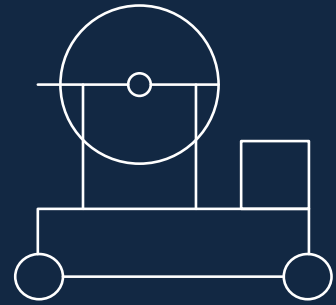
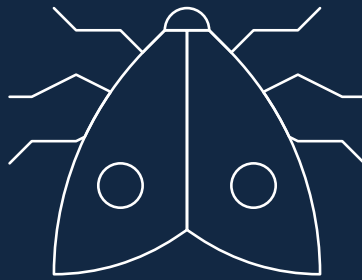
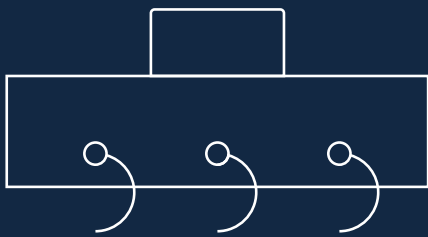




# IGLUNA

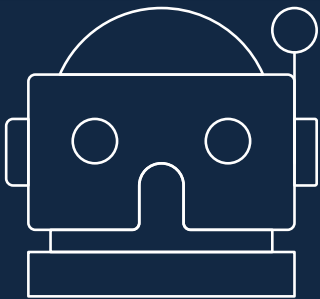


A space habitat

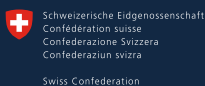


Field Campaign

Lucerne, 16 - 25 July 2021  
Swiss Museum of Transport and Mount Pilatus



Remote operations





Credits: Photo by NASA  
on Unsplash

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# INTRODUCTION

From 16 to 25 July 2021, 12 international student teams are presenting their project on the topic «A space habitat with remote operations» in a hybrid format to the public. This event marks the conclusion of their participation in the IGLUNA platform throughout the academic year 2020-2021.

During the Field Campaign, the teams are setting up their projects on the summit of Mount Pilatus at an altitude of 2132 metres. They are remotely controlling their technologies from the control room installed for the occasion at the VERKEHRSHAUS – Swiss Museum of Transport. The students are also presenting models and proposing interactive activities for the public at the Museum.

Taking into account the current travel restrictions, some teams are testing their technologies in their home country, either in their laboratory or in facilities provided by local partners. They also have the opportunity to be represented at the exhibition at the Swiss Museum of Transport.

In addition, all teams have the opportunity to present the results of their year-long work virtually at their dedicated Project Show. This format allows a worldwide participation in the event, live on Space Innovation social media channels.

The Field Campaign is also punctuated by various official events and visits from several space personalities such as astronauts and representatives of the European Space Agency and the Swiss Space Office in charge of space affairs within the Swiss government.

The full programme of the event is available on the website of Space Innovation, the entity in charge of the coordination of IGLUNA: <https://www.space-innovation.ch/igluna>

# IGLUNA IN LUCERNE



Credits: Photo by SpaceX  
on Unsplash

# PROJECT TEAMS

Life Support Systems	Habitat Conception & Structure	Communication & Navigation	Power Management
P01_GROWBOTHUB	P05_AIX2SPACE	P07_CORODRO	P12_POWERHAB
P02_LOOPS-M	P06_INFLATABLE HABITAT	P08_LIGHT	
P03_LUIEE		P09_LUNAR ZEBRO	
P04_SAMPLE 2		P10_MISTLAB	
		P11_REBELS	

12 teams from 9 countries to showcase relevant technologies for early phases of the lunar exploration in 2021: robotic systems, in-situ resource utilization, moon base demonstration and life support

# P01\_GROWBOTHUB

***GrowBotHub builds and tests a structure for the automatic cultivation of vegetables in extreme environments.***

The team is working on robotic cultivation and pollination, the use of urine-based fertilizers for aeroponic agriculture. During the Field Campaign, GrowBotHub will also test an algorithm scheduling the production of different vegetables for a day-basis harvesting.



<https://growbothub.space>

EPFL, Lausanne, Switzerland



## ***Lunar Operative Outpost for the Production and Storage of Microgreens***

LOOPS-M has developed some prototypes for a fully functional and efficient lunar greenhouse:

- A prototype shield to protect the greenhouse from the lunar environment
- A robotized vertical cultivation system for the production of microgreens
- A waste recovery system based on insects' degradation process
- A Virtual Reality experience of a lunar outpost with the previous systems for an immersive training area



