeks to bridge the gap between Earth-based environmentalists and space advocates by fostering collaboration and shifting the dialogue from an antagonistic "either-or" stance to one that promotes aligning efforts.

On Earth Day, April 22, 2024, these organizations hosted virtual panels and guided discussions on these topics, featuring diverse perspectives from 12 experts in policy, science, environmentalism, industry, and Indigenous space. 140 people, consisting of science and policy academics and space industry professionals from 30 nations registered for the event.<sup>3</sup> This report synthesizes insights from these discussions on "Climate Action + Lunar Exploration," along with ongoing research on the topic. These efforts represent the initial phase of a larger collaborative initiative, **Moon for Earth**, aimed at ensuring that Lunar exploration, utilization, and potential development are beneficial to Earth and humanity.

*We extend a formal invitation to join the coalition working to further investigate the interactions within the Earth-Moon system and to develop policy recommendations to guide emerging governance and environmental protections.*

### Background

Traditionally, the Earth and Moon environments have been considered in isolation, with the Moon viewed as an inert body. However, scientific models clearly indicate that Earth exists as part of an inseparable system that includes the Moon, the orbital space between them with its radiation, electromagnetic and gravitational features, and the Sun. The "Earth's environment" and the biosphere cannot be defined without including these components.

A recurring misconception within the dominant culture has been that any environment is "too vast to influence." Historical examples include the American Frontier, the oceans, the atmosphere, and now orbital space. As ambitions shift to the Moon, we have an opportunity to learn from past mistakes and acknowledge that, because of unique Lunar features, *any human activity will permanently alter the Moon*, which may have unforeseen repercussions for Earth's biosphere. We have yet to thoroughly examine this

relationship and make predictions based on current Lunar exploration plans.

While the projected long-term benefits from advancements such as space-based solar power, nuclear fusion fuel, quantum computing, asteroid mining, and off-world industry may be significant, these potential gains must be weighed against the intermediate negative impacts on climate and environmental stress caused by the development of the necessary infrastructure.

The pressures of climate change and weakening balance of Earth systems creates an imperative to proceed with due regard for the complex interactions at play, and make best efforts to determine the roadmap for the most beneficial outcome.

### **1. Climate Interaction**

Several direct impacts of Space exploration on Earth's atmosphere have been identified. Rocket launches and reentries currently introduce alumina into the upper atmosphere and contribute to ozone layer depletion. Soot deposition from launches is nearing levels comparable to the entire aviation industry. Additionally, the reentry of vehicles and debris releases vaporized metals into the upper atmosphere, with unknown long-term consequences. As Lunar activities escalate, the frequency and energy of launches will inevitably increase.

The supply chain supporting the construction of a permanent Lunar Infrastructure relies on unsustainable, carbon-heavy, single-use engineering practices that exacerbate climate change. To address these concerns, it is crucial to quantify these effects, project their implications over the planned timescales of Lunar missions for all stakeholders involved, and identify areas where environmental impacts can be minimized.

### **2. Lunar Environment**

The Lunar Environment is pristine, unchanged by human actions since its creation, with the exception of the few missions that have landed or crashed on the Moon. This provides humanity a unique opportunity to solve fundamental questions related to the origin and evolution of the Earth and its environment, and possibly even the origin of life. It is therefore of fundamental importance that scientists have the ability to carry out these investigations with limited interference from future State and commercial activities. Science on and from the Moon must be preserved to the greatest extent possible, proceeding with the understanding that utilization will be a compromise with industrial requirements to access “resources” and conduct other potential enterprises. Policy gaps, such as an agreed upon definition of “Site of Special Scientific and Cultural Interest,”

need to be developed along with a mechanism to approve their recognition by the international community.

The increase in Lunar missions also raises the potential problem of orbital debris around the Moon. Due to the Moon's low gravity and absence of atmosphere, this particular issue would be more dire than the situation in Earth orbit. There is an urgent need to apply the lessons learned in Earth orbit to the Moon, and to anticipate additional issues with sustainable end-of-life mission planning.

This must also lead to considerations of developing simple environmental protection guidelines similar to those created on Earth, but applied earlier to the Moon. Humanity has an opportunity to apply what we have learned from the environmental crises on Earth and engage with Lunar missions applying this knowledge, especially noting that the Earth and Moon are of the same system. Additionally, these efforts put forth in sustainable Lunar exploration can potentially support the mitigation of climate change.

