MOON VILLAGE – PARTICIPATION OF EMERGING SPACE COUNTRIES

Annual Report 2022

FEBRUARY 1, 2023

MV-PESC CORE TEAM

Contents

February 2023

Abstract:

The Moon Village – Participation of Emerging Space Countries ("MV-PESC") program was established in January 2020. The aim of the project is to involve Emerging Space countries to join the efforts and have a vested interest in the Moon Village. Today, the MV-PESC project is the largest bottom-up active moon exploration community for Emerging – Space Countries in the world. The key project deliverable are roadmaps from each participating country, known as local teams. Since 2020, the MV-PESC local teams have produced 11 roadmaps.

This report explains the PESC concept and summarizes the general efforts performed since the establishment of the project, in addition to a summary of each country's roadmap. Finally, this report also mentions challenges facing the project and aspirations for the future.

Introduction:

The Apollo program resulted on having 12 persons to walk on the lunar surface. However, the most astonishing achievement was how an entire country was mobilized to put human on the moon using the technologies of the 1960s. What can we achieve if the entire human population was mobilized to expand to outer space? The MV-PESC project is an action to involve everyone in moon activities.

In April 2019, the first MV-PESC workshop was conducted in Kuwait as a pilot project. In December 2019, the founder of the project presented the future plan and later in January 2020, the MVA board approved the project. The core team was formed in March 2020, and the first call for local teams was announced in May 2020. The PESC project adapts both approaches, the bottom – up and the top – down. However, more focus was given to the bottom – up approach.

The PESC project mentors' local teams to draft a roadmap. This roadmap was inspired by the Moon village architectural Working Group roadmap published in January 2020. The drafted roadmaps look at the strength of each country and how to join the international efforts already in place by major space faring countries. The following block diagram shows the PESC concept:

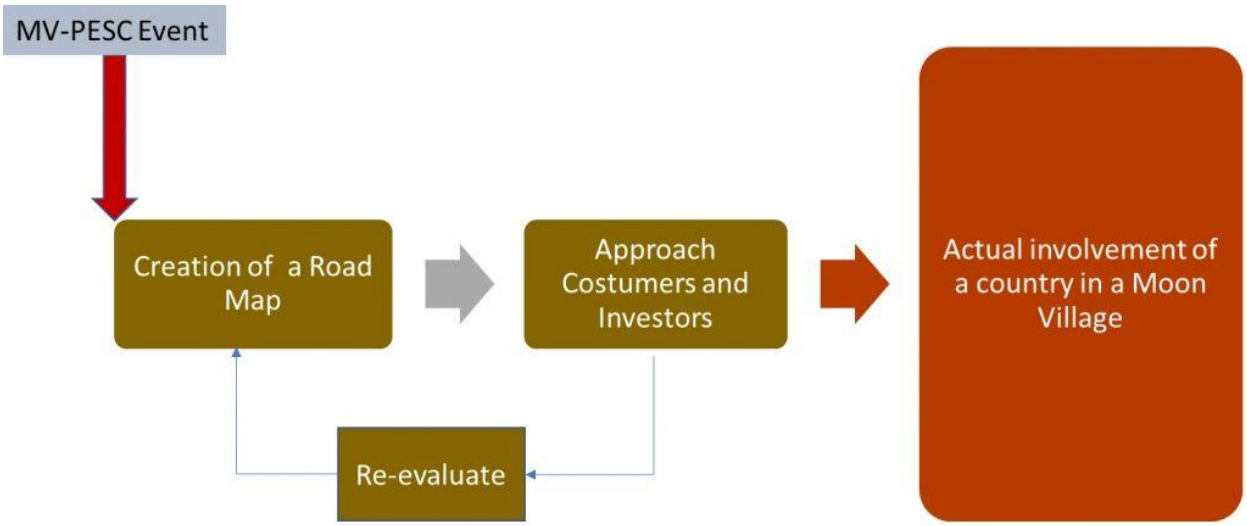

Figure 1: PESC Concept

The roadmap is a document aimed to be communicated for decision makers in each country. It is a dynamic document that can be modified as local teams approach decision makers in the privet or local sectors. This report summarizes the activities since the establishment of the project.

