Recommended Framework and Key Elements for Peaceful and Sustainable Lunar Activities

GLOBAL EXPERT GROUP ON SUSTAINABLE LUNAR ACTIVITIES

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Forword

The near future will see a multitude of lunar missions through the efforts of both space agencies and commercial stakeholders. The current lack of coordination mechanisms for lunar activities presents a serious challenge to future missions and could lead to dangerous conflicts, especially in light of the increased global interest in specific areas like the lunar south pole. The need to preserve the peaceful uses of space, together with the desire to begin a new era of sustainable space exploration, urges the development of a common level playing field for upcoming lunar activities.

A number of issues must be addressed to ensure sustainable lunar exploration and settlement in and around the Moon, including, for example, mitigating the creation of debris in lunar orbit, defining standards to enable interoperability, and regulating access to natural resources.

In 2019, the Moon Village Association (MVA) created an international platform to address these critical issues with the goal of de-risking future lunar missions and increasing global cooperation for lunar exploration and settlement. The MVA decided to promote the development of a neutral forum for multi- stakeholder discussions on lunar exploration: the *Global Expert Group on Sustainable Lunar Activities* (GEGSLA), with the goal of de-risking future lunar missions and increasing global cooperation for lunar exploration and settlement.

The primary goal of GEGSLA meetings is to stimulate informal discussions to prepare documents to be brought to the attention of UNCOPUOS for further discussion and deliberation. The Group started its work with the kick-off meeting on February 25, 2021, creating the basis for increasing global coordination for a new era of sustainable space exploration.

To achieve its goals, the Group had the following goals:

- Leverage contributions from major stakeholders of the space community, including space agencies, private companies, academia, and international organizations;
- Involve the public by promoting outreach efforts regarding the activities of the Group 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 UNCOPUOS or other international forums, for the development of an international framework regulating space resource utilization.

The Group operates by consensus, and it is composed of members and observers, who act in their individual capacity. They are stakeholders in lunar activities, including representatives from space agencies/government, industry, international organizations, academia and civil society. The Group is chaired by Dr. Dumitru-Dorin Prunariu (Romania) and its members include 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, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland and United States of America. The Group also includes about 195 observers from more than 40 countries.

More information can be found at:

https://moonvillageassociation.org/gegsla/about/

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Preamble

The Moon and its relationship to Earth are unique. Created by an impact event approximately 4.5 billion years ago, the Moon has shaped the evolution of terrestrial and marine ecosystems, contributing to the habitability of Earth. Every human culture has expressed the influence of the Moon through its cosmology, spirituality, science, and creative and social life. For these reasons, the exploration and use of the Moon can truly be the province of all humankind.

Now, the Moon, through activities on or around it, is poised to play a new role in facilitating human exploration and use of the solar system and enhancing the long-term sustainability of outer space activities. These activities have the potential to contribute to the future benefit of humankind through the development of new technologies, access to rare resources, and deepening human understanding of the solar system and our place within it.

The promise of the Apollo missions waned when humans left the Moon in 1972 and did not return. In this new phase of human engagement with the Moon, there are multiple stakeholders, emerging technologies, and new goals – including the intent to stay. It is essential that these activities proceed prudently and ethically to reaffirm the confidence of the people of Earth. However, even building on experience gained from over 60 years of space activities, standards and legal norms are needed to guide these activities.

The Global Expert Group on Sustainable Lunar Activities (GEGSLA) was established to promote and support the development of lunar activities in a safe and sustainable manner. Its vision is to enable globally inclusive participation in this next stage of human endeavors in space. For this purpose, the GEGSLA has engaged widely with lunar stakeholders from industry, government, and academia to develop the Recommended Framework and Key Elements for Peaceful and Sustainable Lunar Activities.

The Recommended Framework and Key Elements is designed as a guide for well-balanced lunar projects and offers recommendations for how to implement safe and sustainable lunar activities through norm- setting, coordination, and management. It builds on principles established in international space law, relevant UN outer space treaties and soft law documents (e.g. the UN COPUOS Guidelines for the Long Term Sustainability of Outer Space Activities (2019)), and other distinctive international or multilateral agreements (e.g. the Artemis Accords), national legislation and regulations, and guidance documents (e.g. the Building Blocks for the Development of an International Framework on Space Resource Activities (2019), the MVA Best Practices on Sustainable Lunar Activities (2019), and the Vancouver Recommendations on Space Mining (2020)).

Documents such as the UN Long Term Sustainability Guidelines have developed higher-order principles to guide humanity's engagement with outer space, including the Moon and other celestial bodies. The GEGSLA recognized that the next steps forward might require more detailed elaboration. The GEGSLA seeks to extend existing principles into a framework that can effectively facilitate dialogue and cooperation among multiple lunar stakeholders. The participation of the space industry was vital in verifying sustainable practices and crafting practical recommendations that act as incentives rather than barriers.

The Recommended Framework and Key Elements can act both as a guide for designing lunar activities and as a benchmark against which to gauge the success of those activities in achieving sustainability. The Recommended Framework is aimed at providing transparency, accountability, and certainty for all stakeholders, present and future.

The Recommended Framework and Key Elements are not a proscriptive set of principles to regulate all potential types of lunar activity. Instead, the Recommended Framework and Key Elements is a living document which focuses on lunar activities that are likely to occur in the near and medium terms, within a vision of the long-term expansion of human activities in

lunar orbit and on the lunar surface for the benefit of all peoples irrespective of the degree of their economic or scientific development.

In eleven chapters, the Recommended Framework and Key Elements cover coordination and management; information sharing; safe operations and lunar environmental protection; compatibility and interoperability; lunar governance; benefits for humanity; sustaining the lunar economy; and human Interactions. Moreover, two additional documents advance the work done by the main GEGSLA outcome: the *Technical and Operational Practices and Case Studies on Peaceful and Sustainable Lunar Activities* and *A List of Future Issues of Sustainable Lunar Activities* which are not covered by the Recommended Framework and Key Elements for Peaceful and Sustainable Lunar Activities and recommended it for further discussions at a later stage. While not object of consensus within the GEGSLA plenary, as indicated in the Chair's Explanatory Note on Annexes, these two documents constitute a critical complementary to the overall work.

There is no doubt that exploring and using the Moon in the present era will present unforeseen challenges, testing the limits of human ingenuity and cooperation. It is the hope of the GEGSLA that the Recommended Framework and Key Elements will provide the next steps forward in ensuring the peaceful and sustainable foundation of lunar activities.

Principles

Chapter 1: Objective

The Recommended Framework and Key Elements seek to support the creation of an enabling environment for peaceful, safe, and sustainable activities on the Moon and in its orbit, which is in the interests of, and benefits, all humankind, and all countries, irrespective of their degree of economic or scientific development. The Recommended Framework and Key Elements are designed to:

- Provide certainty and predictability through technology-neutral recommendations to all public and private actors intending to conduct lunar activities under the principles of international space law, enshrined in the Outer Space Treaty, including the freedom of use and exploration of space.

- Promote a constructive, multilateral exchange of views on such activities, including their legal, technical, industrial, social, and economic aspects under UNCOPUOS;

- Facilitate international cooperation and coordination in such activities.

To achieve this objective, the Recommended Framework and Key Elements:

- Identify and define the relationship of lunar activities with existing international space law, including the provisions of the United Nations treaties on outer space, as well as the related United Nations principles and guideline resolutions related to outer space activities;

- Propose recommendations for the consideration of States and international organizations for the possible application to development of domestic policies and regulations, as well as the

possible formulation of an international framework, on such activities;

- Identify necessary, practical, and effective principles, mechanisms, and/or technical standards that contribute to the reduction of the risk of harmful interface with lunar activities and promote long- term sustainability;

- Promote the development of sustainable practices by lunar stakeholders to create, fund, incentivize, and facilitate near-term activities on the Moon and in its orbit.

Chapter 2: Definition of Key Terms

For the purpose of this Recommended Framework, the following terms are defined as:

2.1 *Lunar activity* is any scientific, commercial, and human activity which takes place on the lunar surface, subsurface or orbit, as well as any associated ancillary activities.

2.2 *Commercial activity* is any activity with an exchange to earn a profit, which includes but is not limited to resource extraction and transactions such as selling, bartering, donating, leasing, licensing, etc.

2.3 *Data* refers to information about the lunar environment and lunar activities, such as measurements, results and statistics collected for reference, analysis or decision-making. The data can be digital, visual, quantitative or qualitative, in raw or processed form.

2.4 *Environmental harm* is an adverse effect, both present and future, on the lunar environment that is not trivial or negligible in nature, extent or context that hinders the use of the Moon for scientific and/or commercial purposes or for safe human habitation. Serious environmental harm is actual or potentially adverse effect(s) that are irreversible, of high impact or widespread, or causes actual or potentially adverse effect(s) to the environment of an area of high conservation value, scientific interest, or otherwise is of special significance.

