

International Moon Base Collaborations

Moon Dialogs Research Salon #11 | May 2021



Moon Dialogs

About Moon Dialogs

The Moon Dialogs is a partnership focused on governance and coordination mechanisms for the lunar surface. It is convened by organizations and participating researchers exploring voluntary, multilateral mechanisms, norms, and economic arrangements that aim to grow ecosystems of lunar activity, both governmental and non-governmental.

The project is a collaboration between Open Lunar Foundation, Secure World Foundation, the MIT Space Exploration Initiative, Arizona State University, and For All Moonkind. The Dialogs bring stakeholders to the table on equal footing, with an emphasis on practical tools, operating models, and rights frameworks for the next 10 years. It is not a consensus forum, but a place to put forward ideas which will accelerate short-term activity and support bold plans for sustained presence.

The Moon Dialogs Research Salons

The Moon Dialogs research salons seek to cultivate thought leadership on lunar surface coordination mechanisms to accelerate peaceful and sustained presence on the Moon. We host monthly research salons on salient topics every full Moon.

If you would like to propose a topic or a speaker for our next salon, please contact victoria@moondialogs.org.

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Introduction

Salon 11 examined future international collaborations on the lunar surface with a particular focus on the MOU signed between Russia and China. The panelists shared insights into the initiative and highlighted the prerequisites for coordination between multiple stakeholders in lunar activities. The International Space Station (ISS) cooperation model was also discussed as a precedent for multilateral coordination.

Featured Speakers

Salon 11 featured the following distinguished panelists:

Dr. Yuguang Yang is vice-chair of the IAF Space Transportation Committee, and China's regional coordinator of Moon Village Association as well as the only founding member from China. He is mainly engaged in satellite manufacturing, space system design, and space mission design. He has been engaged in preliminary studies on human space flight, deep space exploration, and in international cooperation in the space field.

Dr. Jinyuan Su is a professor at Wuhan University Institute of International Law, China. He was a Postdoctoral Fellow at the McGill Institute of Air and Space Law. His research interests are international space law, the law of the sea, and international air law. Dr. Jinyuan Su is also a core expert in the ongoing project of Manual of International Law Applicable to Military Uses of Outer Space (MILAMOS).

Dr. Olga Volynskaya is an independent Russian space law and policy expert, formerly international legal counsel of ROSCOSMOS and the Russian Ministry of Foreign Affairs. Corresponding member of the Russian Tsiolkovsky Academy of Cosmonautics, and an individual member of the International Institute of Space Law.

Col. Chris Hadfield is a retired Canadian astronaut and the first Canadian to walk in space. An engineer and former Royal Canadian Air Force fighter pilot, he has flown many aircraft and spacecraft, including two space shuttle missions, and served as commander of the International Space Station. Chris also currently serves as the chair of the board at Open Lunar Foundation.

Key Themes

Listed below are the key themes identified during the discussion. These themes are summarized with insights provided by each featured speaker. To further understand these themes, please watch the [published video](#) of the salon.

Theme 1: National Ambitions for Lunar Activities

Russia, China and Canada participate in both national and international space missions. According to Col. Chris Hadfield, Canada's contribution of two Canadarms (one to the ISS) and a forthcoming Canadarm 3 (for the Lunar Gateway) reflects the continued tradition of collaboration in the planned US-led Lunar Gateway, a space station that will support missions in lunar orbit. Canada also has strong domestic policies to encourage lunar development, including the Lunar Exploration Accelerator Program (LEAP) by the Canadian Space Agency (CSA).