### **3. Social & Psychological Considerations**

Positive influences of Space exploration are often quantified by measurable outcomes, such as those provided by Earth observation data, Global Navigation Satellite Systems, telecommunications, remote Internet access, spinoff technologies, economic generation, jobs created, and fueling STEM inspiration.

Indirect effects relate to a new perspective and global identity shift influenced by the experience and transmission of the Overview Effect, and the subsequent normalization of images of Earth from a wider vantage point. There is a significant correlation between viewing the Earth from orbit or the Moon and the environmental movement. From this perspective, national boundaries disappear and our unity and shared fate is immediately apparent. For example, the “Earthrise” photograph, taken during the Apollo 8 mission, has become an iconic image for the environmental movement.

The nature of the climate crisis is one that transcends all national boundaries and requires global solutions. The global perspective is invaluable in these times, and continued movements born from increasing the number of people in outer space, and furthering their perspective to the Moon, may correlate to more climate action on Earth. Though the shift in general awareness is likely to accelerate, the timescales for threshold numbers required to galvanize positive action may be outpaced by the impacts of the climate crisis. Additionally, whether the shift in identity will lead to substantive additional activism remains unclear, but is a relevant area to explore as an impact multiplier for Lunar activities.

Additionally, there may be an increasing distaste for space and Lunar activities from the public as extreme weather events exert change and threaten stability, food security, global supply chains, and susceptibility to increased radicalization of adversely affected populations. Public support for spending on Space and Lunar exploration in democratic nations may wane. The Lunar exploration narratives will need to assert relevance beyond the current “acceptable reasons” and affirm tangible mitigation efforts for the climate crisis.

#### 4. Inclusion

The number of actors focusing on the Moon and “resource utilization” is small compared to Earth’s vast population, many of whom lack representation in global governance. With current technologies and increased connectivity, there is a unique opportunity to expand existing pathways for inclusion and innovate new ones, engaging a significant portion of the global population to establish more representative governance structures. This inclusive effort, involving traditionally excluded groups like Indigenous and First Nations peoples, is crucial for shaping governance related to Lunar exploration and development. With a global crisis and the shared Heritage of the Moon, *everyone* is a stakeholder and potential contributor to the evolution of our governance towards true sustainability. Dr. Alvin D. Harvey of the Navajo Nation encapsulates this sentiment in his recent *Nature* article, stating that “Weaving together Indigenous and Western science could resolve issues and produce policies that protect and celebrate our shared Moon.”<sup>4</sup>

#### Conclusions

Climate change is perhaps the most critical challenge of our era. Our research delves into how Lunar exploration and utilization could help alleviate this pressing threat. Initial findings reveal that our analysis lacks the granularity needed to determine how clear benefits can outweigh the potential harm on projected timelines. Due to this pressing timeline, it is evident that fostering a “Moon for Earth” ethos demands deliberate and bold actions, rather than passively evolving as a byproduct of current trajectories.

Our objective is to delve into the concrete impacts of Lunar activities as a product of industrial ventures affecting Earth’s atmosphere and local ecosystems. We seek to pinpoint areas necessitating further research to steer Lunar endeavors toward beneficial outcomes. This assessment encompasses not only direct repercussions but also indirect positive effects like spin-off technologies, the psychological benefits linked to the Overview Effect, innovative insights from diverse perspectives, and the evolution of collaborative systems inspired by joint Lunar projects.

We aim to delineate boundaries and guidelines while advocating for measures that amplify benefits and curtail harm. As Space enthusiasts and environmentalists, we believe there is an optimal path forward and we aim to actively contribute to this advancement. While our project is in its nascent stages, we outline the next steps below.

## Call to Action

### The Moon Village Association and The Human Space Program formally invite collaboration in the *Moon for Earth*

**Initiative:** Rigorous research and collaboration with the aim of generating substantive policy recommendations that consider climate change, areas of concern for Lunar protection, and the most up-to-date scientific understanding of the Earth-Moon system.

#### Goal:

Determine pathways to utilize the benefits of Lunar Exploration to mitigate climate change on Earth.