2.5 *Harmful interferenc*e refers to the result of any activity with a significant adverse effect on the lunar activity of other actors, which prevents them from carrying out their legitimate lunar activities or gaining access to an area.

2.6 *Lunar cultural heritage* is any place with human material culture on the Moon or that is associated with intangible practices, representations, expressions, knowledge, or skills that has historical, social, aesthetic, spiritual or scientific significance for present and future generations. Lunar *natural heritage* is any place, geological or landscape formation that has historical, social, aesthetic, spiritual or scientific significance for present and future generations.

2.7 *Interoperability* refers to the development of common standards of design, manufacture, and construction and/or operations to enable software and hardware components to be interchanged or operate in conjunction to facilitate international cooperation, recycling and repurposing.

2.8 The *lunar environment* consists of but is not limited to the lunar surface and subsurface, including mountains and craters, rocks and boulders, regolith, dust, minerals, gasses, water, ice, boundary exosphere, and surrounding lunar orbits.

2.9 The *lunar surface* is understood as the layer of regolith comprising unconsolidated rocks, pebbles, and dust. The lunar subsurface consists of primordial bedrock and lava tubes or caves.

2.10 *Environmental Sustainability* is the ability to preserve the outer space environment for future generations and to oversee the conduct of space activities on and around the Moon indefinitely into the future in a way that realizes the objectives of equitable access to and benefits from the exploration and use of outer space for peaceful purposes.

2.11 Lunar *in situ resources* are mineral or volatile resources on or below the lunar surface which have applications for scientific, commercial, construction or residential utilization.

2.12 *Safe operations* are those activities that, under proper authorization and supervision, are carried out in a way that avoids harm to the lunar environment and human life or other activities on the Moon while safeguarding free and equal access.

2.13 A *safety zone* is a publicly notified area with clear geographic and time-delineated parameters established around the site of a given lunar activity in order to ensure safety and avoid potentially harmful interference among lunar activities.

2.14 A *lunar settlemen*t is a residential area or habitat designed for temporary or permanent human habitation with its associated facilities and the resources required for the maintenance of life.

2.15 *Lunar stakeholders* include governmental and non-governmental entities and international organizations participating directly or indirectly in the exploration and use of the Moon or in any other way contributing to the sustainability of lunar activities.

Chapter 3: International Legal Norms for Lunar Activities

This Chapter identifies existing norms that support the adoption of sustainable practices in all lunar activities and proposes new norms needed for the near future. Such norms should reflect operational experience, i.e., practical, achieve a balance between incentive and prescription, and be technology neutral. Since all actors, whether governmental or non-governmental, should have an equal interest in achieving sustainable use of the Moon, these norms apply to all or are encouraged to be followed by all according to the legal effect of specific norms.

Norms are established by international law, national legislation, or policy, but also by the common acceptance that certain behavior is desirable or good practice. While built on precedence, norms can also be aspirational and responsive to changing public perceptions of ethical behavior. The role of norms in sustainable lunar activity is to provide agreed-upon tenets that guide actions consistent with sustainable practices.

A legal norm is a binding rule that determines the rights and duties of an actor, as enshrined in national and international law. Breaking a legal norm may result in sanctions; however, the norm remains intact even if violated.

A behavioral norm is a standard of behavior, not necessarily enshrined in law but commonly accepted as appropriate. Behavioral norms are shared beliefs between actors which may cover social and moral expectations.

3.1. Summary of existing norms relevant to lunar activities

3.1.1. International legal norms

3.1.1.1. A number of widely recognized international legal norms related to lunar activities have been codified in existing international treaties, including the Outer Space Treaty 1967, the Rescue Agreement 1968, the Liability Convention 1972,

and the Registration Convention 1976. These are widely recognized international law norms and, as such, pertain to lunar activities.

3.1.1.2. The Moon Agreement 1979, although with a limited number of States Parties, contains a number of elements that are relevant to the development of legal norms for lunar activities.

3.1.1.3. Some international instruments can be related to the lunar activities, including, but not limited to, the Constitution and the Radio Regulations of the International Telecommunication Union (ITU).

3.1.2. Current guidelines and principles

3.1.2.1. In addition to international treaties, there are a number of guidelines, principles, and proposed normative frameworks drafted by international governmental and non-governmental organizations and States, and that contain relevant provisions pertaining to lunar activities.

3.1.2.2. The Guidelines for the Long-Term Sustainability of Space Activities 2019 (A/74/20, para 163 and Annex II)

3.1.2.3. Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space 2007 (A/62/20, Annex and General Assembly Resolution 62/217 of December 22, 2007)

3.1.2.4. Safety Framework for Nuclear Power Source Applications in Outer Space 2009 (A/AC.105/934, 2009)

3.1.2.5. The Artemis Accords (2019)

3.1.2.6. The Hague International Space Resources Governance Working Group Building Blocks for the Development of An International Framework (2019)

3.1.2.7. The Vancouver Recommendations on Space Mining (2020)

3.1.2.8. The MVA Best Practices for Sustainable Lunar Activities (2020)

3.1.3. Behavioral Norms from Operational Experience

Extensive operational experience in space activities has been developed in Earth orbit and limited operational experience in lunar activities through the historical activities of States. This operational experience has created behavioral norms which might influence and inform sustainable lunar practices, including (but not limited to) practices in space debris mitigation, radio frequency coordination, and notification and registration.

3.1.4. National Legislation

Some States have adopted national laws, regulations and policies related to space activities, including lunar activities. Such legislation, as state practice, may contribute to the interpretation and development of international law in this field.

3.2. Limitations

Limitations in existing norms arise because many situations have not yet been tested in real circumstances. For example, there has rarely been more than one active lunar surface mission or multiple human missions at the same time. Some of the gaps will be identified and addressed in the technical annexes to this report.

3.3. Proposed norms needed for the near future

3.3.1. Jurisdiction and Control

3.3.1.1. The appropriate States shall retain jurisdiction and control over their personnel and their vehicles, equipment, facilities,

stations, and installations on the Moon. Ownership shall not be affected by their presence on the Moon.

3.3.1.2. Lunar stakeholders shall not carry out activities or conduct themselves in ways which would be contrary to the applicable laws, including their national legislation or international laws.

3.3.2. Registration

Lunar stakeholders should register all space objects under the provisions of national registration practices and in accordance with the Registration Convention 1976 and/or General Assembly resolution 1721 B (XVI) of December 20, 1961, taking into account General Assembly resolution 62/101 on registration practices and other requirements under the relevant treaties, principles, regulations, and resolutions.

Lunar stakeholders should register other objects, like facilities, stations, and installations, which might be partially made by lunar resources or any other things which would not be defined as space objects and notify this registry to the international community in an appropriate way.

3.3.3. Interoperability

Lunar stakeholders recognize that the development of interoperable and common lunar infrastructure and standards will contribute to the safety and viability of lunar operations. Lunar stakeholders should pursue reasonable efforts to develop, promote, utilize, and follow interoperability standards.

3.3.4. Mitigation of harm

With regard to the current state of technology, lunar stakeholders shall take appropriate measures to avoid and mitigate harm to the lunar environment and/or to other operators in that environment.

3.3.4.1. Environmental protection: lunar stakeholders should adopt appropriate measures to avoid harmful contamination to the environment of the Moon or adverse changes in the environment of Earth resulting from the introduction of extraterrestrial matter. This shall include consideration of

a) Internationally agreed planetary protection policies.

b) Adverse changes to designated and internationally endorsed lunar natural or cultural heritage sites

c) Adverse changes to designated and internationally endorsed lunar sites of scientific, commercial or another interest.

3.3.4.2 Space debris mitigation: In consideration of the harmful effects of the creation of space debris on or around the surface of the Moon, lunar stakeholders should adopt appropriate measures as far as possible to avoid the creation of lunar orbital debris and lunar surface debris, and to mitigate the impacts of lunar orbital debris, both in lunar and Earth orbit.

3.3.4.3 Harmful interference: In consideration of a) risks to the safety of persons or property and b) risks to other ongoing space activities, including other lunar activities, Lunar stakeholders should adopt appropriate measures to avoid harmful interference with lunar activities carried out by other stakeholders. Should harmful interference be anticipated, stakeholders should seek appropriate consultation.

3.3.5. Non-appropriation

In line with the provisions of the Outer Space Treaty 1967, no lunar stakeholders shall take national appropriation of the Moon and its orbit by claim of sovereignty, by means of use or occupation, or by any other means. The establishment of safety zones around lunar operations and exclusion or buffer zones around sites of cultural and natural heritage significance, or scientific interest, shall not result in such appropriation.

3.3.6. Freedom of access and scientific investigation

Lunar stakeholders are free to access and use all areas of the Moon and have the freedom of scientific investigation on the Moon in accordance with international law.