Sapienza University of Rome, Rome, Italy



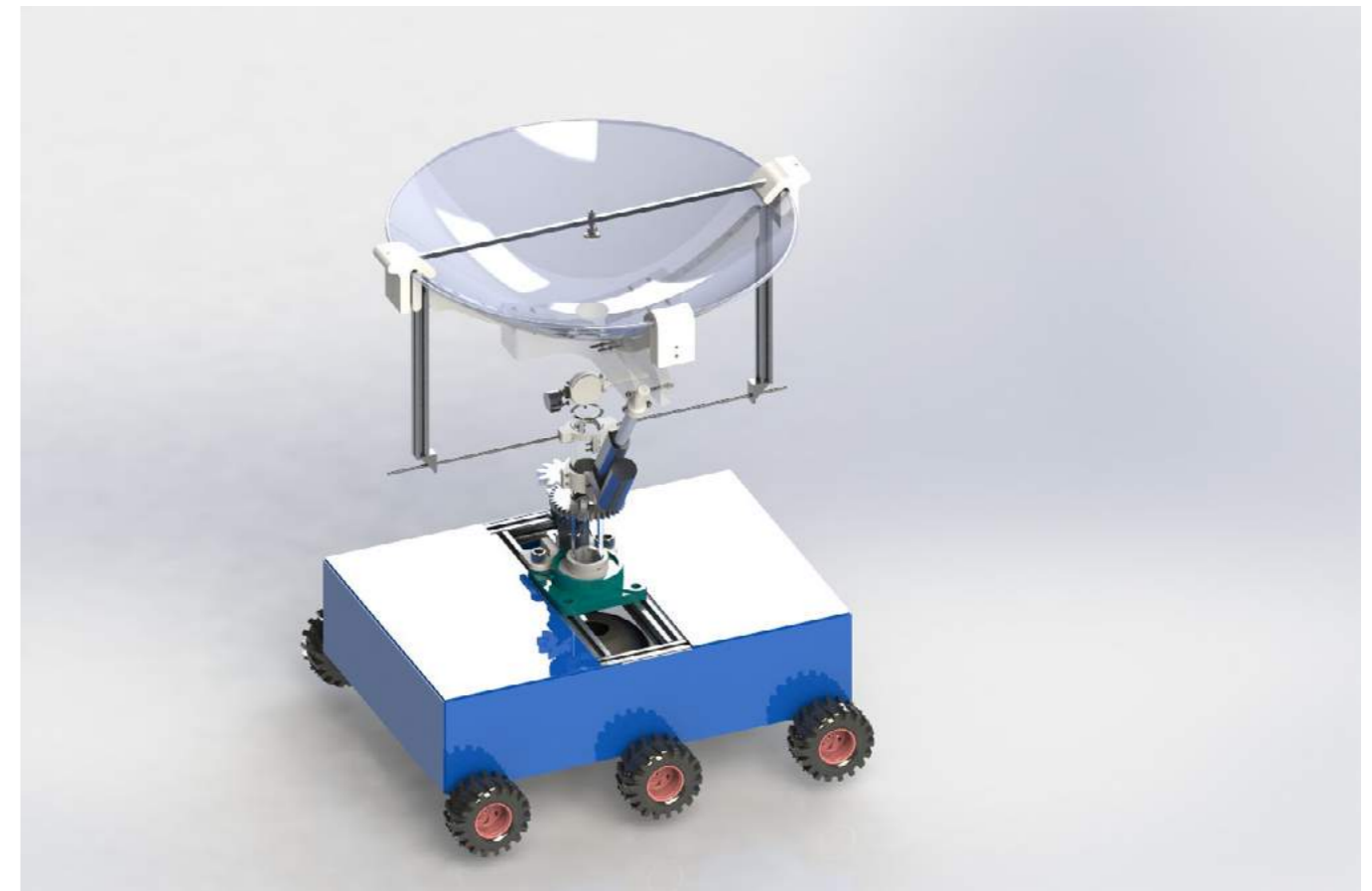


***LUIEE's goal is to use semi-autonomous rovers to extract local resources to assist in the development of a sustainable lunar village***

The lunar environment is home to diverse resources, by harnessing them appropriately, future expeditions will be able to transport supplementary resources with potential impact on launch costs. The rover shall have a lens-mirror mechanism powering a vaporization chamber, the collected material (in-situ resources) will be then provided to the electrolyzer to be processed into hydrogen and oxygen.



Technische Universität Berlin, Berlin, Germany



## P04\_SAMPLE 2

### ***Semi-Autonomous Modular Plant and other Life sustaining Experiment***

SAMPLE 2 aims to grow edible plants on terraformed lunar soil in an autonomous module placed outside the habitat. The process of terraforming lunar soil using anaerobic bacterial species allows to grow plants on initially unfertile soil. This research on bacteria could be brought to market in space branch and in agriculture - it might revolutionize the agrarian industry by making the plant grow more effective and ecological.



