

COMMITTEE TO STUDY LUNANET GOVERNANCE TERMS OF REFERENCE (ToR)

1. VISION AND SCOPE

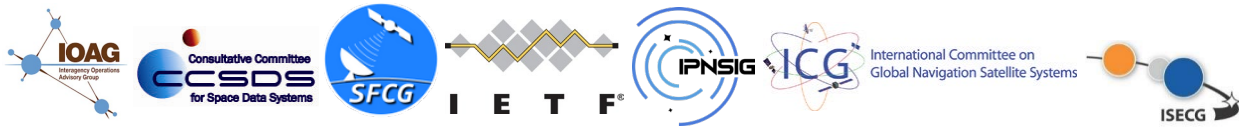
LunaNet is envisioned as having a publicly available (open) architecture to provide communications, position, navigation, and timing (CPNT) services to cislunar users. LunaNet will be implemented as a network-of-networks accessible by all cislunar users, independent of the terrestrial Internet, with international contributions from governmental, commercial, and other stakeholders that, consequently, requires international coordination and collaboration for planning and operation.

These Terms of Reference (ToR) establish an inter-organizational Committee to Study LunaNet Governance (CSLG), hereafter referred to as the Committee, that will recommend an initial multi-stakeholder organizational governance structure, approach, and functions, with their respective interface organizations, to develop guidelines, policies, and practices to help fulfill LunaNet's operational responsibilities. The Committee, as a multi-organizational ad hoc entity led by the Interagency Operations Advisory Group (IOAG), will study alternatives and produce preliminary LunaNet governance deliverables recommending how to achieve a comprehensive integration of the government, commercial, academic and technical community, defining their respective roles in the development, application and implementation of LunaNet governance. This will be done with a view to enabling principles, behavioral norms, rules and procedures for decision-making and activities that shape the evolution and use of LunaNet.

The initial working definition of LunaNet governance is *the development and application by governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and organizations that shape the evolution and use of LunaNet in the context of the relevant international legal framework.*¹ Civil society includes academia and non-governmental organizations like the International Telecommunication Union (ITU) for spectrum management. The intent is that the recommended system of Governance will ensure accountability, transparency, responsiveness, rule of law, stability, equity and inclusiveness, empowerment, secure access, and participation by all stakeholders.

The governance guidelines will provide a structure within which the multiple stakeholders and the implementing facilitating organization can effectively pursue LunaNet's mission. These guidelines

¹ Modified from the definition of Internet governance established by the UN-initiated World Summit on the Information Society (WSIS) in its 2005 report, [Tunis Agenda \(itu.int\)](#): “34. A working definition of Internet governance is the development and application by governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programmes that shape the evolution and use of the Internet.”



are intended to serve as a flexible framework within which the recommended structure can carry out its activities to resolve issues and reach consensus on LunaNet decisions. The guidelines are subject to review by the Committee which may revise the Committee’s organization, products, and processes as needed.

The Committee’s scope of work will be the recommendation and definition of an initial and mature organizational governance structure, roles and responsibilities, functions, and processes, as well as recommended steps to implement the approved organizational governance structure.

2. BACKGROUND

The vision and scope of this ToR are based on the Interoperability Plenary #4 (IOP-4) Communiqué², which unanimously adopted several resolutions, including the proposed direction of evolution of the IOAG. The subsections concerning this ToR are shown below.