Dr. Yuguang Yang summarized China's Lunar Exploration Program (CLEP), currently in its fourth phase. The first and second phases included the launch of lunar orbiters, soft-landing on the Moon, and deploying lunar rovers (Chang'e 1-4). The third phase involved the collection of lunar samples using Chang'e 5. The fourth phase is now ongoing and consists of Chang'e 6 and Chang'e 7. Chang'e 6 will perform sample collection in the lunar south pole region and ascend them to an orbiter that will send them back to Earth. Furthermore, Chang'e 6 (like Chang'e 4) will feature international payloads. Chang'e 7 will provide details about potential sites for the lunar base, and Chang'e 8 will conduct further scientific research and facilitate the demonstration of new technologies (i.e. utilization of lunar water). Following the fourth phase, China will begin the construction of the lunar base. Yang also emphasized that China's ambitions include joint experiments with Russia and several other countries.

Prof. Su highlighted China's lunar ambitions in its domestic policies, such as its social and economic report and its [five-year plan for 2021-2025](#). The policy mentions China's implementation of the fourth phase of CLEP. In addition, China intends to land astronauts on the Moon in the long-term rather than in the near future and to develop super-heavy lift launchers and reusable systems.

Dr. Volynskaya noted that Russia is currently developing its official lunar policy and strategy, which will be publicly shared in the coming months. Roscosmos, Russia's space agency, is already moving forward with Luna-25, its lunar lander mission which is scheduled for launch in October 2021. Dr. Volynskaya emphasized three principles of Russia's future lunar program:

1. The program's scientific value and nature is a top priority
2. The scientific and technological results must be beneficial to the Russian economy
3. The program must be technically and financially feasible

On this basis, Dr. Volynskaya underscored the need for lunar programs to be international to facilitate the sharing of scientific expertise. Russia also intends to launch a new crewed spaceship to the ISS called "Eagle", which will be used to mature lunar plans if the tests are successful.

In response to a question about how the speakers saw Moon activities in the next 50 years, cost reduction was a key aspect. Col. Hadfield saw the potential for communities to exist near the north and south lunar poles where people live in a combined Earth-Moon economic system (enabled by super-heavy lift launch systems). Dr. Yang stated that the Moonbase has to be both accessible and sustainable. The potential of other countries to land on the Moon is dependent on the reduction of transportation costs, which is in turn linked to the introduction of cislunar infrastructure and international cooperation.

Theme 2: Overview of Collaboration Between Russia and China

Panelists raised concerns regarding the regulation and governance of future lunar activities, particularly as the range and pace of activities increase. Prof. Su highlighted the need for mutual assistance, openness and sharing of information in light of upcoming lunar resource utilization, public-private cooperation and coordination, and sustained research in the harsh environment of the Moon. While the Russia-China MoU is not public, Prof. Su stated, the text is built on cooperation between the two states for present and future activities. The MoU must be viewed within the broader, geopolitical context of Russia-China relations.

In 2019, representatives of both countries met to expand long-term collaboration for space, including building launch vehicles and electronic components, establishing communications and more. The ultimate aim of this new initiative is for Russia and China to jointly lead the creation and deployment of a lunar research station aimed at strengthening scientific research. The MoU can be viewed as a form of parity in terms of rights and obligations between Russia and China. It's also an invitation to other countries to discuss how to join and move forward together.

Theme 3: Cooperation Between the Russia-China Lunar Research Base and NASA's Artemis Program

Dr. Volynskaya shared that the hurdles to cooperation were based on political realities and perceptions. When the Artemis program was launched, for example, the US approached Russia for partnership. That failed, however, because the Russian representatives identified an absence of parity and mutual respect. Therefore, the lack of openness and opportunities for equal participation resulted in Russia's inability to engage with the Artemis program.

Dr. Volynskaya explained that the US statement made in 2019 regarding the strategic threat of Russia and China for US space capabilities significantly affected the possibilities for future cooperation. Accusations regarding the development of anti-satellite weapons by Russia and China, for example, prevented diplomatic progress on Artemis, despite strong indications that Russian scientists and technical experts were willing to cooperate on the program.

Prof. Su noted that while cooperation is an important aspect in the formation of domestic space policies and an obligation under the Outer Space Treaty, the UN Charter, and other international treaties, states cannot be forced into cooperation. This is one reason why China-US cooperation is sparse. Prof. Su stated that this sensitive relationship may require an amendment (to international and domestic law) to officially allow future cooperation. First, there must be efforts made to build trust and confidence between the two countries which would then demonstrate a willingness to cooperate.