Warsaw University of Technology, Warsaw, Poland





Credits: Photo by NASA  
on Unsplash

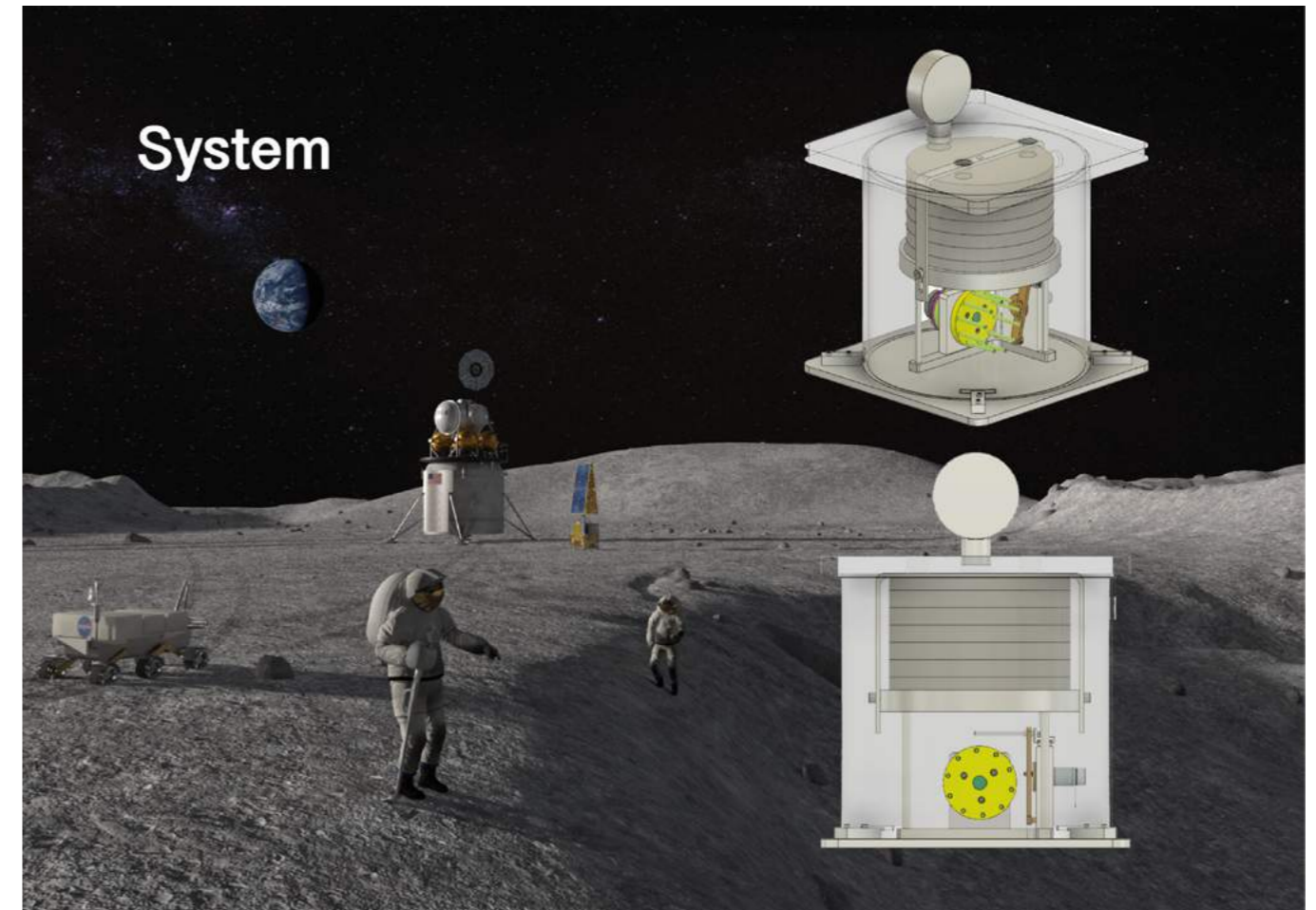
## *Winding machine for application on the moon and other astronomical objects*

AIX2SPACE is building a production machine of continuous fibres from Lunar regolith simulant, that will enable an economic and sustainable infrastructure on the Moon. The team constantly evaluates the performance of the automation system, in order to perform the process with minimal human interaction. Transporting heavy, high-volume payloads into space poses immense economic challenges, as well as technological complexities. The in-situ utilization of resources, such as lunar regolith, offers the opportunity to reduce transport costs.