PESC Core Team Structure:

The PESC program is led by a global team of active moon and space exploration advocates, engineers and scientist. Each Local Team (by country) is led by a Team Leader. Each Team Leader is responsible for an entire region of the globe. The following are the members of the core team:

Project Manager:
Ghanim Alotaibi, Engineer & Space Researcher, Kuwait

Deputy Project Manager:
Terence Fernandez, Engineer & Research Editor, USA

Middle East Team Leader:
Dr. Peter Schulte, Aerospace Scientist, USA

Asia Team Leader:
David LX Ho, Lawyer, Singapore & Malaysia

Digital Marketing Manager:
Dhanisha Sateesh, Aerospace Engineering Undergrad, Reports & Co-Lead SGAC, India

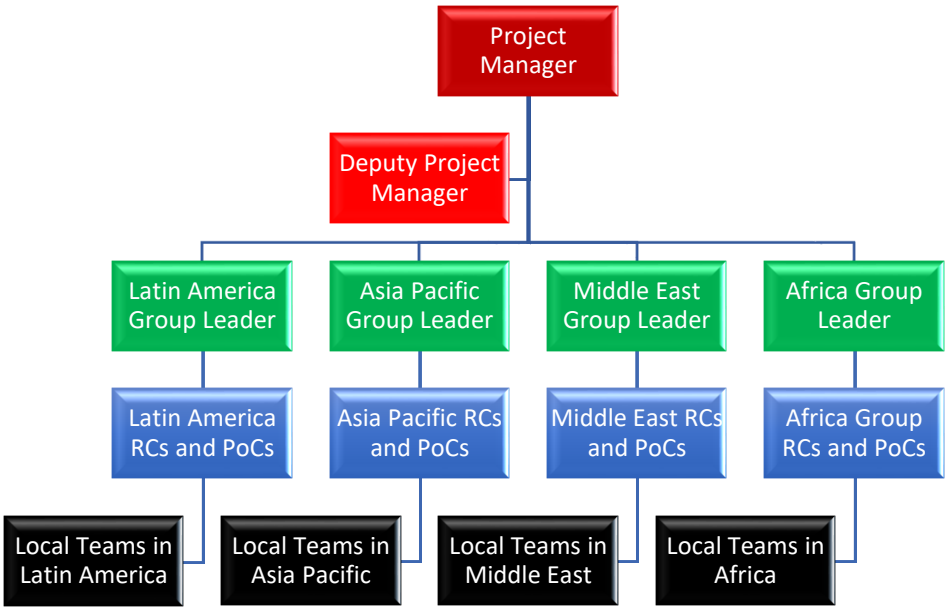

Figure 2: PESC Organizational Structure

The MVA offers the opportunity for individuals from around the world to apply for the positions Regional Coordinator (PC) and Point of Contact (PoC). RCs and PoCs are responsible for performing and/or leading activities in their respective countries including coordinating the work of their local team PESC roadmap. The PESC project core leadership team function as a mentor to local teams in drafting their roadmap and utilizing it as reference to inspire local activities and outreach that build interest in moon exploration among potential partners, government agencies, private entities, researchers, academia, and the public. In brief, the PESC project is a consultation platform to support local teams perform its function as advocate and driver for its country's involvement in the moon. The PoC and RC positions however, are completely independent from the PESC project.

The diagram above shows the workflow structure of the project. The Project Manager (PM) and Deputy Project Manager (DPM) support group leaders in overseeing the local team's drafting of the roadmap with the cooperation of the country PoC. As the roadmap is completed, local teams are assumed prepared to perform local moon activities. RCs and PoCs are not members of the PESC core team but have received mentorship for the PESC roadmap by the core team, and as a result, motivated their decision to register as MVA members. RCs and PoCs who take on the drafting of the PESC roadmap have become implementers of the roadmap themselves.

It is important to note that in 2022, following the approval of the above structure by the MVA board, the PESC project core team decided to create a new job vacancy for a Social Media Manager. The position is not shown in the structure. However, a new structure will be proposed for 2023 adding more positions.