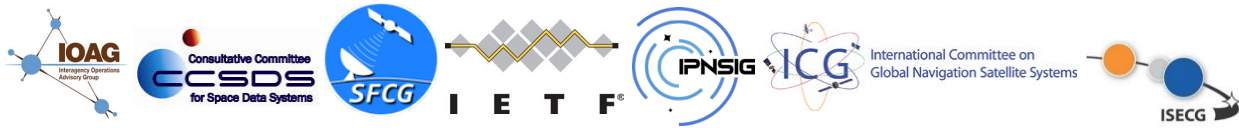
“In regard to the work of the Lunar Communications Architecture Working Group (LCAWG):

- “1. The IOP acknowledges and endorses the Lunar communications architecture as defined by the working group and urges the working group to complete the documentation.
- “2. The IOP endorses the use of down-selected communication standards for enhancing the interoperability among the future Lunar missions.
- “3. The IOP acknowledges the need for DTN-based Space Internetworking Service, In-situ Tracking, In-situ Navigation, and Network Time to be offered by the relay assets.
- “4. The IOP acknowledges the IOAG’s role in coordinating with the IOAG member agency’s projects to leverage on the currently planned relay orbiters for providing relay services to future Lunar missions.”

“In regard to the proposed evolution of the Interagency Operations Advisory Group (IOAG):

- “1. IOAG as the operations coordinator for the future Projects such as the Exploration Program:
 - d. “The IOP recommends that the IOAG continue to pursue efforts to achieve cross-support across the international space community and to expand the extent of space communications, navigation, and mission operations interoperability.
 - e. “The IOP recommends that the IOAG continue efforts to expand membership and participation to include other national space agencies.
- “2. Interaction with Commercial Providers and Operators, Academia and Emerging Space Agencies
 - a. “The IOP acknowledges the potential benefits of a closer interaction with commercial providers and operators of operations services.

² IOP-4 was held on December 18-20, 2018. The Communiqué was approved by Agenzia Spaziale Italiana (ASI, Italy), Centre National d’Etudes Spatiales (CNES, France), China National Space Administration (CNSA), Canadian Space Agency (CSA), Deutsches Zentrum für Luft- und Raumfahrt (DLR, Germany), European Space Agency (ESA), Japan Aerospace Exploration Agency (JAXA), Korea Aerospace Research Institute (KARI, Republic of Korea), National Aeronautics and Space Administration (NASA, United States), Russia Federal Space Agency (ROSKOSMOS), United Arab Emirates Space Agency (UAESA) and United Kingdom Space Agency (UKSA).

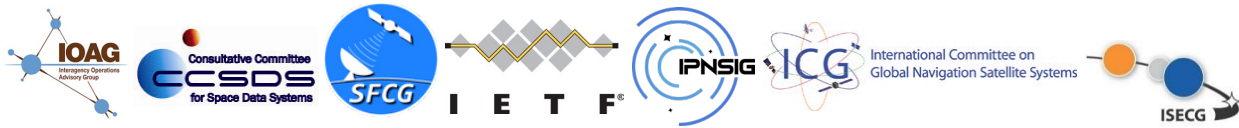


- b. “The IOP also sees potential benefits in establishing contacts to Academia and emerging Space Agencies and sees a role for the IOAG to establish and maintain these links.
- c. “The IOP asks the IOAG to explore options and establish mechanisms to engage with relevant commercial providers as an initial step.”

3. GUIDING PRINCIPLES

The following is an initial set of draft architectural and process principles that should guide all stakeholders in their decisions related to the governance of LunaNet.