#### Approach:

1. Elaborate the current Lunar exploration, utilization, and development plans, including all actors.
2. Examine, by involving the environmental scientists and organizations, the current projections of climate change (and their range), timelines, and system-wide implications for these plans:
  - a. the effects of climate change on Space/Lunar plans/infrastructure.
  - b. the effect of Space activities on climate change and the Moon.
  - c. define: nonlinear systems, thresholds, self correcting mechanisms, social & political pressures, and the unknown.
3. Examine the science behind the Earth-Moon System interactions, and the uniqueness of portions of this environment.
4. Outline the legal framework and holes in environmental protections regarding all of Earth orbit, including the Moon/Celestial bodies.
5. Analysis and formal policy recommendations

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#### Endnotes

1. <https://moonvillageassociation.org/gegsla/about/>

2. <https://humansppaceprogram.org>
3. Earth Day Expert Panel event information and recordings at <https://cosmiccitizen.org/space4earth> and <https://moonvillageassociation.org/earth-day-2024-climate-action-lunar-exploration/>
4. Harvey, Alvin D. "Stop sending human remains to the Moon." Nature 625 (2024): 425. doi.10.1038/d41586-024-00106-8

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- **Dr. Aaron Boley** - Astrophysics Professor, Outer Space Institute, Canada
- **Dr. Alice Gorman** - Space Archaeology Professor, GEGSLA, Australia
- **Dr. Alvin D. Harvey** - MIT Astronautics, Indigenous Methodology, Navajo Nation
- **Dr. Claire Nelson** - Sustainability Engineer, Futurist, Caribbean
- **Dr. Jean Claude Worms** - COSPAR, France
- **Justin Ahasteen, Esq.** - Navajo Nation Washington Office, Navajo Nation
- **Dr. Martin Elvis** - Astrophysics Professor, Harvard-Smithsonian, USA
- **Dr. Namrata Goswami** - Space Policy Professor, India
- **Sahba El Shawa** - Space Sustainability, the Overview Effect, Jordan & Palestine & Canada

The Global Expert Group on Sustainable Lunar Activities, Jared Angaza from The Human Space Program and Making Space for the Environment Project, John Finegan of the Human Space Program, Glafki Antoniou and Ulpia Elena Botezatu of Moon Village Association, Analog Astronaut Conference organizers and attendees, and Dylan Greher.

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## **Report of the Moon Village Association on the International Moon Day 2023 and Outlook for 2024**

### **Introduction**

1. The interest in the exploration and utilisation of the Moon has seen a major surge of efforts globally in the last few years. Several missions have already been launched, and many more are planned in the next few years (i.e. about 100 are planned until 2030). This includes plans for the return of humans to the Moon. This is the reason why the general public needs to be made aware of all these developments and prospective events. In this spirit, in August 2021, MVA recommended (A/AC.105/2021/CRP.14) that COPUOS adopt and propose to the UN General Assembly the recognition of International Moon Day an annual educational, cultural, and scientific event.
2. COPUOS took note of the proposal for the proclamation of the International Moon Day (A/AC.105/2021/CRP.14) and agreed to recommend that the General Assembly, at its seventy-sixth session in 2021, proclaim that International Moon Day be observed annually, on 20 July.
3. At its seventy-sixth session, the UN General Assembly approved the proposal on December 9 (A/76/415, item 13).. The relevant text is hereafter: “Declares 20 July International Moon Day, to observe each year at the international level the anniversary of the first landing by humans on the Moon on 20 July 1969 as part of the Apollo 11 lunar mission, taking into consideration the achievements of all States in the exploration of the Moon, and to raise public awareness about sustainable Moon exploration and utilization”
4. Starting on July 20, 2022, the International Moon Day has been celebrated annually following the approval of the UN General Assembly. The International Moon Day serves to inform the public about the work undertaken in this area by COPUOS and its member States, with facilitation from the Office for Outer Space Affairs.
5. Because MVA has been an early advocate of the concept of the International Moon Day (IMD) celebration, MVA is taking the initiative to support and contribute to its implementation. However, all Member States, organisations of the United Nations system, other international and regional organisations, as well as civil society, including non-governmental organisations and individuals, are invited to organize events on this date and are encouraged to inform MVA of these events to enhance their visibility and promote future cooperation.
6. In 2023, MVA presented the results of the First International Moon Day celebration of 2022 to the STSC, LSC, and COPUOS with technical presentations. These results are available on the UNOOSA website.
7. At this meeting of COPUOS MVA shall present the results of the IMD 2023 and Outlook for 2024 in a technical presentation. Details of the date and time of this presentation will be indicated in the COPUOS schedule.