Calls for local teams and review of participation:

Since the establishment of PESC, 2 calls for teams were announced in 2020 and 2021. The following table shows all the local teams accepted to draft PESC roadmaps:

Table 1: Local Teams accepted for the PESC project

Seq.	**Year 2020**	**Year 2021**
1	Kuwait (2019)	Oman
2	Jordan	Pakistan
3	Nepal	Mauritius
4	Mongolia	Nigeria
5	Egypt	Cameron
6	Kenya	
7	Colombia	
8	Chile	
9	Mexico	
Total	9	5

As shown in the table above, 14 local teams have been accepted in the PESC project. Highlighted in red, are local teams that did not deliever a roadmap. Hence during the last 2 years, the PESC project produced 11 roadmaps. The high numbers of participating teams excceded expectation, especially in 2020. The fact that only 3 teams discontinued their participation (given that all work is volunteer based), suggest that the selection criteria was also effective.

In 2022, no call for local teams were announced. The focus of PESC in 2022 was for local teams to strengthen communication, interaction and perform more outreach activities. A new call announcement is planned for February or March 2023.

General summary for the roadmaps and notable activities:

Local teams participating in the project vary significantly. Some local teams are completely independent and working in countries with no space agencies. Other teams are well connected with their space agencies. Some teams have lost many members since they participated, while others are gaining more members. We have few teams are inactive after the submission of the

roadmaps. Below, a summary of the roadmap and the status of each local team per country is presented.

Middle East:

Kuwait:

Kuwait progress was slow in 2021. However, it is important to mention that the Kuwait PESC team has presented the importance of moon exploration to potential key stakeholders on several occasions. The PESC team's request to stakeholders is for Kuwait to build new capacity for moon exploration. This request was included as a section in a proposal by the Kuwait Foundation for the Advancement of Sciences to establish a space agency. Kuwait has joined COPUOS as a response to a request by KuwaitSat-1 team.

	January 2021	**January 2022**	**January 2023**
PESC Team	4 members Independent Group	6 members independent group	6 members independent group
Space Agency Connection	No space agency and not a member in COPUOS	Kuwait has joined COPUOS in September 2021	No Space Agency
Country's Capability and potential for the Moon	A detailed survey will be conducted	A Detailed survey will be established	
MVA Local Network	Network Established		
Past Actions	Outreach activities Started working on research projects	Remote Sensing of the moon project was proposed for the Physics department - Kuwait University Moon Exploration ideas was introduced in the final proposal to establish a space program. This proposal was submitted to high government officials.	Analog Missions and Arts initiative. First all Kuwaiti crew in an analog mission.

		Outreach activities (webinars and lectures)	
Proposed Bottom/Up Activities	Outreach about cultural considerations Conducting a survey to about labs equipment and sectors 3 research projects are Thermal management for solar cells and electronics in the moon, Astrophysics in the moon and medical research in the moon	Conducting a survey Continue progress the three projects	Lectures in CAP and participating in the IMD to present about the results of the analog mission conducted in August 2022
Observations	Expand the team in Kuwait Identify connections in the PESC project for partnerships Link individual projects with country's interests More specific goals to measure future progress		
Top/Down Actions	Foster Government Involvement (Participation in COPUOS). Foster involvement of UN Regional Center for Science and Technology		

Egypt:

The Egyptian team expressed that they have slowed down significantly because of the technical challenges (hard problem) of a lunar cubesat mission feasibility study and also busyness of the team leadership with personal and work activities outside of PESC. They have completed the first

draft of a feasibility study in March 2022 and presented it to the Egyptian Space Agency (EgSA). EgSA responded positively and is initiating some discussions with a partner in Europe about implementing the mission. Meanwhile, the team slowly is working on furthering the feasibility study.