3.3.7. Radiofrequency

In conducting lunar activities, lunar stakeholders should adopt appropriate measures to avoid, to the extent possible, the adverse impact caused by the use of radio frequency on the achievement of objectives of any other stakeholder, and give special consideration to the requirements of Moon- based astronomical observation.

Use of radio frequency shall be registered in accordance with the Radio Regulations of the ITU.

3.3.8. Sharing of Scientific Data

Lunar stakeholders should share the scientific data obtained from lunar activities, and disseminate the data to the public and the international scientific community in accordance with international law, including those related to intellectual property rights.

3.3.9. Fair use of resources

In their use of a lunar resource, lunar stakeholders should avoid taking actions which would prevent its use by future generations by overexploiting or contaminating the resource.

3.3.10. Peaceful use of the Moon

3.3.10.1. The Moon and other celestial bodies shall be used by all lunar stakeholders exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on the Moon and other celestial bodies shall be forbidden.

3.3.10.2. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the Moon and other celestial bodies shall also not be prohibited.

Chapter 4: Coordination and Management

Coordination and management mechanisms should be transparent and inclusive among lunar stakeholders and should build upon outreach to the general public in an inclusive, broad, and holistic fashion.

4.1. Agreed-upon principles for coordination and management are a critical enabling factor for safe and sustainable lunar activities.

4.1.1. Principles for the coordination and management of lunar activities should focus on creating an enabling environment for sustainable lunar exploration and utilization through promoting information sharing for the purposes of coordinating safety and reduction of harmful interference.

4.1.2. Principles for the coordination and management of lunar activities should also foster international cooperation.

4.1.3. Principles for the coordination and management of lunar activities will necessarily be implemented at multiple levels with diverse scopes of application. These levels and scopes include multilateral/bilateral, international/ regional / sub-regional, intergovernmental / non-governmental, regulators / industry and private sector.

4.2. Development of principles for the coordination and management of lunar activities should draw on existing mechanisms to the greatest extent possible.

4.2.1. It is important to take into account and build upon those existing regulations and principles governing coordination and management in outer space and that already contribute to lunar sustainability.

4.2.2. In the coordination and management of lunar activities, existing international fora should be utilized to the greatest extent possible. These fora include but are not limited to:

a. UN COPUOS: a unique platform for international cooperation in the peaceful use of space and global space governance and plays a unique role in developing international space law and fostering dialogue among space-faring and emerging space nations.

b. UNOOSA: the Secretariat of the UN COPUOS and "assists any United Nations Member States to establish legal and regulatory frameworks to govern space activities and strengthens the capacity of developing countries to use space science technology and applications for development by helping to integrate space capabilities into national development programmes."

c. The International Space Exploration Coordination Group (ISECG): "a voluntary, non-binding coordination forum of space agencies which exchange information regarding interests, plans and activities in space exploration and work together to strengthen both individual exploration programmes and the collective effort."

d. The Committee on Space Research (COSPAR): a platform for promotion on an international level of scientific research in space, including preparation of scientific and technical standards related to space research.

e. The International Telecommunication Union (ITU): the UN specialized agency for information and communication technologies "which facilitates international connectivity in communications networks, allocating global radio spectrum and satellite orbits, developing the technical standards that ensure networks and technologies seamlessly interconnect, and strive to improve access to ICTs to underserved communities worldwide."

f. The Consultative Committee for Space Data Systems (CCSDS): a "multi- national forum for the development of communications and data systems standards for spaceflight."

g. The "International Organization for Standardization" (ISO): a non- governmental international organization that works to "share knowledge and develop voluntary, consensus-based, market relevant International Standards," including many that deal directly with space activities.

h. The Inter-Agency Space Debris Coordination Committee (IADC): "an international governmental forum for the worldwide coordination of activities related to the issues of man-made [sic] and natural debris in space. The primary purposes of the IADC are to exchange information on space debris research activities between member space agencies, to facilitate opportunities for cooperation in space debris research, to review the progress of ongoing cooperative activities, and to identify debris mitigation options."

i. The International Atomic Energy Agency (IAEA): an "international organization that seeks to promote the peaceful use of nuclear energy, and to inhibit its use for any military purpose, including nuclear weapons."

4.3. To develop safe, sustainable, and transparent lunar activities, there are several aspects for which coordination and management practices will be essential:

4.3.1. Fostering International Cooperation: Coordination of interactions between governments, science communities, industry, and civil society to support sustainable lunar activities.

4.3.2. Registration Practices: Registration of lunar activities shall be encouraged, in accordance with the Outer Space Treaty (1967), Registration Convention (1976) and/or General Assembly resolution

1721 B (XVI), taking into account General Assembly resolution 62/101 on registration practices and other obligations under the relevant treaties, principles, regulations and resolutions. Such registration should focus on types, locations, and durations of lunar activities. General acceptance and consistent implementation of registration requirements and mechanisms across multiple jurisdictions and levels of coordination can be a confidence-building measure that enables multiple types of lunar activities.

4.3.3. Data-Sharing: Scientific data-sharing should be encouraged on the basis of international cooperation and benefit-sharing principles. Any data-sharing needs to take into account proprietary data and export control needs and limitations.

4.3.4. Interoperability: Interoperability of systems and capabilities can promote safety and the development of shared infrastructure to enable sustainable activities.

Key Elements for Sustainable Lunar Activities

Chapter 5: Information Sharing

As a key element of the Outer Space Treaty (1967), the Registration Convention (1976) and the Moon Agreement (1979), information sharing is increasingly treated as a global public good. It plays a fundamental role in developing global space governance and will be at the core of ensuring peaceful and sustainable lunar activities.

5.1. Definition

Lunar information sharing is the exchange of data among stakeholders, carried out either under legal obligations, with the agreement of the relevant stakeholders or on a voluntary basis, throughout the lifecycle of any activity.

5.2. Purpose

Information can be shared for multiple purposes, including:

5.2.1. Transparency: information sharing promotes confidence among lunar stakeholders to verify or ensure the Moon is used exclusively for peaceful purposes and in line with other requirements under international space law.

5.2.2. Coordination: information sharing enhances safety, increases predictability, and reduces the risk of harm and harmful interference.

5.2.3. Cooperation: information sharing fosters dialogues among lunar stakeholders, enables inclusiveness, promotes interoperability, and facilitates exchange among governmental agencies, private entities, and the general public in sustainable lunar activities

5.2.4. Capacity building: information sharing contributes to capacity building in nations and communities, particularly those that have historically been absent from space activities.

5.2.5. Benefit sharing: information sharing can help to ensure that lunar activities are carried out for the benefit and in the interest of all countries. Technical and scientific information, and knowledge derived from lunar activities constitute a benefit and should be shared as widely as possible in accordance with Article XI of the OST.

5.2.6. Safety: information shared helps all stakeholders to better assess their own risks and develop precautionary measures.

5.3. Stakeholders' responsibilities

5.3.1. Stakeholders in lunar information sharing include governmental and non-governmental entities, such as space agencies, lunar project operators, space industries, research and scientific institutions, and the general public.

5.3.2. Stakeholders shall share information in accordance with their legal obligations under international treaties (for example, Articles VIII and XI of the Outer Space Treaty (1967)), and the applicable national legislation relating to outer space or lunar activities.

5.3.3. Stakeholders should factor information sharing into the design and implementation of lunar activities, and consider partial or conditional sharing of information if commercial or other competing considerations require otherwise.

5.3.4. Stakeholders should establish appropriate record-keeping for the information shared with other stakeholders. Publicly available information shared should also be deposited in internationally designated and agreed repositories in a timely manner.

5.3.5. Common standards for data sharing should be developed for the needs of the user.

5.3.6. Stakeholders should provide clear and publicly accessible avenues of contact for enquiries.

5.3.7. Ideally, information sharing should be multi-level and as diverse as possible. It will be most frequently between lunar operators and international or national regulators or authorities to aid in coordination and transparency.

5.3.8. Information should be shared to the extent feasible, subject to legal limitations such as export controls, the protection of intellectual property and other proprietary information.

5.4. Type of information

5.4.1. Lunar operations: including the coordinates of safety or other zones, nature and duration of the operations, changes in the nature of the activity in the course of operation, technical parameters and equipment used, any identified technical vulnerabilities, environmental impact assessments of harm and harmful consequences and mitigation measures proposed to address them.

5.4.2. Scientific: consisting of raw or processed data, results from scientific analysis, or any other information leading to an enhanced understanding of the Moon

5.4.3. Natural hazards: space weather, radiation, asteroid passes or meteorite bombardment, or any other information relevant to the safe operation of plants or personnel.