### **International Moon Day 2023**

8. The theme for 2023 has been “Beginning the New Lunar Journey for Humanity”.
9. The main event was organized on July 20, 2023, in Gwacheon, South Korea, and hosted by the National Science Museum of the Republic of Korea, with sponsorship by Lockheed Martin Corporation.
10. 46 Global events were held in 41 countries. These events included Moon lectures, workshops, webinars, and Telerobotics outreach activities as well as panel discussions. Most global events took place during the week of July 20th. The year 2023 saw participation from 42 countries, compared to 27 in 2022, marking a 55% increase compared.
11. Details of the events are included in the “2023 International Moon Day Annual Report”. This can be downloaded at: <https://internationalmoonday.org/international-moon-day-2023-annual-report/>.

## International Moon Day 2024 Outlook

12. The theme for 2024 is "Illuminating the shadows", as more missions arrive at the Lunar South Pole, so does the mystery unravel and the shadows will be forever illuminated, thus, paving the way for mankind's exploration and harvest of the Moon.
13. At the present, there are more than 20 main events proposed involving more than 25 countries
14. There are plan for more than one main event on 20 July online and in person, considering different time zones. One main event is to be held on 20 July 2024 will be in Harbin, China. This will be organized in cooperation with Harbin Institute of Technology and the Chinese Society of Astronautics. This event will involve stakeholders from all over the world.
15. Delegations, Members and Permanent Observers are kindly invited to organize events in their countries to foster global cooperation in the lunar exploration. Proposals can be filled in, by replying to the call for global event posted on the IMD website: <https://internationalmoonday.org/call-for-organisers-international-moon-day-imd-2024-g>.



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## **Report of the Moon Village Association on the Global Expert Group on Sustainable Lunar Activities – Status/Plan**

Paper submitted by the Moon Village Association

### **I. Introduction and Background**

1. This report summarizes the definition, status, and planning of the Global Expert Group on Sustainable Lunar Activities (GEGSLA) proposed and hosted by the Moon Village Association (MVA). MVA, being a permanent observer of UN COPUOS, has regularly informed all UN COPUOS committees of the progress of its activities.

### **II. The Global Expert Group for Sustainable Lunar Activities (GEGSLA)**

2. The work of the GEGSLA builds on the foundations laid by several recent key documents, including the MVA Best Practices, the Hague Building Blocks for the Development of an International Framework on Space Resource Activities, and the United Nations Guidelines for the Long-term Sustainability of Outer Space Activities, but aims to extend those principles to provide more detailed recommendations and practical guidance.
3. Hence, GEGSLA will provide distinct and new directions for international cooperation to encourage the sustainability of lunar activities. The aim of the Group is to increase coordination mechanisms and individuate the present and future challenges of lunar missions, especially considering the increased global interest in specific areas like the lunar south pole.
4. The primary goal of GEGSLA meetings is to stimulate informal discussions to prepare documents to be brought to the attention of UN COPUOS for further discussion and deliberation. The Group started its work with the kick-off meeting in early 2021, creating the basis for increasing global coordination for a new era of sustainable space exploration.
5. The Group was chaired by Dr. Dumitru-Dorin Prunariu (Romania). Its members included 37 experts from the following countries: Australia, Austria, Brazil, Canada, China, Cyprus, Egypt, France, Germany, India, Israel, Kenya, Luxembourg, Mexico, Netherlands, Nigeria, Romania, Russian Federation, Saudi Arabia, Türkiye, Ukraine, United Kingdom of Great Britain and Northern Ireland, and the United States of America.
6. The Group included about 200 observers from more than 40 countries.
7. The Group completed its activities in December 2022 with the following deliverables:

- (a) *A Recommended Framework and Key Elements for Peaceful and Sustainable Lunar Activities*; attached to this CRP and delivered to all Delegations in a printed format.
- (b) Annex 1 “*Guidelines for lunar activity implementation and operations addressing information-sharing; safe operations and lunar environmental protection; compatibility and interoperability; and lunar governance*” and Annex 2 “*A List of future issues for sustainable lunar activities.*” Both documents can be downloaded at: <https://moonvillageassociation.org/gegsla/documents/>.

8. MVA has already presented, in 2023, the Recommended Framework at the 60<sup>th</sup> Scientific and Technical Subcommittee in the Conference Room Paper [A/AC.105/C.1/2023/CRP20\*] as well as at the 62<sup>nd</sup> Legal Subcommittee in the Conference Room Paper [A/AC.105/C.2/2023/CRP.31] and the 66<sup>th</sup> Committee on the Peaceful Use of Space [A/AC.105/2023/CRP.9].