- 1) **Open Architecture:** Open (publicly available) architecture is a LunaNet design principle for the network to enable an environment with voluntary collaboration to share innovative and sustainable ideas, designs, and plans, and to address specific challenges from concept through implementation and operations. LunaNet governance must recognize the technical management principles for efficient network operation and preserve the end-to-end nature of the network and PNT ecosystem. LunaNet's governance arrangements should enable the potential for innovation with respect to technologies and services.
- 2) **Interoperability via Open International Standards:** LunaNet governance should promote development, adoption and use of open international standards to the greatest extent possible to define the architecture and govern the communication, networking, position, navigation, and timing functions of the LunaNet architecture, to allow for interoperable, resilient, secure, and interconnected networks and systems.
- 3) **Scalability and Dynamic Connectivity:** LunaNet governance should preserve the architectural principle of scaling from a network with a single service provider node supporting a small number of users to an unbounded network-of-networks capable of supporting an ever-increasing number of users. The orbits of the Earth, Moon, and satellites as well as the motion of surface systems contribute to a constantly changing network topology that forms and reforms every time a node disconnects or reconnects.
- 4) **Security and Resilience of the LunaNet:** Operational security and resilience are key objectives in LunaNet's architecture. To preserve the integrity of the LunaNet infrastructure, as well as users' trust in LunaNet, governance structures and principles should be developed that assess and mitigate threats and vulnerabilities while creating a robust architecture that operates through and recovers from incidents.
- 5) **Consensus-based Decision-Making:** LunaNet policymaking, management processes and coordination should be achieved through broad representation of the LunaNet community, appropriate to its mission, and informed by practical experience and the individual and collective expertise of a range of stakeholders. Decisions should be reached through accountable processes that are based on consensus (multi-stakeholder model), where interested stakeholders can directly participate in the work and have access to its results.
- 6) **Open, inclusive, and transparent peer participation:** The development and implementation of LunaNet governance should transpire in an open, transparent, and accountable manner. The full participation of governments, the private sector, academia, and the technical community as peers, considering their specific roles and responsibilities should ensure that outcomes are effective and accepted. The development of LunaNet governance policies and arrangements



must allow and promote harmonization, equitable access, and efficient use of LunaNet among stakeholders.

- 7) **Extensibility across the Solar System:** LunaNet will be architected and implemented to be a much more advanced multi-service-providing network with integrated functionality, in contrast to the much simpler planetary networks that have been used in the past. The LunaNet architecture should be extensible to Mars and other instances in the Solar System, eventually forming the first planetary network of the Solar System Internet (SSI)³.
- 8) **Availability of Services for all Lunar Users:** LunaNet services are intended to be made available for all users in the lunar region – in transit to and from the Moon, in orbit around the Moon, in transit between orbit and surface, and on the surface. To the greatest extent possible, services should have the same provider/user interface and service characteristics regardless of user location. The fully developed architecture should be able to expand coverage and capacity to meet user demand anywhere within the lunar region.
- 9) **Applicability of International Regulations:** Governance will be developed in accordance with applicable treaties such as the Outer Space Treaty and international regulations such as the ITU Radio Regulations while identifying possible changes to the international legal framework needed to govern LunaNet.

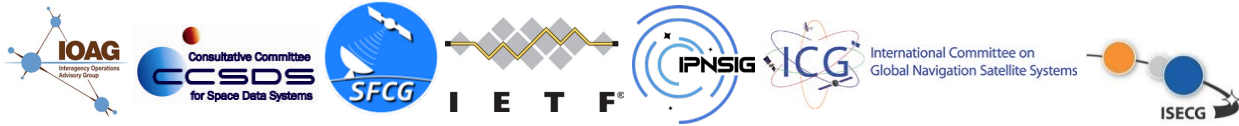
4. OBJECTIVES

In accordance with the Guiding Principles above, the Committee will produce a report recommending the multi-stakeholder organizational governance structure and related processes to achieve and maintain interoperability among stakeholders and facilitate the secure and efficient operational delivery of LunaNet services by LunaNet providers to LunaNet users. The Committee will achieve this objective by holding regular meetings producing documentation to carry out the necessary tasks and promoting the full active participation of Committee members to achieve a comprehensive final product recommending the processes and methods by which LunaNet should be governed that takes into account all stakeholders.

The specific objectives are:

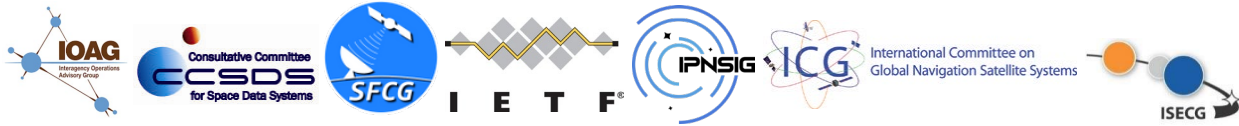
- 1) Define and recommend a LunaNet governance structure and approach, through which the coordination of architectural aspects such as space internetworking, PNT services, physical layer links (spectrum), security, protocols, and standards can be addressed.
 - a. Use and describe the national, international, and regional (if applicable) management process and coordination considering daily operations, incremental short-term evolution, and long-term planning.
 - b. Ensure that governance activities can be carried out by multiple stakeholders to resolve issues and reach consensus on LunaNet recommendations and decisions, employing them accordingly within their government, business, and academic organizations and in different regions while adhering to international treaties, conventions, and regulations.
 - c. Address the governance structure and approach to be able to develop a future platform where the different organizational bodies that will collectively govern the LunaNet will

³ CCSDS 730.1-G-1, Solar System Internetwork (SSI) Architecture, July 2014.



- publish all their documents and work carried out, such as decisions, impacts, recommendations, reports, studies, etc.
- d. Address the potential framework for international treaties and agreements, and national laws and regulations consistent with the larger framework of other inter-governmental and private sector involvement, including legal governance aspects such as private property rights, data rights for personal privacy and the flow of data across national borders, ownership, dispute resolution process, and venues for legal processes.
 - e. Ensure that governance can be extended from LunaNet to other planetary networks across the Solar System.
- 2) Define and recommend organizations that should participate in establishing the governance of LunaNet.
 - a. Identify their relationships either based on their CPNT functions, services or other, and any new organizations that should be established.
 - b. Consider current international and national multi-stakeholder organizations and entities and build on their current roles in developing the governance structure. Examples: IOAG, SFCG, IETF, CCSDS, ICG, etc.
 - c. Consider resources required and cost estimates for the organization options. If the Committee recommends modifying the scope of existing organizations or establishment of a new organization that does not currently exist, the Committee should address how to provide resources and potential funding mechanisms for that proposed organization and/or new element(s).
 - 3) Address the relationship and describe the differences between LunaNet and the Internet, and determine how much Internet governance to adopt. Similarly, address the relationship and describe the differences between GNSS and LunaNet's cislunar PNT and determine the extent of GNSS governance to adopt.
 - a. LunaNet will consider the Internet in terms of its architecture because of the similarity in architecture and services, and therefore lessons learned from Internet governance should also be leveraged to achieve governance of LunaNet.
 - b. LunaNet will consider the governance of various GNSS such as Global Positioning System (GPS), Galileo, Global Navigation Satellite System (GLONASS), BeiDou, Quasi-Zenith Satellite System (QZSS), and Navigation with Indian Constellation (NavIC) that have separate national governance approaches in formulating a unified cislunar PNT governance approach.
 - 4) Define and recommend steps to implement the approved organizational governance structure for LunaNet.
 - a. Promote the adoption of the IOAG recommended LunaNet approach.
 - b. Establish steps to transition the operational LunaNet governance.

Other specific objectives may be added to the ToR as they are identified and coordinated with Committee members.



5. COMMITTEE MEMBERSHIP

Initial Co-Chairs will be determined by the IOAG. Initial Committee Members are the participating IOAG Members and IOAG Observers.

Organizations that have established liaisons with IOAG will be consulted by the Committee including:

- a. The Space Frequency Coordination Group (SFCG) provides international coordination and analysis of the spectrum and acts as an intermediary to the ITU that formally approves Radio Regulations.
- b. The Consultative Committee on Space Data Systems (CCSDS) develops international standards for space communication, networking, and PNT that have been adopted by hundreds of space missions.
- c. The International Committee on Global Navigation Satellite Systems (GNSS) (ICG) is a United Nations forum for coordination and interoperability among GNSS.
- d. The International Space Exploration Coordination Group (ISECG) integrates human exploration programs resulting in the Global Exploration Roadmap that describes the evolution of lunar and Mars systems.