5.4.4. Lessons learned: anomaly resolution and improved operational practices.

5.4.5. Locational information is recorded and provided in a commonly understood set of GIS coordinates.

Chapter 6: Safe Operations and Lunar Environmental Protection

In conducting lunar activities, there will be a need to consider a balance among the interests of environmental protection, scientific research, heritage management and commercial viability. The following measures shall be encouraged in order, to the extent possible, to avoid causing adverse changes to the lunar environment or cislunar space and avoid harmful interference to other lunar operators and stakeholders

6.1. Safety Zones

6.1.1. Safety zones for lunar activities are an essential technical means for implementing core tenets of international space law, including information sharing, consultation, avoiding harmful interference, fulfilling due regard obligations, and providing certainty to operators. Safety zones would contribute to building trust, facilitating coordination, and sustaining peace and security in outer space.

6.1.2. Establishment of safety zones:

6.1.2.1. Safety zones are purely informational and are to be consistent with the principle of free access under Article I and the principle of non-appropriation under Article II of the Outer Space Treaty (1967).

6.1.2.2. Prior to establishing safety zones, the responsible State for a lunar activity should consult with stakeholders whose current and planned lunar activities would be potentially affected by the establishment of such zones.

6.1.2.3. The responsible State for a lunar activity that intends to establish a safety zone should carry out research on the scope, duration, and nature of the safety zone in accordance with

commonly accepted scientific principles and sustainability considerations.

6.1.2.4. The responsible State who decides to establish a safety zone based on the aforementioned research should provide notice to the United Nations Secretary- General.

6.1.2.5. Such notice should include sufficient information regarding the nature of the activity to enable other operators, non-governmental entities and governmental agencies in the vicinity (i) to maintain safety, (ii) to operate with their duty of due regard, and (iii) to avoid potential harmful interference that would require consultation under Article IX of the Outer Space Treaty (1967).

6.1.2.6. In such notice, the responsible State should provide explanations to support the scope, duration, and nature of the safety zone prior to its establishment.

6.1.2.7. If lunar activities change, the associated safety zone notification should be updated in a timely fashion, and the safety zones should be terminated when the relevant activity or activities are concluded.

6.1.3. Effect of safety zones:

6.1.3.1. The purpose of safety zones is to provide notice to others of the location and nature of an operator's activities in order to promote the safety of lunar activities and prevent harmful interference among lunar operations.

6.1.3.2. The establishment and management of safety zones should be guided by principles such as necessity, balance, optimization, and coordination and not result in the appropriation of any areas on the Moon or in its orbit by the responsible State and should

not impede other stakeholders' free access to the Moon and its orbit.

6.2. Lunar Heritage

6.2.1. It is acknowledged that access to cultural heritage is a human right according to the UNESCO Universal Declaration on Cultural Diversity (2001) and the UN Universal Declaration of Human Rights (1948) Article 27.

6.2.2. Lunar activities should be conducted, to the greatest extent possible, to avoid causing adverse changes to lunar cultural and natural heritage.

6.2.3. Lunar heritage is a non-renewable resource which includes both tangible and intangible components.

6.2.4. Lunar natural and cultural heritage duly proclaimed either at the national level or designated by the competent international authorities should be managed in accordance with well-established norms, with due regard to the interests of all the pertinent stakeholders.

6.2.5. Management of natural and cultural heritage values is a key part of sustainable lunar activities, which contributes to free access to the Moon as well as the scientific exploration of the Moon.

6.2.6. The management requirements of lunar heritage should be examined on a case-by-case basis, balancing the specific characteristics and value of the heritage and the free access, exploration and use rights of all stakeholders. In this process, the principle of "Do as much as is necessary and as little as possible" (Burra Charter 2013) should be considered.

6.2.7. An assertion of natural or cultural heritage significance shall not lead to a national appropriation of the relevant lunar sites or areas, which is in contravention of the Outer Space Treaty (1967).

6.2.8. Management and mitigation strategies should be applied consistently across all classes of natural and cultural heritage according to the applicable national or international norms.

6.2.9. The safety of human persons takes precedence over the conservation of heritage.

6.2.10. The determination of heritage significance, management, and mitigation strategies for lunar heritages must proceed from an expert assessment of heritage significance based on the national law, bilateral or multilateral agreements or the standards of an appropriate international authority.

6.2.11. When a State has reason to believe that an activity or experiment planned by it or its nationals on the Moon would cause adverse changes to the cultural heritage sites formulated by others' lunar activities, it should undertake appropriate consultations with the relevant States before proceeding with any such activity or experiment, even if these sites are not yet designated as lunar heritage by relevant national law, by international agreements or by an appropriate international authority.

6.3. Debris Mitigation & Environmental Sustainability

6.3.1. Environmental Sustainability is defined as the status and ability to maintain the conduct of space activities on and around the Moon indefinitely into the future in a manner that realizes the objectives of equitable access to and the benefits from the exploration and use of outer space for peaceful purposes, in order to meet the needs of the present generations while preserving the outer space environment for future generations.

6.3.2. In order to curtail the generation of space debris on the lunar surface and in lunar orbits, it is recommended that:

6.3.2.1. Space systems constructed for lunar activities should be designed to minimize the release of space debris to the greatest extent possible.

6.3.2.2. Stakeholders should limit the probability of accidental collision in orbit of /to or on the Moon.

6.3.2.3. Lunar infrastructure should be based on interoperability principles.

6.3.2.4. During normal operations within lunar orbits or on the lunar surface, stakeholders should avoid the intentional destruction of space objects and assets and other harmful activities which may generate unreasonable and unnecessary space debris.

6.3.2.5. Stakeholders should minimize the risk of post-mission break-ups, including those resulting from stored energy in their lunar activities.

6.3.3. Stakeholders should adopt appropriate measures, where necessary, and follow due regard and other principles under international law to prevent environmental harm to the Moon and to lunar orbits.

6.3.4. Prior to authorizing and/or conducting lunar activities, States and lunar stakeholders may take the following measures on the basis of up-to-date scientific research in line with any relevant COSPAR requirements:

6.3.4.1. Conduct and present an analysis of the environmental impact to determine any environmental harm of the lunar activities while bearing in mind the purpose of those activities; review and approval of the impact of the activity in a timely manner should balance the needs for long-term sustainability with the purpose of utilization of the Moon.

6.3.4.2. Plan for remediation or mitigation as appropriate, and provide proper notification of those activities; and

6.3.4.3. Request consultations with all interested stakeholders if the lunar activities may cause potentially harmful contamination to the Moon and lunar orbits.

6.3.5. States and international organizations should monitor any harmful impacts to the Moon and lunar orbits resulting from lunar activities for which they are responsible to the greatest extent feasible and practicable.

6.3.6. If a harmful impact resulting from a lunar activity is discovered or is reasonably expected to occur, the responsible States or lunar stakeholders should implement appropriate measures to respond to such harmful impact and consider whether the lunar activity should be adjusted or terminated.

6.4. Sites of Special Scientific Interest

6.4.1 In consultation with the international scientific community, areas of special scientific interest on the lunar surface may be identified as requiring special protective arrangements.

6.4.2 Any such special protective arrangements will be agreed upon in consultation with the scientific community and endorsed by competent bodies of the United Nations.

Chapter 7: Interoperability

7.1. Definitions

7.1.1. Interoperability is a key element of sustainable lunar activities. Interoperability is critical to improving international cooperation and benefit sharing, as outlined in the Outer Space Treaty (1967).

7.1.2. Interoperability enables projects, systems, and services to be used together or interchangeably to achieve enhanced quality or stability in their functions and utilities. Interoperability can be achieved at various levels by various means, and applies to the full range of systems and services employed in lunar activities, including spectrum, communications, navigation, transport, life support, and all other operations.

7.1.3. Interoperability requires coordination, consultation, and information sharing. International standardization initiatives will contribute to interoperability and should be promoted among lunar stakeholders.

7.1.4. Interoperability can be achieved among all types of lunar stakeholders by signing agreements or by adopting common standards.

7.1.5. Any information related to interoperability should be shared as widely as possible, to the extent permitted by the relevant protective requirements about intellectual property and other proprietary information, and user feedback should be incorporated into the design and manufacture of systems and services to achieve further interoperability.

7.2. Function of interoperability

7.2.1. Interoperability enables international cooperation and facilitates the effective participation of all lunar stakeholders.

7.2.2. Interoperability reduces the risk of systems and service failure and increases the safety and stability of lunar activities.

7.2.3. Interoperability assists in aiding persons in the event of accidents, distress, or other emergency situations and in avoiding catastrophic failures of equipment which might endanger persons or harmfully contaminate the lunar environment.

7.2.4. Interoperability supports the optimization of the use of resources by avoiding duplication of infrastructure, reusing materials, and facilitating repair and maintenance, which in turn contributes to reducing harm to the lunar environment.