<https://aix2.space/>

RWTH Aachen University, Aachen, Germany



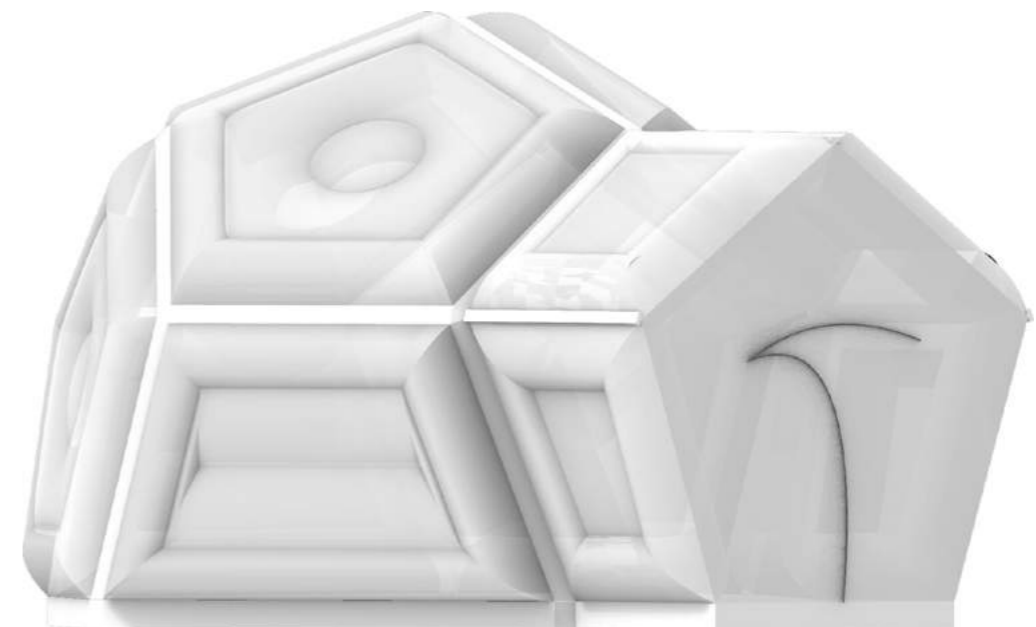
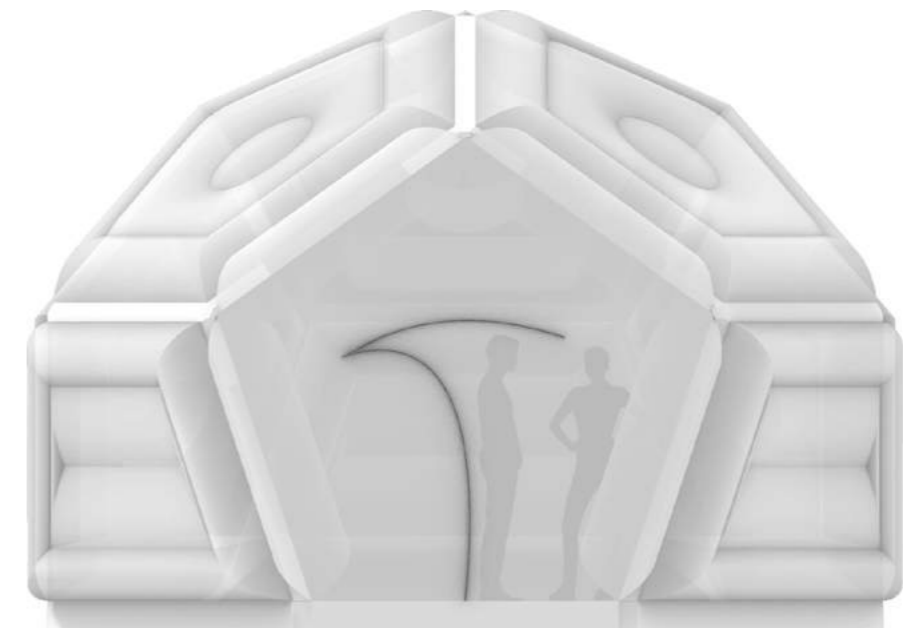
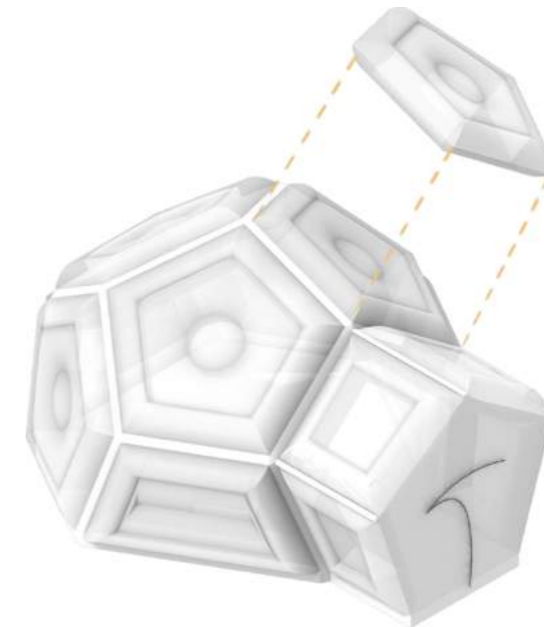
# P06\_INFLATABLE HABITAT

## *Lightweight and flexible Lunar Habitat*

The Inflatable Lunar Habitat is a flexible, inflatable dome construction. It could be used in different extreme conditions around the world. The aim is to achieve a high level of flexibility, so that assembling, disassembling and transportation are something anyone can do. The interior space is separated by an airlock and offers room for scientific experiments. This concept could eventually be useful in the design of a space habitat.



BTU Cottbus-Senftenberg, Cottbus, Germany





Credits: Photo by NASA  
on Unsplash

## ***Autonomous and collaborative rover and drone***

The objective of CoRoDro is to develop and perfect algorithms that allow a drone and a rover to explore a hostile and unknown area by collaborating. Eventually, the goal is to explore lava tubes on the Moon. During the Field Campaign, the CoRoDro team will run tests to obtain a global map of the terrain to be explored and more precise data on predefined points of interest.