The Committee may also partner with non-governmental institutions and organizations such as:

- a. Industry Consortia and Members
- b. Academic Organizations and Institutions
- c. Other international organizations such as the Internet Engineering Task Force (IETF) and Internet Society's Interplanetary Networking Special Interest Group (IPNSIG)

Committee membership may be revisited based on rechartering the IOAG by the Interoperability Plenary in 2023.

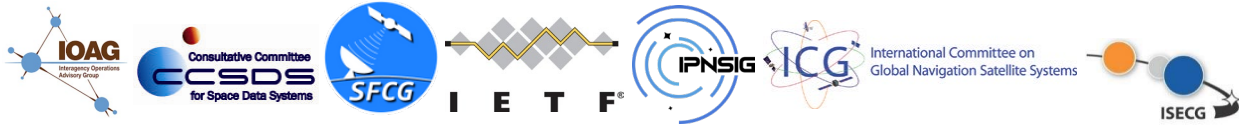
6. LINES OF ACTION AND DELIVERABLES

The Committee shall carry out the following lines of action to achieve its purpose:

- a. Develop their own plan to achieve the Committee's objectives.
- b. Provide roles and responsibilities to their own Committee members.
- c. Consult with subject matter experts from stakeholder organizations and other organizations as required, including such fields as CPNT and other engineering disciplines, law, organizational design, and Internet governance.

The Committee shall prepare and deliver to the member organizations of the Committee:

- a. A plan for the Committee, including major tasks to study key governance aspects and how best to address them with LunaNet with a schedule for meeting the objectives in this ToR.
- b. A report that defines and recommends how to establish and operate the governance of LunaNet while meeting the above objectives along with an explanation of those recommendations and definitions.



7. SUCCESS FACTORS AND INDICATORS

The stakeholder organizations participating in the Committee are invested in the success of the Committee and request that periodic evidence of ongoing efforts be provided including:

- a. Meeting minutes and participation in the Committee's meetings.
- b. Modifications of the ToR approved by the Committee to be ratified by the IOAG.
- c. Submittal of the Committee's plan for approval by the stakeholder organizations.
- d. Reports on progress according to the plan including any modifications to the plan.
- e. Submittal of the Committee's final report for approval by the stakeholder organizations which may include advance review of draft versions.

8. RESOURCES AND FUNDING SOURCES

IOAG will provide the administrative support for the Committee's meetings including provision of shared folders and files, calendar, meeting notices, attendee lists, online teleconferencing, meeting notes or minutes, action items, etc.

The Committee will be funded by Committee members contributing resources (primarily personnel) and other voluntary contributions such as accommodations for in-person meetings.

9. APPROVAL

The signatories to these Terms of Reference agree to cooperate in pursuing the objective of studying and recommending an approach to govern LunaNet on a "best effort basis" without guarantee of success or commitment to adopt the resulting recommendation.

Pier Bargellini

Pier Bargellini (Jun 6, 2023 10:31 GMT+2)

Mr. Pier Bargellini, Chairman, Interagency Operations Advisory Group (IOAG)

Bruno Espinosa (on behalf of Maite Arza)

Bruno Espinosa (on behalf of Maite Arza) (Jun 12, 2023 09:08 GMT+2)

Ms. Maite Arza, Executive Secretary, Space Frequency Coordination Group (SFCG)

Sami Asmar

Sami Asmar (Jun 5, 2023 23:04 PDT)

Mr. Sami Asmar, General Secretary, Consultative Committee on Space Data Systems (CCSDS)

Ed Birrane

Ed Birrane (Jun 6, 2023 16:04 EDT)

Dr. Ed Birrane, Chairman, Internet Engineering Task Force (IETF) Delay and Disruption Tolerant Networking Working Group (DTN WG)

Y. Kaneko

Y. Kaneko (Jun 6, 2023 08:12 GMT+9)

Mr. Yosuke Kaneko, Chairman, Internet Society's Interplanetary Networking Special Interest Group (IPNSIG)











Committee to Study LunaNet Governance ToR_for signatures (no ICG)


Final Audit Report


2023-06-12


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