

HIGHLIGHTS 2025
YEARLY STATUS REPORT

PLANETARY INFRASTRUCTURES

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The plants are growing in the Bioloops stand in Cologne.



THE YEAR 2025

Planetary Infrastructures - The Year 2025

2025 was a defining year of integration, validation, and strategic acceleration. With EDEN LUNA entering full Assembly, Integration, and Test in Bremen, critical subsystems were installed and connected to the new distributed control architecture. Parallel to this, EDEN Next Gen. consolidated international alignment with CSA, NASA, and industry partners, refining system requirements and advancing the Lunar Agriculture Module concept. Circular food production advanced through BioLoops, where urine-based nutrient solutions successfully sustained controlled tomato cultivation, marking tangible progress toward closed-loop life-support systems.

Our engineering capabilities proved competitive under real mission constraints: The SMU group secured victory at the ESA Space Resources Challenge, demonstrating regolith excavation and beneficiation within strict mass and power limits - translating innovation directly into a winning system development. With Aeolis, we expanded ISRU thinking to Martian atmospheric utilization, validating pneumatic regolith classification through simulation and review.

In 2025, the Planetary research cluster secured two major funding successes. The SMU group, in collaboration with the University of Bremen, won support within the Excellence Cluster for the "Martian Mindset," establishing a forward-looking research paradigm for scarcity-driven production under extreme resource constraints. In parallel, the EDEN team successfully won the DLR-internal Transfer Call 2025 with the MEPA+ concept, advancing plant cultivation systems toward humanitarian deployments.

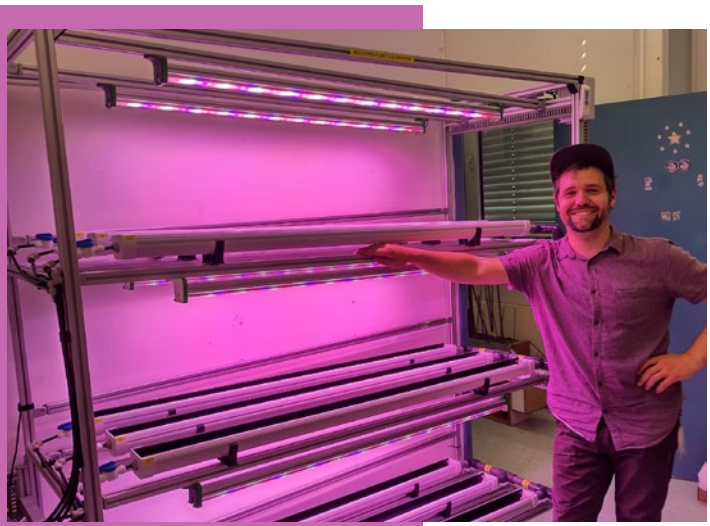
Across all projects, 2025 transformed concepts into integrated systems - advancing lunar and Martian readiness while also delivering solutions with immediate societal relevance.

Prof. Dr. Daniel Schubert
Research Cluster Leader – Planetary Infrastructures

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PLANETARY INFRASTRUCTURES

For a successful human exploration strategy, resources such as water, oxygen, food, and also rocket fuel, energy, habitat building materials, and many different types of consumables will need to be generated and adequately recycled within future extra-terrestrial outposts. Combining two approaches, reclamation and recycling, is the key focus of the Planetary Infrastructures research area. The group is administered by the Department of System Analysis Space Segment (SRS) at the DLR Institute of Space Systems in Bremen (Germany). The department operates the Institute's Concurrent Engineering Facility (CEF) as well as the Planetary Infrastructures laboratory, including the Space Habitation Plant Laboratory (EDEN Lab), ISRU Breadboard

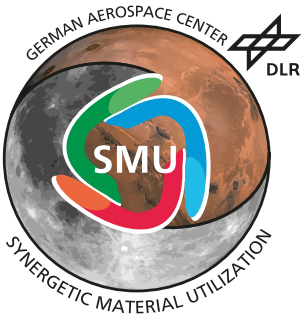


DLR Institute of Space Systems, Bremen (Germany)



THE EDEN INITIATIVE

In 2011, the DLR Institute of Space Systems launched its research initiative called EDEN: Evolution & Design of Environmentally-closed Nutrition-Sources. The research initiative focuses on bio-regenerative life support systems (BLSS), especially greenhouse modules and how these technologies can be integrated in future space habitats. It is the goal of the EDEN team to further advance the latest cultivation technologies and to adjust these developments into space-related applications. Even though present scenarios for future human missions to the Moon and Mars are still several years from coming to fruition, the development of these technologies needs to start today. Only this way will highly-reliable and resource-efficient BLSS be ready for implementation into the mission architecture for humanity's journey to the Moon and Mars.