<http://corodro.ae-isae-supero.fr/>

ISAE Supaero, Toulouse, France



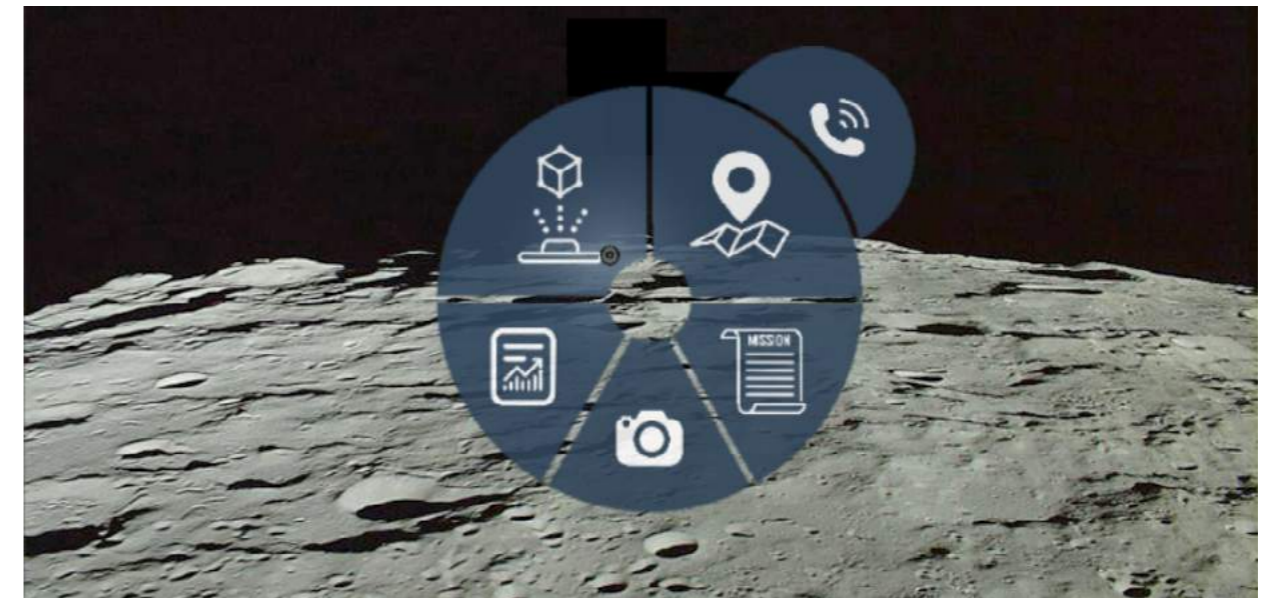
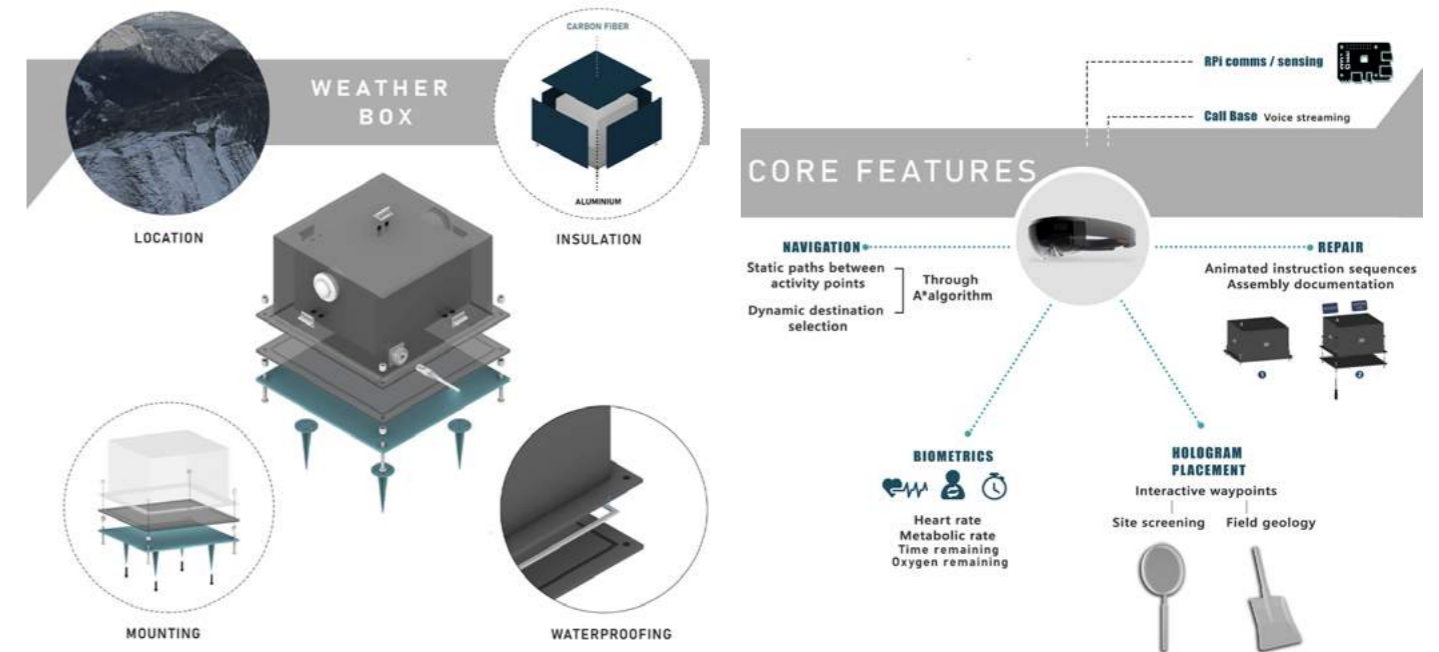
## Gadget based on AR technology for astronauts' navigation and assistance on lunar exploration missions

Focused on reducing the operational risk, possibility of error and time needed for diverse mission objectives, LIGHT aims at delivering an Augmented Reality assistance system to aid in the efficient navigation, faster repair of equipment as well as real time monitoring of the astronaut's health and environmental condition, through an interactive user interface projected on the Microsoft Hololens.