	January 2021	**January 2022**	**January 2023**
PESC Team	11 Members from different background	~20 members, but only ~10 are currently active; 4 doing most of the work	The team only has 4-5 active members, with two of them devoted to advancing the study.
Space Agency Connection	Well Connected to space agency	Well Connected to space agency	Well Connected to space agency
Country's Capability and potential for the Moon	Earth Observation	Small satellite to perform science mission (i.e. 6U CubeSat) either from Egypt alone or partnering with other countries	Small satellite to perform science mission (3U CubeSat)
MVA Local Network	Network Established	1 PESC team founder is North Africa Regional Coordinator 2 PESC team leaders are Egypt National Coordinators ~750 Facebook followers	Team founder (former N. Africa Regional Coordinator) and one team leader (former National Coordinator) are no longer active. 1 national coordinator remains, as well as one technical team leader
Past Actions	Meetings with Space agency	1.) Held 2 major online events: Back To the Moon webinar and [SG]Egypt (each event had over 100 applications) 2.) Selected payload and scientific experiments for 12U CubeSat mission to Moon 3.) Finished preliminary study of technical feasibility of CubeSat mission and began preparing	MVA Egypt team successfully completed an initial draft of a 3U Lunar CubeSat feasibility study and presented it to the Director of the Egyptian Space Agency (EgSA) in March 2022. EgSA was very impressed with the study and wants to use it. The agency is initiating some discussions with a partner in Europe about implementing the mission together. To motivate the team, the technical leader reached out to Bernadette to request that MVA provide recognition letters on official letterhead for

		report/presentation for Egyptian Space Agency 4.) Presented on roadmap at IAC 2021	the active team members who have contributed to the CubeSat study. Did a Zoom webinar for MVA in May 2022. Gave a talk at a university in Egypt on International Moon Day
Proposed Bottom/Up Activities	Literature Research to identify the payload of the 12 U moon orbiter	1.) Finish preparing technical report/presentation for EgSA 2.) Consolidating team and improving how we manage internally; recruit new members, reorganize, and set goals for next 6 months 3.) MVA Support: Social media ideas/support from Samantha (Hoda will connect her with Loay) 4.) MVA Support: Continued technical guidance from Peter and other MVA SMEs as requested by the technical team	MVA Egypt technical team is continuing to develop more details for the next version of the study, including working on propulsion, communication, and attitude determination and control subsystems. At the current rate of progress, they expect the next draft to be complete in June 2023 and will be presented to new head of EgSA, though that could be accelerated if more members become active or if new active members join.
Observations	Participate in MVA WGs More specific Goals to measure future progress	----------	The technical team is dedicated but very small. Moataz, the founder of the team had to step away due to family and job busyness, and there has not been strong leadership replacing him. Once about 40 members strong with several branches of activities, it seems like the team is currently only focused on this single task.

Top/Down Actions	Forster African cooperation in Lunar CubeSat Mission Define a longer term strategy after the 12 U CubeSat launch	----------	None currently

Jordan:

The Jordanian team is making excellent progress toward establishing an analog facility, even faster than they originally anticipated. Their successful rover and spacesuit design competitions provided some great publicity, and they are starting to network and make connections with other key players in Jordan (universities, entrepreneurial organizations, government/royalty).

	January 2021	**January 2022**	**January 2023**
PESC Team	4 Members independent Group	5 members independent group	5 members independent group
Space Agency Connection	No Space agency	No space agency	No space agency
Country's Capability and potential for the Moon	The desert in Jordan can host an analogue facility	same as 2021	same as 2022 + UN-affiliated regional center (RCSSTEWA) for space education based in Jordan
MVA Local Network	Network not yet established	National coordinator is PESC team leader; 2nd applicant for national coordinator is PESC team member; created separate Jordan Space Research Initiative (JSRI) as social media presence within Jordan	National coordinator is PESC team leader; 2nd national coordinator is PESC team member