Prof. Su raised two avenues for such cooperation: 1) providing mutual assistance for astronauts and 2) addressing the challenges of space debris. NASA's previous assistance to CNSA is an indication of possible future opportunities. For example, NASA has supported CNSA during Chang'e 4 landing on the far side of the Moon. In this regard, Col. Hadfield noted that the focus should be on unity. While the ISS was initially fueled by nationalistic sentiment, the complexities of operating in space eventually resulted in unity as a key parameter. Astronauts from different nations had to work together to solve complex challenges in space—a symbol of the cooperation required on Earth. Thus, the ISS presents a model not only for solving technical challenges but also geopolitical ones. It provides lessons for international cooperation on a daily basis.

Theme 4: Role of the Private Sector

Panelists also discussed the growth of commercialization in space. China, for example, is considering opportunities in the future lunar economy and space resource utilization, with Chang'e 7 and Chang'e 8 missions being crucial steps towards confirming the availability of resources on the Moon. Dr. Yang noted that this will require the involvement of the private sector, enhancing commercial activities in the future. Dr. Volynskaya concurred, but noted the possibility that the private sector may not have the necessary funds to engage. In this event, states will have to subsidize the private sector's activities, either through additional funding or infrastructure.

Q&A With Featured Speakers

Following the conclusion of the event, the panelists were emailed with supplementary questions from the audience that were not addressed during the salon. Each panelist provided insights via email which are summarized below.

Q1: There are a variety of perspectives on the Russia-China MOU - could you comment on what you've been seeing and what motivates those different perspectives?

Based on the announced Chang'e 6/7/8 and Luna-25 Missions, Dr. Yang believes it's likely that the lunar station will be robotic at first but that cooperation on human missions and cislunar infrastructure may become part of the collaboration. Prof. Su points out that the purpose of the MoU is cooperation, it does not attempt to clarify critical legal issues.

Dr. Volynskaya explains that the MoU is not sufficient to start real work on the lunar station. Russia and China will need a legally binding intergovernmental agreement that would set forth the details of cooperation. According to Dr. Volynskaya's sources, this agreement is currently in development. Dr. Volynskaya sees the need for a similar procedure with the Artemis Accords as well and hopes that this delay will give the international community time to start a multilateral dialog (maybe facilitated through the UN Committee on the Peaceful Uses of Outer Space (COPUOS). Prof. Su and Col. Hadfield consider the timing of the announcement a reaction to the Artemis Accords, making a clear statement that it will not be the only scientific program on the Moon. Prof. Su hopes this will stimulate competition, while Col. Hadfield believes that the Biden Administration and the new NASA Administrator will have an opportunity to harmonize the Artemis Accords with the MoU.

Q2: What risks or opportunities do you see in the next 5-10 years of space collaboration? Are there risks any of you are concerned about in regards to different stakeholders taking very different approaches from one another?

Dr. Yang sees the uncertainty of international policy as the greatest challenge to space collaboration. Dr. Yang and Prof. Su agree that the development of launch capabilities and key technologies will also influence the future roadmap of lunar exploration.

Prof. Su foresees dual opportunities in coalition building and mutual competition which may have positive, stimulating effects. Further, collaboration can lead to the development of complementary capabilities. Prof. Su is concerned, however, about the coordination of lunar activities. Since most research activities are currently localized and focused on the polar regions rather than spread out across the entire surface of the Moon. Prof. Su remarks that the non-excludability in a common area can lead to interferences between commons users. Prof. Su sees a need to substantiate the Outer Space Treaty obligations of due regard and consultation to prevent such interference.