SYNERGETIC MATERIAL UTILIZATION

The Young Investigator Group Synergetic Material Utilization (SMU) was founded in 2021 after winning a DLR internal competition. The group focuses on the development of technologies for ISRU on the Moon and Mars and how to establish synergies between ISRU and life-support systems. The group consists of two PhD candidates, one research associate, several student assistants, and group leader Dr. Paul Zabel. The current research focus is set on two areas: 1) regolith beneficiation and utilization and 2) in-situ propellant and consumables production. In the first area, a beneficiation breadboard is under construction to pre-process lunar regolith before utilization. The goal of the second area is to develop a prototype for extracting water from the lunar surface. Furthermore, the group conducts feasibility studies and analysis related to the whole field of ISRU. All activities are of high near-term importance for space exploration and are high priorities in national, European and international roadmaps.

THE TEAM



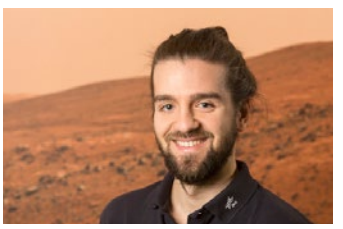
PROF. DR. DANIEL SCHUBERT studied at the Technical University of Berlin and has an engineering diploma in industrial engineering with an emphasis on aerospace and production techniques. 2018 he received his doctorate at the University of Bremen. Since December 2023, he holds a professorship at the Technical University of Dresden. In 2011, he initiated the EDEN group at the DLR Institute of Space Systems for technology investigations on Bio-regenerative Life Support Systems and has since served as the team leader of this group.



DR. PAUL ZABEL studied aerospace engineering at the Technical University of Dresden and has a doctorate from the same university. He joined the EDEN team in 2012. Since 2021, he leads the Synergetic Material Utilization group at the DLR Institute of Space Systems. He is the coordinator of the EU-funded project LUWEX. Dr. Zabel is also the deputy manager of the Planetary Infrastructures Laboratory. His research expertise is in ISRU research and innovation and also in life-support systems.



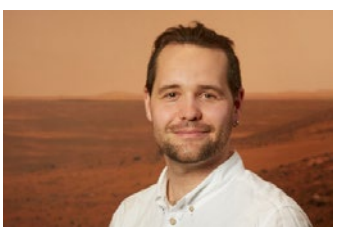
CLAUDIA PHILPOT is a Diploma Engineer who studied aerospace engineering and physics at the Technical University of Berlin and joined the EDEN team in 2022. Her expertise as a satellite operations manager in Industry and Research as well as programmatic experience working with ESA on industry-driven ISS utilization supports her role as the Project Manager for EDEN LUNA and as Subsystem Engineer for the CEA Technologies developed at DLR.



DR. CONRAD ZEIDLER has been a member of the EDEN research team since January 2011. For his industrial engineering diploma at the Technical University of Braunschweig, he specialized on aerospace engineering and has profound knowledge of trade-off analysis techniques (e.g., AHP). He is an expert in simulation methods and control software. Within EDEN, he is responsible for monitoring and controlling the plant growth and environmental parameters.



MICHEL FABIEN FRANKE is a systems engineer and project manager with a background in automotive (Volkswagen's work-study degree program) and space (University of Bremen) engineering. As part of the Planetary Infrastructures group, his research focuses on bio-regenerative life support systems (BLSS). Currently, he is working as the project manager for the CSA-DLR collaboration LAM-GTD and responsible for the Life Support work package of the ESA-funded project Deep Space Habitat Simulator (DSHS).