7.2.5. Interoperability can facilitate optimization and reduce costs for lunar systems development and operation.

7.3. Common standards

7.3.1. Lunar stakeholders should be encouraged to develop and implement common standards of design, manufacture, construction, and operation and to adopt standard data formats, technical references, and procedures in order to achieve interoperability. In doing so, existing international standards should be considered and, if necessary, adapted for lunar activities.

7.3.2. Common interoperability standards should be technically neutral and should not become a barrier to equal participation in lunar activities.

7.3.3. Common interoperability standards should strive to achieve a balance between adhering to general practices and fostering innovations.

7.3.4. Common interoperability standards should start with the systems and services related to the materials and resources that are used by all lunar stakeholders (e.g., water, oxygen, regolith, spectrum, power).

7.3.5. Effective realization of interoperability will depend upon a culture of willingness, readiness, and capacity at all organizational levels during the entire lifecycle of lunar activity.

7.3.6. Common interoperability standards will change as technology develops.

7.4. Participation

7.4.1. Interoperability may lower the cost of entry into the lunar economy and encourages broader participation by non-spacefaring nations and private entities.

7.4.2. Common interoperability standards should not be used to exclude newcomers, particularly emerging space nations, or to enable collusion or anti-competitive behavior.

7.4.3. Lunar stakeholders should promote awareness and capacity building to enable emerging space nations to adopt common interoperability standards.

Chapter 8: Lunar Governance

8.1. Definitions

8.1.1. Lunar governance broadly encompasses all decision-making and management related to the full range of lunar activities, which, through multi-stakeholder engagement and dynamic interactive processes, supports sustainable exploration and use of the Moon.

8.1.2. Lunar governance addresses shared challenges and expectations related to the use and exploration of the Moon in order to ensure peace and security thereon, maintain sustainability and benefit all humankind.

8.2. Lunar governance adaptive framework

Lunar governance will be guided by a wide range of hard and soft law instruments and requires a complex and adaptive framework. It seeks to:

8.2.1. Respect general principles and norms such as those enshrined in international space law and soft law instruments, including but not limited to peaceful uses, due regard, non- interference, mutual understanding, non-discrimination, equal access, freedom of exploration, non-appropriation, information sharing and transparency, and international cooperation;

8.2.2. Ensure predictability, accountability, coherence, and synergy in a manner that fosters cooperation, including fair access and market competition among multi-stakeholders in lunar activities; and

8.2.3. Align governmental, intergovernmental, and non-governmental actors through an adaptive process, including public-private partnerships, private funding initiatives, and the application of new technologies.

8.3. Operationalization of the framework

Lunar stakeholders should strive to operationalize this multilaterally agreed-upon framework with a focus on the protection and management of the lunar environment and sustainable lunar activities. This process should include the meaningful involvement of stakeholders from developing countries.

8.4. Global space governance

Lunar governance should be considered within, and contribute to, global space governance, including the Space 2030 Agenda and the Guidelines for the Long-Term Sustainability of Space Activities, and as a pioneering project for deep-space governance.

Chapter 9: Benefits for Humanity

The common interest of all humankind in the exploration and use of outer space, including the Moon and other celestial bodies, is universally recognized. According to international law, lunar activities should be carried out for the benefit of all people, both present and future, irrespective of the degree of their economic or scientific development. In addition to promoting international cooperation, sharing the benefits of lunar exploration and use contributes to sustainability for present and future lunar activities, including the exploration and use of lunar resources.

9.1. Key principles of benefit sharing

9.1.1. Sharing the benefits of lunar exploration and use should be based on the principles enshrined in the Outer Space Treaty (1967) and informed by the Moon Agreement (1979), as well as relevant UN documents such as the Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries (1996) and the UN Declaration on the Responsibilities of the Present Generation Towards Future Generations (1997). Sharing the benefits of lunar activities should ensure the use of the Moon and other celestial bodies is exclusively for peaceful purposes.

9.1.2. Lunar stakeholders are encouraged to share the benefits of their lunar activities without discrimination of any kind, on the basis of equality and equal opportunities, and in accordance with applicable laws.

9.1.3. The exploration and use of the Moon shall be aimed at increasing the general prosperity and well-being of humankind. Benefits

should be derived from sustainable lunar practices and contribute to sustainable development on the Moon and Earth.

9.1.4. Lunar benefit sharing can be a catalyst for information and benefit sharing on Earth. Benefit sharing is a two-way process, as recipients of benefits are able to develop a greater capacity to contribute innovation and support to lunar activities.

9.2. The benefits of lunar exploration and use for humanity

9.2.1. Lunar benefits may derive not only from activity on the Moon itself but from the efforts made on Earth to develop technologies and systems for lunar exploration and use. The benefits may be scientific, technological, social, or inspirational. These include, but are not limited to, the following examples:

9.2.2. Scientific benefits.

9.2.2.1. Lunar exploration and use will increase human knowledge of the Moon itself, the Earth-Moon system, the Solar System and the Universe. This knowledge has both intrinsic and practical value.

9.2.2.2. The lunar surface provides a platform for astronomical observations; in particular, the far side of the Moon provides unparalleled opportunities for radio astronomy.

9.2.2.3. Permanently shadowed regions at the lunar poles constitute unique areas that may preserve important records of the delivery of volatiles and organic materials to the inner Solar System, including the Earth.

9.2.3. Technological benefits.

9.2.3.1. Exploration and use of the Moon increase the diversity of human technologies and may vault humanity into a new phase of innovation.

9.2.3.2. Technological solutions created by science and industry on the Moon can be used for the benefit of people on Earth.

9.2.4. Social benefits.

9.2.4.1. Sustainable lunar activities can be the source of new models for cooperation and governance to promote greater peace and prosperity on Earth.

9.2.4.2. The lunar economy and its sustainable development will create a new economic sphere and promote cooperation between the space sector and non-space sectors.

9.2.4.3. The scientific and technological advances achieved by lunar activities will further promote education, training, and capacity building in the field of space science and technology.

9.2.5. Inspirational benefits.

9.2.5.1. The Moon has provided inspiration for social goods throughout the deep history of human existence in the form of music, art, literature and science.

9.2.5.2. Exploration of the Moon may help inspire more young people to take up scientific and technical education, leading to wider societal benefits beyond the space programme itself.

9.2.5.3. The exploration and use of the Moon will enhance and make accessible new sources of inspiration deriving from the closer engagement with the lunar landscape and environment.

9.2.6. Sustainability benefits.

9.2.6.1. Technologies, governance structures and science developed on the Moon can be used to help achieve the Sustainable Development Goals.

9.2.6.2. Studies of the ages of lunar craters will help refine our understanding of the impact threat to Earth from comets and asteroids. Space technology and infrastructure developed with the aid of lunar resources may also aid the interception of asteroids and comets, which might otherwise impact the Earth in the future.

9.2.6.3. Technologies developed through lunar activities can be used to sustainably use resources on other celestial bodies such as planets, moons and asteroids.

9.2.6.4. The utilization of lunar resources may ultimately help reduce environmental pressures due to mining activities on Earth.

9.2.7. Further exploration of the solar system.

9.2.7.1. The infrastructure established on the Moon and in its orbit can be utilized as a base or transfer point for deep space exploration to other celestial bodies. This reduces the costs and environmental impacts of deep space missions.

9.2.7.2. The Moon can be used to develop environmental, social and governance protocols which might be adapted for other celestial bodies.

9.3. Mechanisms for sharing the benefits of lunar exploration and use with humanity

9.3.1. Mechanisms for sharing may be different according to whether the benefit is scientific, technological, social, inspirational, sustainable or exploratory.

9.3.2. There is no one-size-fits-all solution for sharing the benefits of lunar activities. Lunar stakeholders are encouraged to consult to agree on the exact nature of the benefit shared and how to share

such benefit. Diversity, inclusiveness and transparency are key elements to consider when developing such mechanisms.

9.3.3. Benefit sharing can occur across multiple levels and adopt different forms.

9.3.4. Scientific data and results, technical standards and skills, etc., should be translated into different languages to facilitate their wide dissemination and to benefit the greatest and most diverse groups of people.

9.3.5. An international framework should set out the rules for sharing benefits and facilitate their distribution, taking into account current international space law treaties and instruments.

9.3.6. Lunar stakeholders are encouraged to identify which benefits to share and factor sharing of such benefits into the early stages of project planning while acknowledging that not all benefits will be immediately available, and many may arise in the process of lunar activities.

9.3.7. Lunar stakeholders are encouraged to have regard to the desirability of making a portion of samples of lunar materials available to the international community for scientific investigation and to share scientific research results through channels of scientific exchanges, and in this regard, the provisions of the Outer Space Treaty (1967) and the principle of Open Science should be taken into account.