9. In 2024, MVA has presented its report at the 61<sup>th</sup> Scientific and Technical Subcommittee in the Conference Room Paper [A/AC.105/C.1/2024/CRP.11\*].

10. As part of its continuous efforts to promote sustainable lunar activities, the Moon Village Association (MVA) is hosting a side event during the 67<sup>th</sup> session of UN COPUOS titled “*Sustainable Lunar Environment: Challenges and Opportunities.*” This event takes place on Thursday, June 20, from 13:15 to 14:15 CEST in Room M4. The event is co-hosted by COSPAR, the International Astronomical Union (IAU), and For All Moonkind. This event provides a platform for informal discussions and knowledge sharing, further supporting the goals of GEGSLA and fostering international cooperation in lunar activities.

### **III. GEGSLA Operational Phase**

1. The Operational Phase started in January 2023 and is ongoing. Its goals are to promote consideration and implementation of the Recommended Framework produced by the Group, with a special focus on discussions conducted within the UN COPUOS as well as an in-depth assessment of few specific issues as defined in the following paragraphs.
2. Details of the Project Plan for 2024 can be found on the relevant GEGSLA webpage of the MVA website: <https://moonvillageassociation.org/gegsla/about/>.
3. There is no distinction between Members and Observers. There are only Participants in the Group. The Group consist of major stakeholders in lunar activities, including representatives from space agencies/government, industry, international organizations, academia, and civil society. Participants are over 200 former Members and Observers of the Group and will act on a personal basis. Any views expressed at the meetings or by the Group do not represent the position of organizations to which the participants may belong. Moreover, the Group already includes new participants from large scientific organizations like COSPAR, and more participants are invited to join.
4. In 2024, GEGSLA held 2 plenary meetings and has continued to work with the following Working Groups to investigate in depth some aspect of the Framework document:

WG1: Lunar Environmental Protection

WG2: Lunar Technical Coordination

WG3: Lunar Multi-stakeholder Coordination.

Each Working Group is composed of about 15 technical experts from around the world.

The Status Report of each WG can be found in the Annex, with some preliminary conclusions, except for the WG3 that is elaborating on its conclusion

5. The Framework Document is considered a starting point to urgently initiate a conversation on lunar consultation and possibly coordination between Delegations. The preliminary conclusion of the Working Groups, are supporting the goal to establish a permanent consultation body within the UN system, to de-risk future lunar activities, hopefully within 2024, in order to insure sustainable lunar activities.
6. MVA is acknowledging and support the proposal made by Romania to establish the Action Team on Lunar Consultation Activities (ATLAC)

## Annex

### Status Report Working Group 1: Lunar Environmental Protection

#### I. Introduction

1. Working Group 1 has the following objectives:
  - i. Offer clarification on the meaning of "harmful contamination" of the lunar environment as specified in Article IX of the OST and consider the extent to which this concept needs to be developed to include other forms of harmful interference.
  - ii. Assess aspects and locations of the lunar environment which merit protection from harmful contamination and other interference in order to preserve scientific, cultural and/or aesthetic value.
  - iii. Make recommendations which may be helpful in protecting these environments.
2. To date, the Working Group has held three meetings and has made preliminary progress in understanding current usage of the term 'harmful contamination', and in assessing the value of applying principles in existing international environmental law to the lunar environment.

#### II. Definition of "harmful contamination"

1. The term 'harmful contamination' is not defined in the Outer Space Treaty (OST). The WG is seeking to clarify how this expression is typically understood by States Parties to the OST and other space actors. The WG heard expert testimony from Niklas Hedman, former Acting Director of UNOOSA, that the background to the wording in Article IX of the OST was primarily concerned about preventing interference with the activities of other States Parties (i.e., through the principles of 'Due Regard' and 'Harmful Interference'). This is consistent with the interpretation provided by the Cologne Commentary on Space Law:

"The definition of harmful contamination appears to be a broad concept, covering all possible kinds, forms or instances of harmful interference in outer space, deliberate or unintentional alike. 'Harmful' retains its ordinary meaning, namely causing or capable of causing significant harm. Thus, Article IX implies that 'any contamination which would result in harm to a State's experiments or programs is to be avoided.'"