beamproject.gr

Aristotle University of Thessaloniki, Thessaloniki, Greece





# P09\_LUNAR ZEBRO

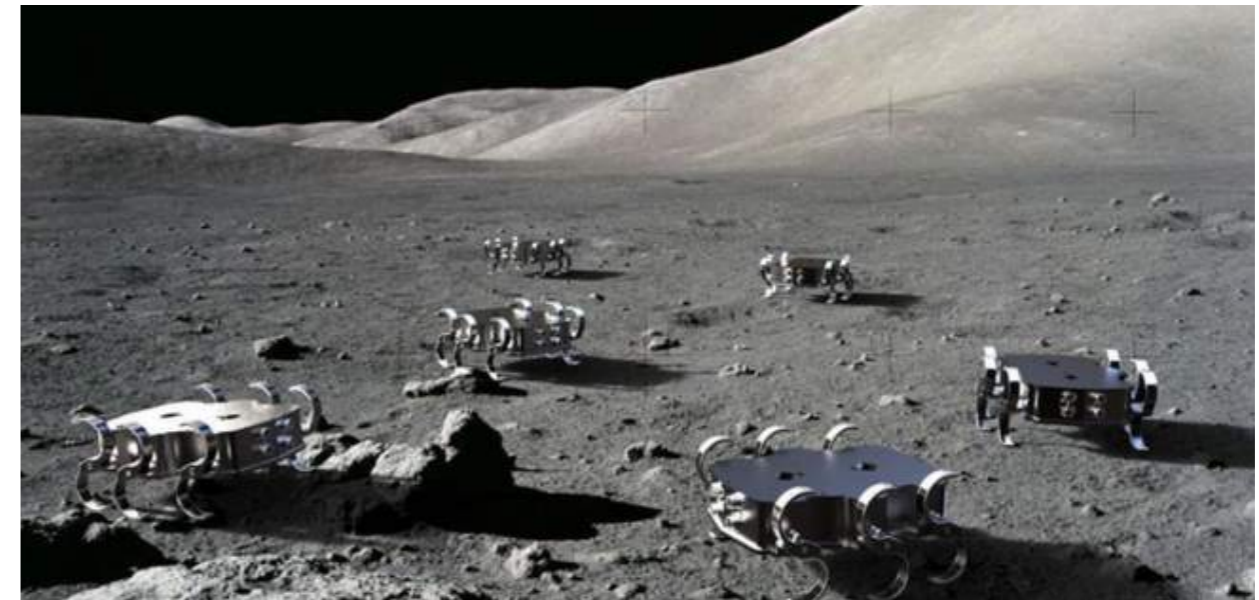
## *Swarm of miniaturized and autonomous roving robots*

The Lunar Zebro team at IGLUNA 2021 designs, develops and builds robots to demonstrate continuous autonomous operations to find multiple known targets in an unknown terrain. The Field Campaign provides the project with a unique opportunity to take the first step towards implementing swarming in a Moon-like environment, as well as to test and validate some of the Lunar Zebro's crucial subsystems.



<https://zebro.space/igluna-2021/>

TU Delft, Delft, Netherlands



## *Multi-robot autonomous planetary exploration*

MISTLab envisions exploring a lava tubes on the moon with a swarm of highly autonomous small-size robots, controlled by a single audio-visual interface. The operator would interact with the robot team to achieve an exploration task. This project will provide validation of a self-organizing system composed by multiple entities for the exploration of extreme environments. Due to COVID, Team MIST Lab will demonstrate their capabilities from Canada.



Polytechnique Montreal, Montreal, Canada



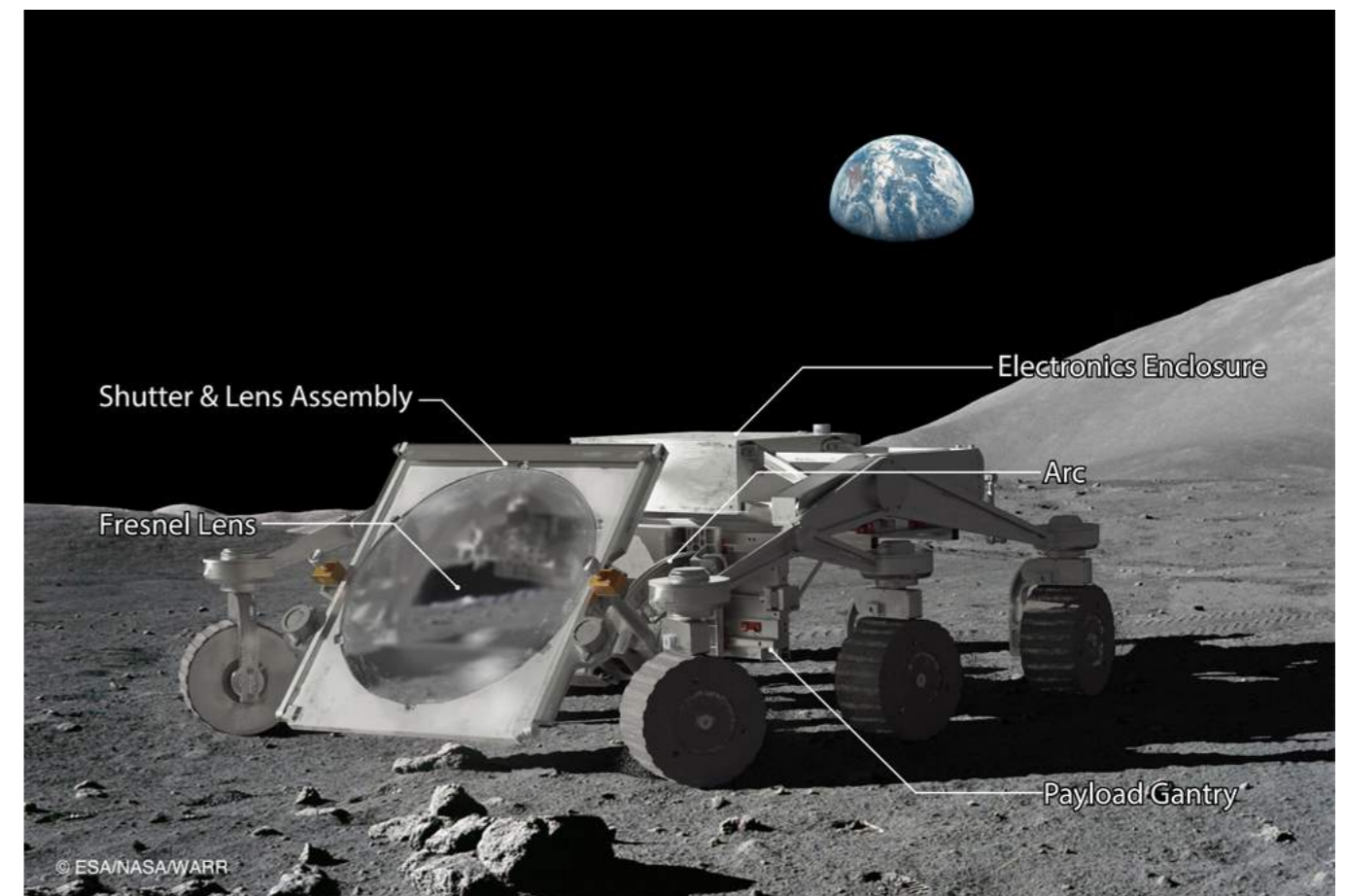
## *Solar sintering regolith on the lunar surface*