9.4. Role of developing countries and emerging space nations in benefit sharing

9.4.1. Partnerships, joint ventures and agreements between established and emerging space nations can enable the sharing of scientific and

technical benefits. Well-resourced lunar stakeholders are encouraged to contribute to the relevant capacity building of developing countries and emerging space nations by undertaking programmes, creating partnerships and other appropriate means.

9.4.2. Information sharing enables those countries to participate in lunar exploration or to work with partners in order to share benefits without duplication of investment.

9.4.3. Sharing data and results with developing countries and emerging space nations can provide them with an opportunity to develop and contribute their own science to lunar exploration.

9.4.4. Collaboration between scientists from different countries, including developing countries, on experiments and data analysis, is a mechanism for inclusion and capacity building.

9.4.5. Space nations with lunar projects should be encouraged to invite astronauts from emerging space nations and provide training to them by mutual agreement.

9.4.6. Benefit sharing can take the form of allowing access to infrastructure, such as launch pads, processes and resources by agreement to enable participation by stakeholders from developing countries and emerging space nations.

Chapter 10: Sustained Lunar Economy

A lunar economy is an integral part of the space economy, should be oriented towards the global benefit of humanity, and should take into account environmental sustainability on Earth and on the Moon. Achieving a sustainable lunar economy is only possible by allowing equitable access to all stakeholders.

10.1. Drivers for a sustainable lunar economy

Space agencies, space industries, and science and technology institutions have implemented multiple pilot/ad hoc programs and initiatives related to the space economy, which provide an evidence base of operational knowledge and good practices to inform the development of a lunar economy.

10.1.1. A lunar economy should be based on a diverse set of customers that includes, but is not limited to, governmental actors, space-industry actors and customers from outside the space sector.

10.1.2. A sustainable lunar economy will be supported by lunar activities primarily funded by governments and increasingly by private investment enabled by governments and should create new economic opportunities to serve the general public and for the benefit and in the interest of all countries.

10.1.3. The development of long-term ground infrastructure on the lunar surface will be of critical importance to the emergence of a lunar economy. Such infrastructure could be a shared asset between governments as well as the private and public sectors, encouraging international cooperation and public-private partnership models. Examples of potential areas of shared infrastructure include landing pads, ground transport, and interoperable navigation and communication systems.

10.1.4. A sustainable lunar economy enables the long-term exploration and use of the Moon for continued access to the benefits deriving from lunar activities and resources.

10.1.5. A sustainable lunar economy should enable growth both on Earth and on the Moon, aiming at supporting the independence of lunar activities from supply from Earth as well as contributing to sustainable development on Earth.

10.1.6. Government space exploration programs will play a key role in establishing a lunar economy. In addition to allocating portions of national budgets for space activities, governments can also be supportive of the involvement of the private sector in lunar activities.

10.2. Involvement of developing countries in the development of a lunar economy

10.2.1. It is critical to involve developing countries in achieving a sustainable lunar economy. Such involvement might be achieved in various ways, including:

10.2.1.1. These countries could contribute by proposing a vision for the long-term development of a lunar economy;

10.2.1.2. A more direct and short-term approach would directly involve developing countries, based on their different capabilities, in existing and upcoming missions;

10.2.1.3. Sharing scientific and technical information are critical steps to involve developing countries in the lunar economy.

10.2.2. The special needs of developing countries and opportunities provided by their distinct attributes are important for consideration related to the lunar economy.

10.2.3. Providing partnership opportunities to developing countries, including those with emerging space capabilities, is important to further develop their capacity and contribute to the lunar economy.

10.3. Role of terrestrial industry sectors in the development of a lunar economy.

10.3.1. The development of a lunar economy will draw upon experience from both terrestrial sectors as well as other areas of the space economy.

10.3.2. The involvement of non-space industry actors in lunar activities could lower costs and close knowledge gaps. Such involvement might be achieved by:

10.3.2.1. Raising awareness among non-space sectors on the role and value of a lunar economy;

10.3.2.2. Promoting the inclusion of a lunar economy dimension in the general industry policies;

10.3.2.3. Providing platforms and fora to foster exchanges between lunar stakeholders and other industry sectors. In this regard, the specific role played by local governments and other special economic zones and authorities in economic development should be acknowledged.

10.4. Regulatory needs for a sustainable lunar economy.

10.4.1. As the number of lunar activities and stakeholders increase, regulatory measures will be needed for the long-term growth and function of a lunar economy.

10.4.2. The lunar economy, in particular commercial investments, and activities, requires some level of legal certainty and predictability to develop.

In this regard, special consideration should be given to the protection of proprietary information and intellectual property rights without prejudice to the legal obligations under the OST.

10.4.3. Regulatory approaches in support of a sustained lunar economy should be adaptive in nature and achieve a mutually agreed balance between enabling investments while reducing uncertainty.

Chapter 11: Human Interaction

A key part of the sustainable and peaceful use of the Moon is maintaining harmonious relations between lunar stakeholders, including the individuals they comprise. Human interactions on the Moon are governed by international treaties, national legislations and other international norms, among which the principle of international cooperation and protection of human rights are the most important. As a lunar community develops and lunar stakeholders and activities increase, it will be important to prevent emergencies and disasters, disputes, and human rights violations. Achieving this requires appropriate regulation of human interactions.

11.1. Emergency support services

11.1.1. Principles of cooperation and mutual assistance to astronauts and personnel, as well as international obligations to notify, rescue, return and take all possible steps, and render all necessary assistance in space and on celestial bodies to them, are outlined in Article 5 of the Outer Space Treaty (1967) and the Rescue Agreement (1968), and further reinforced in the Moon Agreement (1979). It is noted that the Rescue Agreement focuses mainly on personnel returning to Earth; however, these principles should be applicable, *mutatis mutandis*, to any person on the Moon or in cislunar space.

11.1.2. As a first step, all States conducting lunar activities are encouraged to become a Party to the Rescue Agreement (1968).

11.1.3. Emergency support services for lunar activities can be built upon relevant principles and norms, including the *negotiorum gestio* and/or the Good Samaritan principles that rescuers acting on a voluntary basis in assisting a person in distress cannot be sued for wrongdoing.

11.1.4. To enable interoperability and provide legal certainty about procedures, rules, and responsibilities for managing emergencies and disasters, it is suggested that lunar stakeholders develop codes of conduct, and common standards, leveraging relevant experience with human spaceflight, to achieve rapid responses and clear communications.

11.1.5. The protection of human life on the Moon is paramount and should be prioritized in response to any emergency situation. It will be the joint duty of all lunar stakeholders to cooperate and coordinate to take all necessary steps in order to manage the safety of persons during emergency situations.

11.1.6. All lunar stakeholders should follow the due diligence principle to provide safe working conditions for their space-based persons.

11.1.7. In developing the most suitable mechanisms for emergency and disaster responses, lunar stakeholders should take into account the unique conditions of the lunar environment that are likely to create emergencies and disasters which have no precedent on Earth, and return to Earth may not always be possible for space-based personnel.

11.1.8. Lunar stakeholders should undertake to provide, either singly or in collaboration, material resources and relevant training to afford safety to personnel in the event of an emergency. These may include but are not limited to access to radiation shelters, pressurized pods, supplies of oxygen, food and water, first aid kits, and portable communication kits. These resources may be surface-based or located in orbiting modules. Such training and support can be shared between stakeholders.

11.1.9. To prevent and manage emergency situations on the Moon, lunar stakeholders should use satellite monitoring and detection services and share information with other stakeholders to reduce

the risk of emergencies and facilitate better preparation for response and mitigation.

11.1.10. For lunar activities, a dedicated frequency should be established to make emergency requests. Human lunar stakeholders should use this communication channel for emergencies to request help. Lunar operators receiving these requests should respond accordingly.

11.2. Individual rights

11.2.1. Lunar stakeholders are bound by international human rights law, consisting of the UN Universal Declaration of Human Rights, the International Covenant on Civil and Political Rights (1966) and the International Covenant on Economic, Social and Cultural Rights (1966) as per Article III of the Outer Space Treaty (1967), and other relevant human rights international treaties.

11.2.2. National legislation and/or policies should guarantee the protection of individual rights on the Moon for personnel from those nations.

11.2.3. Where relevant, conditions to maintain the physical and mental health and safety of space-based personnel should be guided by the COSPAR and World Health Organization's recommendations.

11.3. Dispute settlement mechanisms

11.3.1. The existence of disputes between lunar stakeholders shall not be allowed to compromise the safety of space-based actors.

11.3.2. The purpose of dispute resolution is to maintain harmonious relations in lunar activities and ensure the exclusively peaceful use of the Moon. Disputes may be settled on the Moon and from

Earth, using existing mechanisms adaptable to the unique lunar situations as well as any future mechanisms established by lunar stakeholders.