2. Thus, current understanding of 'harmful contamination' does not appear to include any requirement to protect the lunar environment in and of itself. In addition, current interpretations have generally relied for guidance on the COSPAR Planetary Protection Policy (PPP), which only provides guidelines for the prevention of biological contamination. The Moon Agreement takes a more comprehensive position in Article 7, which identifies harmful contamination as the introduction of "extra-environmental matter or otherwise" where "otherwise" could potentially include forms of contamination other than biological. Article 7 requires that lunar operators to "take measures to prevent the disruption of the existing balance of its environment".

3. The WG considers that it would be desirable to reach agreement on a broader definition of ‘harmful contamination’ which extends protection to aspects of the lunar environment itself (e.g., the protection of areas of scientific, cultural and/or aesthetic value), as well as wider forms of possible contamination (e.g. physical, chemical, and radiological contamination, in addition to the biological contamination covered by the PPP). After extensive discussion, the WG favours adoption of the definition presented in Section 3(b) of Annexe I (p. 32) of the GEGSLA Framework Document (<https://moonvillageassociation.org/download/gegsla-annexes>):

“Harmful Contamination of a lunar environment or lunar orbits is defined as the deliberate or unintentional changing of that environment through the introduction of extra-environmental materials or otherwise, so as to cause harmful interference<sup>1</sup> with other actors carrying out legitimate lunar activities such as science, exploration, or commerce; or to damage sites of scientific or cultural importance.”

4. The WG considers that this proposed interpretation of ‘harmful contamination’ has merit because it better defines ‘contamination’ (in part by taking language already in the Moon Agreement) and extends the concept beyond biological contamination, yet remains consistent with the original intention of the OST that ‘harmful’ relates primarily to impact on other space activities rather than to the lunar environment per se.

### **III. Relevance of international environmental law**

5. The WG notes that, according to Article III of the OST, space activities must comply with international law, and this therefore includes relevant aspects of international environmental law. To this end, the WG established a sub-group to consider the principles of international environmental law that can be applied and adapted to human activities on the Moon. Several such principles were identified, including:

- Precaution
- Prevention
- Long-term sustainability
- Intergenerational solidarity
- Publicity and transparency

6. A key tool in preventing environmental harm on Earth is the implementation of Environmental Impact Assessments (EIA), the importance of which was stressed at the United Nations Conference on Environment and Development (UNCED, Principle 17). The WG considers it desirable that the requirement for EIAs be extended to human activities on the Moon.

### **VI. Identifying Sites of Special Scientific Interest (SSSI)**

10. The WG has begun consideration of how to identify SSSI on the Moon. We are liaising with the IAU on identifying sites of specifically astronomical interest. The WG agrees that the IAU is the best

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<sup>1</sup> Here (p. 32 of the Annexes) ‘harmful interference’ is defined as: “undertaking an activity which prevents other actors from carrying out their legitimate lunar activities or gaining access to an area; contaminates or depletes a resource being utilized by another actor or presents risks to the safety of lunar activities.”

forum for coordinating discussions on sites of value for astronomical observations from the Moon. In order to reach agreement on lunar sites of special interest for other scientific applications (e.g. astrobiology, geology), the WG considers the best approach would be to form a consortium of relevant scientific organisations (e.g. COSPAR, IAU, UNESCO) where the topic might be further developed. However, the WG is still in the process of considering this topic and hasn't yet reached any final recommendations.

## **VII. Next steps**

11. Over the coming months, WG1 will continue its deliberations on how to best identify SSSI on the Moon. The WG will continue to make use of existing fora and international meetings to interact with the community and refine our recommendations, including participation in the forthcoming UN meeting on Sustainable Lunar Activities in Vienna on 18 June (<https://www.unoosa.org/oosa/en/ourwork/moon-mars-and-beyond/sustainable-lunar-activities-conference-2024.html>) and a MVA-sponsored side event at UNCOPUOS on 20 June.