Living on the moon: an image long depicted in science fiction films and books. Project REBELS is working on realizing this dream by developing a rover capable of solar sintering regolith. The teams contributes to a permanent inhabited lunar basis by building its infrastructure. At the Field Campaign we will demonstrate the feasibility of solar sintering regolith.



<https://exploration.warr.de/>

Technische Universität München, München, Deutschland





Credits: Photo by NASA  
on Unsplash

# P12\_POWERHAB

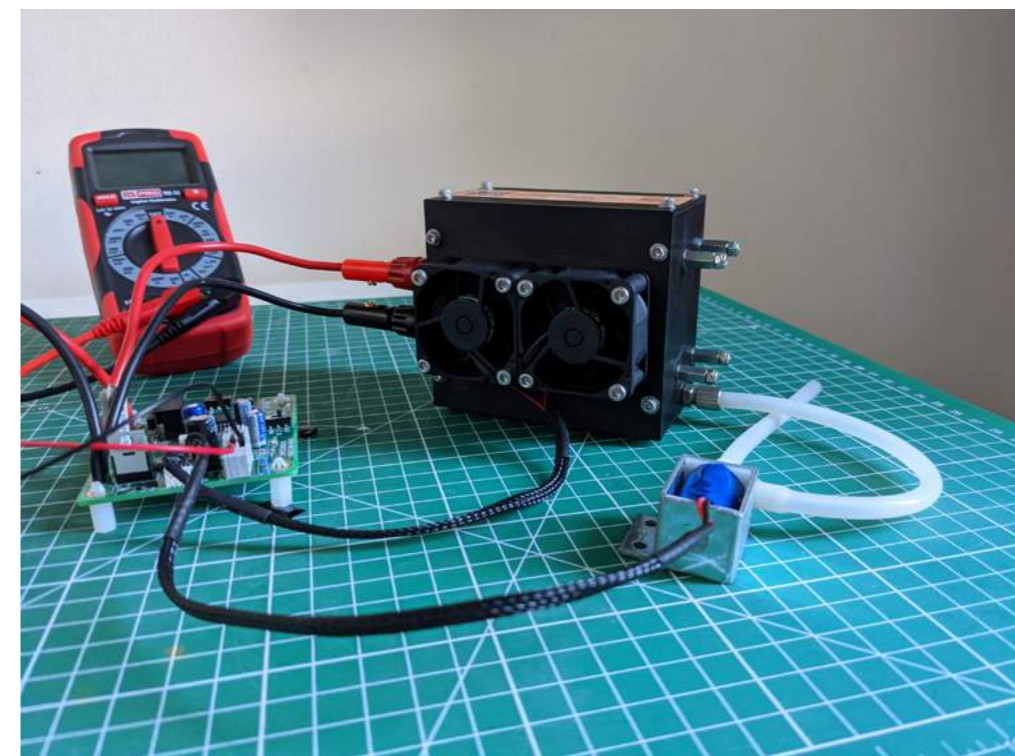
***A complete power system for long-term space missions consisting of solar, thermal, dynamic and space-based energy harvesting concepts.***