11.3.3. As stakeholders and sponsors of lunar activities, States are responsible for resolving disputes between them peacefully, preferably through amicable methods such as negotiation, mediation, arbitration, and judicial settlement.

11.3.4. States are recommended to include acceptance of dispute settlement mechanisms in their cooperative agreements.

Chair's Explanatory Note on Annexes

In addition to participating at plenary discussions, the members of GEGSLA also formed four sub- groups. Under the instruction of the Chair, subgroups worked intensively through regular meetings to advance topics which are developed in the plenary. The outcome of the sub-group deliberations was compiled in a separate document titled *Technical and Operational Practices and Case Studies on Peaceful and Sustainable Lunar Activities*.[1] Furthermore, upon the Chair's suggestion, the observers of GEGSLA through their collective efforts identified *A List of Future Issues of Sustainable Lunar Activities*[2] which are not covered by the Recommended Framework and Key Elements for Peaceful and Sustainable Lunar Activities, and recommended it for further discussions at a later stage.

The Chair on behalf of the Bureau of GEGSLA thanks the members of the sub-groups and observers for their efforts to enrich the evidence base and to further the perspective of our joint initiative towards peaceful and sustainable lunar activities, and takes the liberty to share the aforementioned two documents with interested lunar stakeholders.

The Chair would like to note that due to time constraint, GEGSLA did not have time to discuss aforementioned two documents, therefore they should be treated as separate and independent from the Recommended Framework and Key Elements for Peaceful and Sustainable Lunar Activities which was adopted by the GEGSLA plenary in consensus.

[1] https://moonvillageassociation.org/gegsla-annexes/
[2] https://moonvillageassociation.org/gegsla-annexes/

GEGSLA Members

Members of the Group participated on a personal basis and any views expressed at the meetings or by the Group do not represent the position of organizations to whom members may belong.

Here is the list of Members in alphabetical order:

Ayman Ahmed is the Head of the Space Imaging division at the Egyptian Space Agency- EgSA, He is a member of EgSA board of directors and member of Egyptian National Space Council, a Member of the African space Working Group to Develop African Space Policy and Strategy, a Member of the Industrial Advisory Board, Coventry University. Ayman has a Master's degree in Business Administration and Ph.D. in satellite earth observation systems. He coordinated a number of space projects at national and international levels, received the united nation office of outer space affairs– UNOOSA prize 2021, and has a patent in improving the performance of electronic systems in the space environment.

Nasr Al-Sahhaf has practical experience, academic, scientific research, as well as government and diplomacy. He served as advisor to the Royal Private Affairs and represented KSA at the UNCOPUOS. He established the National Space Geodesy Center in 2009, and, as principal investigator, set out to establish the first of its kind project in the region, COGNET. A network of Continuous Operating Receiver Stations (CORS). Under his supervision a team of engineers and technicians were able to successfully build (in-house) an atomic clock. thus, reviving the Saudi Arabian Laser Ranging Observatory (SALRO). He is currently Chair of the International Moon Day Group.

Ioana Bratu is a lecturer and researcher at Vrije Universiteit Amsterdam, where she is introducing space law as a new area of law part of the educational curricula. She is also a founder of AI & Space Law Society, an internationally unique concept advocating for the sustainable development of space via a newly recognized United Nations SDG 18. Before joining the academic environment, she was an attorney-at-law for more than 10 years part of international law firms and as a founder of her private practice.

Irina Chernykh is an Assistant Professor at the Department of International Law of Law Institute at RUDN University. The main focus of her research is on international space law, especially the sustainability of outer space activities. She is responsible for the Centre of International Space Law named after prof. Gennady Zhukov at the same Department. She teaches various international legal disciplines in the full-time and evening department. She leads the student team for the Manfred Lachs Space Law Moot Court Competition and holds the position of the Executive Secretary of Space Law Research journal. She is a member of the International Institute of Space Law.

Ian Christensen is Director of Private Sector Programs at Secure World Foundation (SWF), a non-profit organization promoting the secure, sustainable and peaceful uses of outer space. He is responsible for leading SWF's engagement activities with the commercial space industry, where his activities focus on policy and governance topics in support of the development of private sector space capabilities. Mr. Christensen was a member of the Hague International Space Resources Governance Working Group, where he chaired the Group's Socioeconomic Panel. Mr. Christensen holds a Master of Arts (M.A.) in international science and technology policy, focusing on space policy from the George Washington University Elliott School for International Affairs.

Timothy Cichan is the Space Exploration Architect at Lockheed Martin, where he leads a multi- disciplinary team of engineers who figure out how to help astronauts and robots visit the Moon, asteroids, and Mars. He previously was the Orion System Architect. Timothy joined Lockheed Martin in 2002, and has worked for both human spaceflight and commercial communication satellite teams, in optimal trajectory design, mission analysis, subsystem development, and systems engineering. He has a Master's and Bachelor's degree in Aerospace Engineering from Penn State.

Renata Corrêa Ribeiro has a Ph.D. in International Relations and works with International Space Cooperation at the Brazilian Space Agency since 2016. She has been a visiting scholar at Indiana University and conducted researches focused on space cooperation in emerging countries, published in important scientific journals. Since 2019, she has been actively engaging in COPUOS as a Brazilian delegate.

Ian Crawford is currently Professor of Planetary Science and Astrobiology at Birkbeck College, University of London. The main focus of his research is in the area of lunar exploration, including the remote sensing of the lunar surface and the laboratory analysis of lunar samples. Ian also has research interests in astrobiology and in the future of space exploration, which he believes will become increasingly important for the future of humanity. A more detailed summary of his interests, and list of publications, can be found at: https://www.bbk.ac.uk/our-staff/profile/8004655/ian-crawford

George Danos, Republic of Cyprus, Cyprus Space Exploration Organisation (CSEO).

Ziv Dubinsky is the founder of Metabolic Robots ltd from Israel, he is an inventor and entrepreneur dedicated to building strong agrifood tech solutions and sustainable space exploration. Ziv was awarded by the Israeli prime minister for innovation on his work on defense systems and food safety solutions, robots, welfare and efficiency AI, for poultry and insect farming. He is also owner of a pottery school.

Marc Fournier is a former engineer in environment in renewable energies that commits to open techs&science since 2008 by creating or co-operating open frameworks to engage citizen in open projects in Robotics, Medicine (Citizen research on cancer with ROCHE witch Epidemium), Science and Space (Space gambit with NASA/ OpenSpace Maker with CNES/ Mars Society/) and R&D projects. Cofounder of the citizen ScienceLab "La Paillasse" in 2011 which he was Secretary, Treasurer and Director until 2019. Lecturer for higher education establishments (Science PO, ESSEC, ENSCI...) Speaker for 50+ groups (BNP, Engie, GRDF, ...) & International conferences, Panelist in policy work group (French ministry of research on open science, Environment).

Mike Gold is the Chief Growth Officer at Redwire and is responsible for all of the company's civil, commercial, and national security business development; marketing/communications; and government relations activities. Prior to joining Redwire, Mr. Gold was NASA's Associate Administrator for Space Policy and Partnerships and also served as Acting Associate Administrator for the Office of International and Interagency Relations, and Senior Advisor to the Administrator for International and Legal

Affairs. During his tenure at NASA, Mr. Gold led the development and implementation of the Artemis Accords, the binding agreements for the Lunar Gateway, the first lunar resource purchase by NASA, and reforming/updating planetary protection policies. Due to this trailblazing policy work, Mr. Gold was awarded NASA's Outstanding Leadership Medal in 2021.

Alice Gorman is an internationally recognised leader in the field of space archaeology and author of the award-winning book Dr Space Junk vs the Universe: Archaeology and the Future. Her research focuses on the archaeology and heritage of space exploration, including space junk, planetary landing sites, off-earth mining, and space habitats. She is an Associate Professor at Flinders University in Adelaide and a heritage consultant with over 25 years' experience working with Indigenous communities in Australia. Gorman is also a member of the Advisory Council of the Space Industry Association of Australia.

Gernot Groemer has a background in astrophysics and astrobiology from the Leopold-Franzens University, Innsbruck and studied at the International Space University. He is the director of the Austrian Space Forum, managing Mars analog missions since 2003 and leads projects to develop advanced spacesuit simulators. He teaches and does research at various universities in the field of human Mars exploration. Dr. Groemer led 13 Mars expedition simulations, including the Dhofar desert in Oman, the Northern Sahara, Utah and southern Spain and is engaged in various boards and expert groups on Mars and Moon exploration.

Linli Guo is a member of GEGSLA/MV and worked a space engineer in CAST. In the past five years, she has been mainly interested in the construction of the lunar base, the utilization of in-situ lunar resources, and the security and legal issues of cislunar space.