Furthermore, Prof. Su finds the lack of consideration for environmental protection concerning and would like to see planetary protection guidelines developed into widely accepted norms. Dr. Volynskaya adds their concern regarding commercial activities and the risk of private stakeholders ignoring or disregarding space law and respective international obligations due to short-term profit opportunities and commercial interest. Additionally, the protection of some state's space assets "by any means" is worrisome, especially since the registration mechanisms are insufficient to create transparency of launched assets, activities and orbital data. Dr. Volynskaya notes that the UN Long-Term Sustainability guidelines (LTS) are a step towards filling the regulatory gap in that they give guidance on trust and transparency building, predictability, stability, and sustainability. More needs to be done, however, to keep up with the pace of commercial developments.

Q3: As these large bilateral frameworks emerge, what is the role of the UN? What types of cooperation and dialog could occur through the UN to support greater multilateralism in the context of these agreements being made today?

Dr. Yang believes that the UN's contributions are limited. While it can foster a dialog, multilateralism ultimately depends on direct communication between corresponding agencies and countries. Prof. Su points out that it is still unclear whether collaboration under the Artemis Accords and International Lunar Research Station (ILRS) will be multilateral or bilateral. These interactions are program-based activities, therefore they do not form international intergovernmental organizations. Dr. Volynskaya emphasizes the substantial experience and acceptance of COPUOS and its subcommittees in decision-making and regulation.

Prof. Su, as well, feels that the UN will remain the central organization for regulation of such activities, the expansion of international cooperation, and disaster management.

The LTS process represents the ability of the international community of experts to converge and propose practical solutions. While it is not yet in effect, some delegations are already trying to form a working group on space resources in the Legal Subcommittee of COPUOS. Due to its foundational nature, Col. Hadfield believes the UN needs to update the Outer Space Treaty to reflect the realities of current and future space and lunar activities. The UN will either have to keep up with the accelerating pace of space development or become irrelevant. Dr. Volynskaya hopes there will be more openness and transparency about goals and intentions regarding the future of international cooperation, which will lead to the creation of clear objectives that can be implemented.

Q4: Do you see possibilities for other multilateral frameworks, negotiated with all relevant parties, open to all interested countries and international partners? If so, on what topics? For example, Russia is taking some strong stances on space resources - is this something we could begin to build multilateral agreements around?

Col. Hadfield is convinced that there is willingness for multilateral agreements but that vision, leadership, and inclusiveness is needed in balance with self-interest. Col. Hadfield looks at space debris, environmental awareness, and earth observation as areas most likely to facilitate cooperation.

Prof. Su and Dr. Volynskaya believe the international collaboration seen in the Hague Working Group, the Moon Village Association, IAA, COSPAR, and others could potentially influence future multilateral frameworks. Prof. Su wants the UN to play a central role in the discussions, however, and Dr. Volynskaya adds that it will be important yet difficult to consider and combine all the knowledge and expertise created in these fora. Dr. Volynskaya sees a need for COPUOS to engage with non-state actors more and grant them better opportunities to speak and negotiate in an international arena. Dr. Yang adds that most space powers recognize the need for wider involvement of the international community and encourages cooperation with non-space-capable nations through contributions of valuable resources (such as ground stations).

Q5: For Dr. Yuguang and Dr. Su, what is the status of China's new taikonaut module and how many people might it carry to the Moon? Does China have a lunar lander in development and, if so, how many taikonauts might it carry to the surface? (Related question: What else do we know about China's new generation crew capsule that can transport humans to low Earth orbit (LEO) and the Moon?)

According to the formal release from China's Manned Space Agency, explains Dr. Yang, China will launch the core module, Tianhe-1, to LEO in April and then launch Tianzhou-2 (its resupply ship) to dock with it. Following that mission, the Shenzhou-12 spaceship will bring three astronauts to the station. After technical demonstrations and preparations, China will launch the Wentian and Mengtian experimental modules to the station. Finally, the station will have three modules, forming a 60t level MIR-like space station. This station will only work in LEO and will not carry astronauts to the Moon.