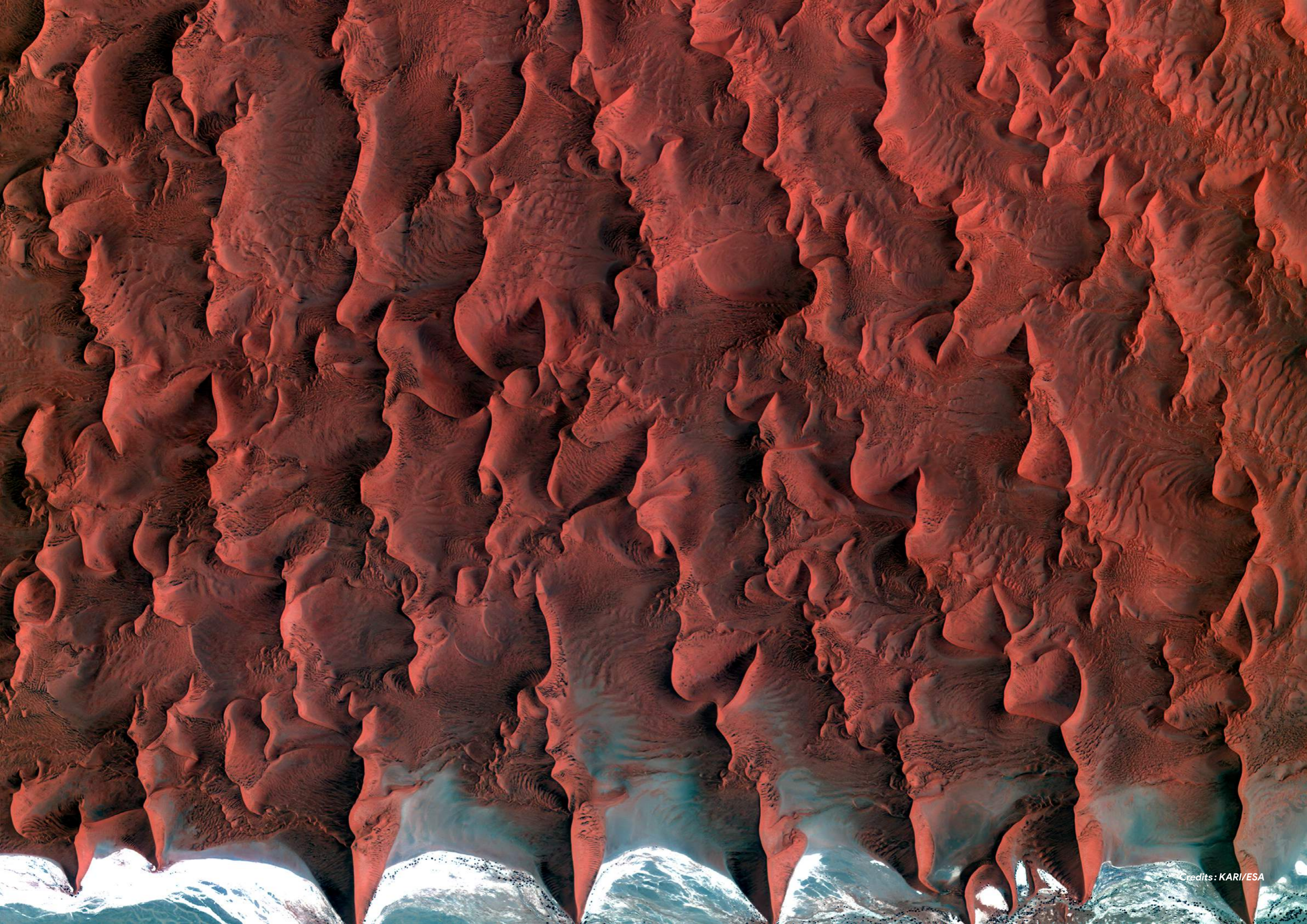
PowerHab has developed a Hydrogen Fuel Cell Prototype, a Wireless Power Transmission Prototype, a Solar Power Satellite Simulation with specific Orbit and a Nuclear Energy Feasibility Study Poster. The prototypes demonstrate technologies as part of a holistic power system wirelessly transmitting, collected solar energy, by LASER based wireless power transmission to the lunar surface.



<https://www.powerhab.co.uk/>

University of Strathclyde, Glasgow, Scotland





# IGLUNA

IGLUNA is an interdisciplinary platform where students from worldwide universities design and collaborate on innovative projects for the future of space exploration and the improvement of life on Earth.

During the project, university students apply their knowledge to solve a technical challenge, to sustain life in an extreme environment, increasing in parallel the maturity of technologies relevant to the space domain. A board of experts from space agencies, renowned international companies and research institutions are mentoring the students throughout the year to consolidate the projects for the Field Campaign.

IGLUNA is part of the ESA\_Lab@ initiative launched by the European Space Agency to create a hub for innovation between universities, research organizations and industry. Space Innovation coordinates the IGLUNA platform and leads the main systems engineering activities, coaches the student teams, organises the events, and communicates to the general public.



<https://space-innovation.ch/igluna>  
[igluna@space-innovation.ch](mailto:igluna@space-innovation.ch)

Credits: Photo by NASA  
on Unsplash



# ABOUT SPACE INNOVATION

Space Innovation builds on the multi-domain relevance of space technologies to support the development of disruptive innovation projects in the space sector. The entity is based at EPFL and ETH Zürich in Switzerland.

Its focus is:

- Strengthening Switzerland's space capabilities
- Offering opportunities to involve players in space innovation
- Enabling space technologies to contribute to sustainable development

Its core capabilities are:

- An established network in Switzerland
- A solid national and international recognition and reputation
- Access to cutting edge technologies (from academia, RTOs and industrial partners)

Its value proposition is:

- Pro-active advancing of member's goals
- Establishing & supporting innovative projects with partners
- To be its members' voice in national and international happenings



# IGLUNA PARTNERS



SAPIENZA  
UNIVERSITÀ DI ROMA



Warsaw University  
of Technology



# IGLUNA SPONSORS

# PROJECT TEAMS SPONSORS





TU Delft Robotics Institute



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