## **VIII. WG Participants**

### **Co-Chairs**

Jean-Claude Worms, COSPAR, France  
Ian Crawford, Birkbeck University of London, UK

### **Members**

Alice Gorman, Flinders University, Australia  
Anne-Sophie Martin, Institute for International Legal Studies (ISGI-CNR), Italy  
Aya Farag, Faculty of navigation science and space technology, Egypt  
David Kendall, Outer Space Institute, Canada  
Edvaldo Silva, CESMAC University Centre, Brazil  
Farah Diya Yasmine, Space Generation Advisory Council, Indonesia  
Flavia Alvim de Carvalho, EJUSP and PUC Minas, Brasil  
Frank Koch, Orbit Recycling, Germany  
Marc Fournier, SNCF / La Paillasse, France  
Naresh Kannan, University of Rostock, Germany, United Kingdom  
Richard Green, IAU

### **Observers**

Niklas Hedman, COSPAR  
Güneş Ünüvar, Researcher, Luxembourg Center for European Law  
Saleem Zoughbi, Senior Expert, at the United Emirate University,

## **Status Report Working Group 2: Lunar Technical Coordination**

### **I. Introduction**

1. The Lunar Technical Coordination Working Group was assembled earlier in 2023, with the initial set of members selected in August. The key objectives of the group are to:

- i. Facilitate information sharing between organizations performing missions on the lunar surface or planning lunar surface missions.
- ii. Communicate GEGSLA Recommend Framework to lunar stakeholder community and receive feedback, particularly for chapters 5,6 and 7.
- iii. Determine the highest priorities for the definition and agreement of best practices to ensure efficient and safe lunar activities, while protecting the lunar environment.
- iv. Work toward those best practices being implemented by organizations operating on the lunar surface.
- v. Coordinate technical standards to further the goal of compatibility and interoperability.

### **II. Engagement with Other Coordination Groups**

2. The GEGSLA Working Group 2 (WG 2) mission's is to discuss methods to streamline and harmonize technical standards, protocols, and best practices for lunar exploration activities, ensuring a cohesive and safe approach to the Moon's utilization.

#### **A. Lunar Surface Innovation Consortium (LSIC)**

3. LSIC operates in collaboration with NASA's Space Technology Mission Directorate and is an integral part of the Lunar Surface Innovation Initiative (LSII). Its key activities involve engaging with a diverse array of industry, academia, and governmental entities to innovate and develop technologies tailored for operations on the lunar surface. WG 2 submitted an abstract to the LSIC Spring Meeting, which was held 23-26 April 2024 at Johns Hopkins Applied Physics Laboratory in Laurel, MD, USA. The abstract was selected for a poster (see below). Marchel Holle and Tim Cichan attended in person, and Ekaterina Seltikova attended the virtual session, and informed attendees of the work of GEGSLA and the Recommended Framework. Tim Cichan also co-led the International breakout group to foster great international collaboration on the Moon.




## GEGSLA: Global Expert Group on Sustainable Lunar Activities

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**WHAT IS GEGSLA?**  
200 participants – 26 countries



**Why?**

- Increase in lunar missions
- No coordination mechanism for lunar activities
- Issues to be addressed:
  - mitigating the creation of debris in lunar orbit
  - defining standards to enable interoperability
  - de-risking future lunar operations




- WG1 Lunar Environmental Protection
- WG2 Lunar Technical Coordination
- WG3 Lunar Multi-stakeholder Coordination

GEGSLA is an initiative of the Moon Village Association (MVA), a permanent global informal forum for stakeholders like governments, industry, academia and the public interested in the development of the Moon Village.

**RECOMMENDED FRAMEWORK AND KEY ELEMENTS**

**GEGSLA Objectives**

- Leverage contributions from space agencies, private companies, academia, and international organizations
- Involve the public by promoting outreach efforts through the involvement of local actors at the global level
- Serve as a platform to exchange information and views within the space community on key issues for the peaceful and sustainable conduct of lunar activities
- Support complementary activities, within UN COPUOS or other international fora, for the development of international frameworks related to lunar coordination (e.g. space resource utilization, long-term sustainability)



**What is the Recommended Framework and Key Elements for Peaceful and Sustainable Lunar Activities?**

A guide for well-balanced lunar projects which:

- Shows how to implement safe and sustainable lunar activities through norm-setting, coordination, and management
- Builds on principles established in international space law, relevant UN outer space treaties, soft law documents, and multilateral agreements
- Extends existing principles into a framework to effectively facilitate dialogue and cooperation among multiple lunar stakeholders.
- Aims at providing transparency, accountability, and certainty for all stakeholders, present and future
- A living document which focuses on the near and medium terms
- A comprehensive input to the UN to start the discussion on International lunar coordination

**Structure of the Recommended Framework and Key Elements for Peaceful and Sustainable Lunar Activities**

**Principles**

- Chapter 1: Objective
- Chapter 2: Definition of Key Terms
- Chapter 3: International Legal Norms for Lunar Activities
- Chapter 4: Coordination and Management