Past Actions	Investor identified for the Analogue facility	1.) Completed rover design competition (ISRU payload) and analog space suit improvement competition with finalists (2 teams from each competition) in Wadi Rum desert. All participants were students and recent graduates 2.) Established partnerships with Borderless Labs, Lunares, FabLab Irbid, Zain Innovation Campus (zinc), and Space Hero to provide funding and in-kind support for competitions 3.) Completed a series of webinars with LunAres, including livestream of their final analog EVA 4.) Applied and accepted to Jordan 12 entrepreneurship/mentoring program 5.) Shared about JSRI in local and international forums: • Queen Rania National Entrepreneurship Competition in Jordan • IAC 2021 in Dubai • European Rover Challenge in Poland	1.) Completed space architecture design competition for analog facility in Wadi Rum with three finalists. All finalists were students. 2.) Established partnerships with HTU (AlHussein Technical University), and currently discussing partnerships with space startups/NGOs. 3.) Completed a series of webinars on space architecture featuring prominent space architects 4.) Received Jordan 12 20,000 JOD grant which will be used to formally register JSRI as startup in Jordan 5.) Shared about JSRI in local and international forums: • IAC 2022 in Paris (paper on site selection criteria for space analogs) • Acta Astronautica (Published journal paper on societal benefits of space analog research and lunar exploration in Jordan)
Proposed Bottom/Up Activities	Set up analogue facility in Wadi Rum desert as goal to foster	1. Complete Jordan 12 entrepreneurship capacity building and mentorship program (end of Jan)	1. Propose use of Jordan 12 funds for registration and formaliznig organization

	capacity building. Proof of concept Outreach activities and branding	2. Develop business plan for development of analog facility (mid Feb) 3. MVA Support: Networking/connections to other analog facilities; want to learn from them what requirements they took into account when building their facility	2. Fundraising for first analog mission (small scale) proposed in December 3. MVA Support: Networking/connections to other analog facilities; establishing scientific research goals for mission in December; support in applying for grants/incubators
Observations	Set up Network Participate in MVA WGs Specific Goals to measure future progress Contact the UN Regional Space Center Use MVA social media platforms for outreach in Jordan.	----------	UN Regional Center contacted; partnership in discussion Social media growth (over 2000 followers across platforms)
Top/Down Actions	Foster Government Involvement	----------	Foster Government Involvement (ongoing bottleneck)

Asia Pacific:

Mongolia:

Mongolia's progress was slow in 2022, due mainly to restrictions in connection with the CovId-19 pandemic. However, Mongolia's goals and objectives for the near term have been identified, and the Mongolia PESC team has presented its moon exploration plans to potential key stakeholders, including (notably) the Prime Minister of Mongolia. The Mongolia PESC team remains a part of the country's group of experts studying its efforts for space.

	January 2021	**January 2022**	**January 2023**
PESC Team	9 team members, many of them working in space - related institutes	No new updates	------
Space Agency Connection	No space agency, but well connected to the National Space council and other space- related institutes	No new updates	------
Country's Capability and potential for the Moon	Geographical and environmental factors makes the Gobi desert ideal for moon analogue facility Vision 2050 support some space activities including space start-ups and analogue facility	No new updates	-------
MVA Local Network	Not Yet Established	MVA PESC team functions as the effective local network	------
Past Actions		MVA PESC team has met with the Prime Minister of Mongolia and mentioned the PESC project	------

Proposed Bottom/Up Activities	Draft rules and guidelines for Lunar Rover competition Analogue Facility Perform a survey to understand the needs of potential stockholders (including international partners in Asia)	All activities in progress	--------
Observations	A suggestion to consider the south pole for the analogue facility and convince a major player to co-sponsor To integrate moon plans with education in Mongolia will attract more stockholders To expand Mongolia's experience in LOE to the moon ISRO can be a potential stockholder especially that the MVA has an agreement with ISRO for outreach. Mongolia PESC team can benefit from that Involving Mongolia PESC team in MVA WGs Specific action plan to measure future progress	No new updates	-------
Top/Down Actions	Fostering government to involve in moon activities	MVA PESC team is plugged into government led initiatives to promote moon activities	-------

Pakistan:

Pakistan joined the PESC project in 2022. Pakistan's goals and objectives for the near term have been identified, and the Pakistan PESC team has presented its moon exploration plans to potential key stakeholders. The Pakistan PESC team is part of a group of activists who are well plugged into the space community of the country.