Dan Hendrickson serves as the Vice President of Business Development for Astrobotic, a lunar logistics company based in Pittsburgh, Pennsylvania. Dan leads the company's lunar and space robotics sales efforts. Prior to Astrobotic, Dan served as the Director of Civil and Commercial Space Systems at the Aerospace Industries Association (AIA). During his time at AIA, he was a consensus builder among a council of 50

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Frank Koch studied physics at the renowned universities of Braunschweig and Heidelberg, Germany. In 2015, he founded “Orbit Recycling” to bring sustainability into space. Orbit Recycling offers a unique approach to the supply of building materials in space based on recycled space debris and addresses pressing societal challenges such as environmental protection and sustainability for space activities. In 2020, Orbit Recycling was granted the "Most Pioneering Aluminum Recycling Company" award and in 2022 the “Innovation Award for Lunar Construction Cost Reduction 2022”.

Tufan Kayaci completed his bachelor’s degree in physics engineering and his master's degree in Electronics Engineering between 2002-2009 at Ankara University. He is an expert in Image Processing technologies in his master education. He started his career for the first time in 2010 at the Ministry of Transport and Infrastructure, General Directorate of Aviation and Space Technologies. He worked on many projects on space systems and launch technologies. He started working at the Turkish Space Agency in 2019. He is currently the Head of Launch Systems Department at the Turkish Space Agency.

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Omolade Odetara works as a Product Owner at LeanSpace, transforming software for the space industry and enabling the future space economy with an innovation platform that makes it easy to build entire space software infrastructures. 2020-2022 he was Lead Coordinator, Lagos for NASA SpaceApps; the International hackathon focused on space exploration. Previously, he was a General Partner at StellarXpora, a venture studio driven towards expanding the economic space ecosystem in Africa. In 2020-2021 was a Business and Communication Analyst at Space hubs Africa, where he built a community of space enthusiasts and empowered them to create space-based solutions for their communities.

Jing Peng, China, China Academy of Space Technology.

Dumitru-Dorin Prunariu is a member of the Board of the Romanian Space Agency. He is one of the founding members and former President of the Association of Space Explorers (ASE), was also the President of the Romanian Space Agency, the Ambassador of Romania to the Russian Federation, the Chair of the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS), Co-vice-chair of the COPUOS Working Group on Space2030 Agenda, representative of Romania in the International Relations Committee of the European Space Agency (ESA), Member of the Trustees Board of the International Astronautical Academy (IAA), the Vice-Chairman of the Board of Directors of the Asteroid Foundation. D. Prunariu earned a degree in Aerospace engineering (1976) from the University POLITEHNICA of Bucharest and a Ph.D. in the field of space flight dynamics. In May 1981 Prunariu accomplished an eight-day space flight on board Soyuz-40 spacecraft and Saliut-6 space station. For his

accomplishments an asteroid was named with his name, the asteroid “10707 Prunariu”.

Rajeswari Rajagopalan is the Director of the Centre for Security, Strategy & Technology (CSST) at the Observer Research Foundation, New Delhi. She is also a Senior Fellow at the Australian Strategic Policy Institute (ASPI), Canberra. Dr. Rajagopalan was the Technical Advisor to the United Nations Group of Governmental Experts (GGE) on Prevention of Arms Race in Outer Space (PAROS) (July 2018-July 2019). She was also a Non-Resident Indo-Pacific Fellow at the Perth US Asia Centre in 2020. Dr. Rajagopalan joined ORF after a five-year stint at the National Security Council Secretariat (2003-2007), Government of India, where she was an Assistant Director.

Rosa Ma Ramirez de Arellano y Haro is a lawyer specializing in Public International Law and State Assets in Space Matters (Telecommunications, Broadcasting, Outer Space and Aeronautics). Currently, she is General Coordinator of International Affairs and Security in Space Matters of the Mexican Space Agency. Member of DELEGAMEX as advisor and Alternate Head in some conferences, forums and global and regional instances related to telecommunications, radio communication, planning of satellite orbits and outer space, before the ITU, ICAO, WMO, CITEL, COPUOS, OECD, WHS. In addition, she was Vice President of the International Federation of Astronautics from 1998 to 2004, Full Member of the International Academy of Astronautics (IAA), Member of the International Institute of Space Law. In 2018, she was elected president to lead the 61st session of the UN Commission for the Peaceful Uses of Outer Space (COPUOS) and the UNISPACE+50 HIGH-LEVEL SUMMIT, in which a Resolution was adopted to elaborate the Space2030 Agenda and its implementation plan that complement the Sendai Summit on disaster management; the Paris Agreement; and the sustainable development goals (SDGs). She is a professor at different public and private universities in Mexico, where she teaches Space Law, Broadcasting, Aeronautics and Public Administration, and has various publications on telecommunications, space activities, transportation, and infrastructure, as well as prevent the emergency of new areas of strategic competition and conflict.

Gao Rufei started his career in the space industry in 1989 when he joined China Great Wall Industry Corp. He focused mainly on the business

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Antonino Salmeri is a space lawyer specialized in the multilateral, multilevel and multi-stakeholder governance of space resource and lunar activities, currently working as Policy Analyst at the Open Lunar Foundation. Dr. Salmeri is the recipient of the 2022 Young Space Leaders Award of the International Astronautical Federation and holds four advanced degrees in law. His main expertise is in the development of adaptive governance mechanisms and innovative policy solutions for the peaceful, cooperative, safe and sustainable conduct of lunar and space resource activities. Dr. Salmeri holds several key positions in various international space organizations, including for instance Policy & Advocacy Coordinator at the Space Generation Advisory Council.

Parameswaran Sreekumar is a high-energy astrophysicist who was involved in India's lunar exploration program as PI / Co-PI of x-ray payloads on Chandrayaan-1 and -2 missions. Currently, he is the Satish Dhawan Professor at ISRO HQ and is an advisor to the Space Science Program Office, which he headed prior to his retirement. His expertise includes design of space experiments and he has keen interest in lunar regolith composition studies.

Mark Sundahl is a Professor of Law at Cleveland State University and is the Director of the university's Global Space Law Center. He has served as a member of NASA's Regulatory and Policy Committee and as a member of the FAA's Commercial Space Transportation Advisory Committee. He has addressed the United Nations on multiple occasions as a member of the U.S. delegation to the UNCOPUOS. Prof. Sundahl has been a member of the Board of Editors of the journal *Air & Space Law* since 2016.

Maria Terekhova, Ukraine, Yuzhnoye State Design Office**.**

Guoyu Wang holds a doctor degree in Law and Economics, he is the Dean of the Academy of Air, Space Policy and Law of BIT; Deputy Director, CNSA Space Law Center (2017-), Legal Counsellor in Space Law, CNSA Lunar Exploration and Space Project Center (2016-), Board Director of IISL (2021-), Board Member of the Advisory Committee of SWF (2020-). He has been severed as a Chinese delegate to UNCOPUOS (2012-), IADC (2014-2016) meetings, as well as a Chinese expert in the Long-term Sustainability for Outer Space Activities Working Group (2012-2019). He is an editorial member and expert of MILAMOS Project since 2018, an expert of The Hague International Working Group on Space Resources Governance (2015-2019), a member of the Council of the Off-World Approach (2020-).

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Yu Xu a career diplomat and international lawyer, joined the Chinese Foreign Ministry at 1997, spent most years in the legal field, and held various positions, such as Deputy Director in charge of private international law and criminal justice and Director on public international law and UN legal affairs. In 2013, Xu was nominated by the UN Secretary General as Expert of Al-Qaida and Taliban Sanctions Committees, and stayed at New York in the next five years and travelled intensively across the world to monitor the sanctions implementation. After finished this stint, Xu rejoined the Chinese foreign service at 2019, and now worked in the field of peaceful use of outer space.

GEGSLA Chairmanship

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Giuseppe Reibaldi - MVA President & GEGSLA Executive Secretary

Dr. Reibaldi is a Senior Space Policy Adviser. Apart from being President of the MVA he also acts as the Executive Secretary of the "The Hague Space Resources Governance Working Group" which started under his initiative in 2015. Moreover, he is, since 2013, the Director of Human Spaceflight at the International Academy of Astronautics. For 35 years (1977- 2012) he worked for the European Space Agency covering different functions and fields.

Giuliana Rotola - GEGSLA Implementation Support Officer

Ms. Rotola is a space law and policy researcher. She holds a Law degree from the University of Trento and a Master of Space Studies from the International Space University. Previously, she worked at the European Southern Observatory, as a research fellow with the Legal Priorities Project, the Center for Space Governance, and the Open Lunar Foundation. She serves as Policy and Advocacy Coordinator for the Space Generation Advisory Council.

The Secretariat liaise with the Members and Observers of the Group, maintain a dedicated website and social media, organize meetings, lead discussions, and prepare documents. The Chairman, the Vice-Chairs, or Executive Secretary represent the Group in external events. Each Vice-Chair represents a Stakeholder group.

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