**Key Elements for Sustainable Lunar Activities**

- Chapter 5: Information Sharing
- Chapter 6: Safe Operations and Lunar Environmental Protection
- Chapter 7: Compatibility/Interoperability
- Chapter 8: Responsible Governance
- Chapter 9: Benefits for Humanity
- Chapter 10: Sustained Lunar Economy
- Chapter 11: Human Interaction

**11 chapters covering:**

- Coordination
- Management
- Information sharing
- Safe operations
- Lunar environmental protection
- Compatibility
- Interoperability
- Lunar governance
- Benefits for humanity
- Sustaining the lunar economy
- Human interactions

You can download the Recommended Framework and Key Elements for Peaceful and Sustainable Lunar Activities here:



**GEGSLA and LSIC – COMMON GOALS**

The objectives of the Lunar Technical Coordination working group align well with the objectives of LSIC:

- Facilitate information sharing between organizations performing missions on the lunar surface, or planning lunar surface missions
- Communicate the elements of GEGSLA Recommended Framework to lunar stakeholder community and receive feedback
- Determine the highest priorities for the definition and agreement of best practices to ensure efficient and safe lunar activities, while protecting the lunar environment
- Work toward those best practices being implemented by organizations operating on the lunar surface
- Coordinate technical standards to further the goal of compatibility and interoperability.

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GEGSLA Documents



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MVA Page

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**REFERENCES**

[1] G. Rabakht, et al. (2023) IAC-23-D4.2.4  
[2] GEGSLA, Recommended Framework and Key Elements for Peaceful and Sustainable Lunar Activities, <https://moonvillageassociation.org/gegsla/documents/gegsla-recommended-framework/>



### III. Plans for 2024 Activities

4. The 2024 activities for the Lunar Technical Coordination Working Group have been planned. One key task is to enhance integration with international lunar coordination efforts. Elements of the plan include:

- Inviting other groups to present at future working group meetings
- Engagement at Spacetide Tokyo and Secure World Foundation sustainability conference (8-12 July)
- Hold a virtual workshop during International Moon Day (IMD)
- Identify any impediments to international coordination

5. NASA's Office of Technology, Policy, and Strategy (OTPS) is soliciting input from the lunar community to help develop a framework for minimizing interference and contamination in lunar activities. Responses to the Lunar Non-Interference Questionnaire are due by June 7, 2024. WG2 will help coordinate the GEGSLA input to the survey. (<https://www.nasa.gov/organizations/otps/otps-seeks-input-from-the-lunar-community-to-inform-a-framework-for-further-work-on-non-interference-of-lunar-activities/>)

6. The International Lunar Research Station has been adding members, and now includes China, Russia, Venezuela, South Africa, Azerbaijan, Pakistan, Belarus, and Egypt. The working group plans to develop ideas for how the ILRS and the Artemis program should coordinate to prevent harmful interference.

7. The Lunar Technical Coordination Working Group supports the proposal of the Lunar Multi-Stakeholder Coordination Working Group for an International Committee on Lunar Operations. With the existence of many coordination groups, an international one should be focused on a few very important issues. Sharing information regarding the ongoing and planned operations and engaging in consultations for purposes of coordination is a key objective, along with identifying the shared needs and concerns of lunar operators. It would be advantageous for industry to have a defined method of providing input to the committee, perhaps organized as an advisory group.

### IV. WG Participants

#### Co-Chairs

Timothy Cichan, Lockheed Martin, USA

Marchel Holle, iSpace, Japan

#### Members

Arvind Ramana, Australian Space Agency, Australia

Carlos Mariscal, Dereum Labs, Mexico

Clara Richard, ICAD/DSI/SGAC, Spain/UK

Ekaterina Seltikova, Technical Unit Research for a Thriving Lunar Ecosystem, SGAC France

Hassan ABOUSEADA, Egyptian Space Agency, Egypt

Laura Champion, Lockheed Martin, United States

Madison Feehan, Space Copy / NASA, Canada

Omolade Odetara Leanspace, France

Suzanne Gillen, Redwire, USA

Prof. Dr. Bernd J. HOEFER, A9C Capital WLL, Bahrain / DiMOS Operations GmbH, Germany

Bahrain

Shreya Santra, Department of Aerospace Engineering, Tohoku University, Japan

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