	January 2023
PESC Team	Total number of 6 core team members and they have created a local volunteer base network with other volunteers.
Space Agency Connection	MVA PESC team has a direct connection with SUPARCO(Pakistan Space & Upper Atmosphere Research Commission). We are planning to organize events in collaboration with SUPARCO - SEADS (Space Education & Awareness Drive) a project by SUPARCO
Country's Capability and potential for the Moon	Pakistan has recently launched the National Incubation Center for Aerospace Technologies (NICAT) funded by the Ministry of Information Technology & Telecom and Ignite to allow startups to accelerate their growth in the space industry. NICAT Cohort-1 Startup Application 2023 is open now. MVA PESC in contact with (NICAT) to present the MVA Moon Voyagers Project to the stakeholders
MVA Local Network	MVA PESC team functions as the effective local network and forms a local volunteer base network.
Past Actions	Organized two webinars last year through MVA 1- Lunar Imaging & Data Processing 2- Opportunity to focus on upcoming lunar missions as a writer Organized two International Moon Day 2022 events 1- Moon Over Us Online Workshop 2- Mastruk Jagek (Observing the Moon) Cultural Astronomy Event

Proposed Bottom/Up Activities	Initiate Webinar Series based Moon Voyagers Project with SME's
Observations	Involving Pakistan PESC Team in MVA's Working Group Integrate Moon Voyagers Workshops with private STEM in space educational organizations to increase the number of participation this year.
Top/Down Actions	Action plans to pitch MVA Moon Voyagers at the National Incubation Center for Aerospace Technologies (NICAT) funded by the Ministry of Information Technology & Telecom.

Nepal:

Local team from Nepal submitted a roadmap and was active in the first year of participation. Currently, the team is inactive.

Latin America:

Chile:

The Chilean Space Association "ASHIDE" joined the PESC project since the first call in 2020. ASHIDE perform many research projects already before the participation with PESC. Ongoing Research projects are as follow:

1- Installing and amateur radio signal repeater antenna on the moon.
2- Installing an analog lunar laboratory for the training of miners in Chile.
3- Growing Vegetables in eternal terrariums on the moon
4- Installing a VLF radio antenna at a shadowed crater on the moon.
5- Studying the effect of environmental conditions on crops.
6- Creating smart clothing for the moon
7- Moonbiks

ACHIDE has been cooperating strongly in the drafting of the text of laws that propose both the creation of the Space Agency and a Law for Space Activity in Chile. In this sense, they have made progress in the institutional framework and there is a hope that in the coming months the government will be presenting a formal bill in this regard.

ACHIDE involve members from different ages groups from students to university professors. They are the largest team in the PESC project.

Colombia:

Colombia participated in the initial cohort of the PESC roadmap generation. From this 12 areas of interest were identified and suggested, being one of them the development of analog missions. Colombia is a country with high diversity in geography and biology which provide a relevant environment for analogs. The proposal in the context of the PESC roadmap served four purposes: first, to develop outreach activities related to space, second, to provide tools and an environment to conduct research, third, to provide access to individuals which otherwise could not participate in analog experiences, and last, to provide connection of the activities and research conducted locally into the global discourse of human spaceflight.

The recommendation to develop analog research derived into the creation of Fundación Cydonia by some of the original PESC members. The Cydonia Foundation is a non-profit located in Colombia which designed, built, and currently operates the Analog Habitat for Simulated Space Exploration in Colombia, HAdEES-C by its Spanish acronym. This was possible through the support of the Space Initiatives Incubator grant of the Space Generation Advisory Council, as well as from Universidad Nacional de Colombia and the private company Boltcom. The foundation also counted with voluntary labor for the construction of the habitat and donations from private individuals that have allowed to develop operations. The habitat has housed season 1 of analog missions which counted with 5 crews, with the call for season 2 currently open.

Several challenges remain in the implementation of the roadmap. Since most of the members are voluntary, implementation takes longer than desired. The ecosystem is still nascent, which makes it difficult to find adopters of the proposed lines of the roadmap. It is also important to find and consolidate pathways to 1) develop consistent funding for the activities, and 2) transmit the research and activities results to the global discourse of human spaceflight.

Mexico:

The local team from Mexico consisted of 3 members in 2021. By the end of 2022, only one member remained in the project. This member is the founder of Dereum Labs, a startup that aims on providing infrastructure and services to expand Earth Industries into Space This project is divided in stages and relies on the cooperation of several actors inside and outside Mexico, for example, a key part of this infrastructure is made of rovers or mobile vehicles, which will be developed in cooperation of universities and private companies, with government support and with commercial technology from international partners or suppliers. Launching services will also be provided by space agencies and private companies outside the country. Significant progress was documented and the local team is well connected with the space agency. In the future, more efforts will focus on recruiting new members.