During the first test launch of Long March -5B last year, the test vehicle of China's new generation of spaceships, it was taken to LEO and it used its own engine raising apogee (the point in an object's orbit that is farthest from the center of the earth) to about 8000km. Then, it returned to Earth with speeds closer to second cosmic velocity. This can be recognized as activity in preparation for future human lunar missions. The central government of China has formally announced that human lunar missions will be considered for the next five year national plan, but no concrete scheme has been released.

Q6: Will there be a 2021 China Space White Paper and if so would anyone be able to comment as to when this might be released? Do we expect a timeline for crewed lunar landings and settlements to be set out this year?

Dr. Yang sees it as possible but believes that it is too early to know a timeline. Prof. Su projects it to be released this year despite a lack of official confirmation. Prof. Su is uncertain about the publication of a timeline on crewed lunar landings and settlements.



Q7: Is there a link to the technical book that Olga mentioned? Is the book Dr. Volyskaya mentioned, *Cosmonautics in the 21st Century*, available for purchase and is it available in English or only Russian?

The book is called “Космонавтика XXI века. Попытка прогноза развития до 2101 года” [*Cosmonautics of the XXI century. An attempt to forecast the development until the year 2101*], published in 2010 and republished in 2011 by RTS-Soft, Moscow. The book can be downloaded in .djvu format here: [Космонавтика XXI века. Попытка прогноза развития до 2101 года. \(novosti-kosmonavtiki.ru\)](http://novosti-kosmonavtiki.ru). It was written by a “dream team” of authors and edited by Boris Chertok and Prof. Yuri Baturin. Chertok is a legendary space scientist and engineer who worked with Sergey Korolev, the Chief Designer of the Soviet space program. Prof. Baturin is a cosmonaut, hero of Russia and a Doctor of Law. According to Dr. Volynskaya, there is only the Russian version, but she hopes that it will be eventually translated to English.

Q8: Are there any international collaborations being proposed for lunar based telescopes, such as the Square Kilometre Array? (The far side of the Moon is a unique location in the whole solar system for building large telescopes.)

Dr. Yang thinks that it is still too early to have a well-informed discussion but that there is wide recognition of the need for a large radio telescope on the far side of the Moon. For now, China’s launch capabilities of eight-ton lunar probes, and even with the TLO capability of 50 tons, make such a mission impractical. Dr. Yang projects the need for human-based missions and in-situ resource utilization (ISRU) for it to become practical. Dr. Volynskaya adds that maybe the ISONscope project could offer a pathway towards telescopes on the Moon.

Q9: Did China provide inputs to the COPUOS consultations on space resources? Does Chinese space policy take a particular position on commercial ISRU?

Prof. Su considers it likely that China has provided inputs to the COPUOS consultation on space resources since China supports the discussion of the issue within COPUOS. China advocates for the exploration and use of outer space for the benefit of all countries. Dr. Yang notes that there is still a lot of work to do, especially considering that China is the only space-capable nation without a space law. Prof. Su adds that China has not taken a particular position on commercial ISRU.

Policy Recommendations

Based on this discussion, several policy recommendations were identified to help inform future international collaboration on lunar bases.

- **Build trust and mutual confidence**—this will form the starting point of international cooperation. Col. Hadfield proposed building unity by introducing symbolic ways to collaborate, such as [the proposal](#) to share satellite data.
- **Develop international norms on how to “settle other planets”**—Col. Hadfield notes that technologies and space capabilities are rapidly developing and that regulatory measures must keep up with those trends.
- **Affirm the role of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS)**—COPUOS can be a useful forum for engaging in discussions related to international collaboration. However, COPUOS needs to adapt to the accelerating pace of developing space capabilities or it risks becoming irrelevant.
- **Create clear, consistent standards**—particularly for interoperability, must be developed. They are a crucial element for future lunar missions.
- **Make cooperation the goal**—rather than focus on confrontation as a goal, the global common principle and other principles found in the Outer Space Treaty should be affirmed and further built upon.

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