Africa:

In total, 5 local teams applied for the PESC project. Only Kenya and Mauritius submitted roadmaps. However, none of them continued to be active after the submission of the roadmap. The PESC core team is looking for a plan to promote the PESC project in Africa.

The Impact of MV-PESC Around the World:

During the last three years, the MV-PESC project was successful to accomplish the following:

1- Spread the concept that the moon can provide opportunities for developing countries.
2- Creating new opportunities for individuals in developing countries in moon activities.

As mentioned above, the roadmap is a document to be shared with decision makers. Many local teams were able to communicate with decision makers.

Egypt local team drafted a preliminary study about an Egyptian orbiter around the moon. The orbiter include an imager based on a technology that was developed locally. This study was submitted to Egypt Space Agency in March 2022. The response was very positive. Egypt Space Agency provided a feedback and recommended to create a new version of the study. Egypt PESC local team is currently working on the new study.

Kuwait local team submitted the roadmap for the Kuwait Foundation for the Advancement of Sciences (KFAS) in 2021. Very recently, KFAS requested clarifications about the roadmap as the country gaining more momentum for space after the successful launch of KuwaitSat-1. Jordan local team is also gaining more momentum as they were successful to obtain funds from local institute to continue working on the project mentioned in the roadmap (lunar habitat for analog missions in Jordan).

Local teams from Mongolia and Chile contacted high officials. Mongolia Local team presented the roadmap next to the prim minister in 2022. Local team in Chile proposed moon activities to be part of a local space policy. The effort in Chile is part of larger effort to create a space agency. Similarly, Mexico PESC local team is trying to add moon activities to the national space policy as they are in close contact with the local space agency.

Being an active member in PESC local teams is an opportunity for individuals to be involved in moon activities under the umbrella of the Moon Village Association. There were many bottom – up activities organized by local teams in their countries. For Example, 6 PESC local teams participated in the International Moon Day activities. These countries are Jordan, Kuwait, Chile, Pakistan, Mexico and Egypt.

Challenges and Aspirations

The community of the PESC project is growing. The PESC project is the largest bottom-up moon community in the world for Emerging Space Countries. However, some challenges are still being faced in the PESC project.

Interaction among local teams and the wider MVA community needs to be improved and ideally the PESC project is a community to provide support for local teams to grow their interaction with MVA. In that regard, the PESC project should facilitate stronger communication between local teams and the wider MVA community. Last year, the PESC core team organized monthly webinars where a local team was featured to present an update of their work on a public webinar, with the MVA community invited to attend. Additionally, it was planned last year to invite speakers on topics that interest local teams. Although several webinars were organized, the webinar series failed to continue due to the small number of PESC core team members and its limitation to create awareness to the webinars.

Another important challenge to the PESC project is outreach and publicity, which include publicity for the webinar series. The lack of personnel dedicated to performing outreach and publicity for the activities of PESC made it difficult to do so. Although a call for social media officer was made twice in 2022, social media accounts were only created in 2023. More efforts need to be invested in social media and the publicity of the PESC project.

As observed in Table (1) above, there is a particular challenge in the participation of countries from the African continent. We have accepted 5 African local teams, but only 2 roadmaps submissions. More efforts and strategy focused on African nations is required.

The PESC core team aspiration is to widen and strengthen the PESC community by resuming the monthly webinar series, and have it serve as an informal meeting to discuss partnerships and share advice. To make this happen, a call for two communication managers will be announced in 2023. In addition, another call for outreach manager, Africa group leader and Latin America Group leader will be announced as well. The plan for 2023 will be discussed in more details in separate document.

Conclusion

The PESC project was successful to produce 11 roadmaps in the past 3 years. However, the main challenge today is to consolidate the spirit of a community among the local teams. Another challenge is to conduct a sustainable outreach activity using social media to show case the work of every local team. In addition to the new call that will be announced during the first quarter of 2023, there will be a considerable focus to overcome the mentioned challenges. A new call for new positions in the core team will be announced.