MARKUS DORN, a horticulture expert with an M.Sc. in plant sciences (University of Natural Resources and Life Sciences, Vienna), joined the team in 2017 to consult on horticultural matters. He has evaluated plant candidates, developed cultivation methods for fruit trees in planetary habitats, and organized the EDEN plant lab. Since 2023, he leads the Planetary Infrastructures lab.



KUNAL KULKARNI is a PhD candidate in the Synergetic Material Utilization research group and is working on the development of beneficiation technologies for the processing of lunar and Martian regoliths. He holds a M.Sc. in Space Engineering from the Technical University of Berlin. He joined DLR in 2022. His research expertise is in ISRU technologies and the design of space systems.



VINCENT VRAKKING studied at the Technical University of Delft in the Netherlands and holds a M.Sc. in aerospace engineering. He joined the EDEN team 2012 focuses on structure and subsystem design and the development of 3D-printing prototypes. He currently is the Lead System Engineer for the EDEN LUNA project.



JESS BUNCHEK is a botanist (B.Sc., Purdue University), agronomist (M.Sc., Penn State University), and PhD candidate in space systems engineering at the University of Bremen. She supported crop production on the International Space Station at NASA's Kennedy Space Center before joining the EDEN team as a DLR-NASA guest scientist in 2020. From 2020 to 2022, she overwintered at Neumayer Station III as the EDEN ISS greenhouse operator. Her research focuses on resource efficiency and the interaction between crops and the astronaut crew.



LUCA KIEWIET is a PhD candidate in the Synergetic Material Utilization research group and develops water extraction methods for the Moon and Mars. He holds a 2nd-level Master's degree in Space Systems Engineering from the Politecnico di Torino and a double degree in Space Science and Technology from Luleå University and Université Paul Sabatier Toulouse. He joined DLR in 2021. His expertise is ISRU and space mechanisms.



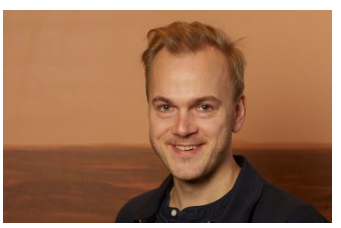
TOBIAS KORTH studied Aerospace Engineering at the Technical University of Dresden and completed his final thesis with the EDEN group in 2022. After rejoining the team in July 2024 as a subsystem engineer, he is responsible for the development of the Atmosphere Management Systems for the projects EDEN LUNA and LAM-GTD as well as implementing novelties in the EDEN plant cultivation laboratory.



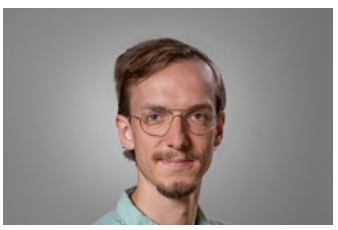
KYUNGHWAN KIM is a PhD researcher in the EDEN group at DLR, which he joined in 2022, and an External PhD Student at the TUM, Professorship of Human Spaceflight Technology. His research focuses on human factors engineering for lunar agriculture and habitation systems, including astronaut task performance, posture and movement analysis, workload assessment, and reduced-gravity simulation for the Lunar Agriculture Module. He holds an interdisciplinary background with an M.Sc. in Space Studies and an M.Arch., supporting research at the intersection of space systems, habitat design, ergonomics, and astronaut operations.



MATEO REJÓN LÓPEZ is a physicist (B.Sc., University of Granada, 2017) and aerospace engineer (M.Sc., Technical University of Delft, 2023). He has extensive experience in In-Situ Resource Utilization, including his work on lunar bricks at ESA's EAC and lead of the ESA-sponsored team at the Over the Dusty Moon Challenge held at the Colorado School of Mines. He joined SMU in March 2024, where he works as project scientist.



TOR BLOMQVIST studied Food Science and Agronomy at the Swedish University of Agricultural Sciences (SLU). Tor is investigating how to implement post-harvest management in space and is now working on the VESTA project. This initiative is aimed at establishing a state-of-the-art R&D infrastructure for closed-loop food production on the Moon and Mars by integrating innovative solutions for post-harvest management and food production.



CHRISTIAN SCHNORR studied Food Technology at the University of Applied Sciences in Fulda and currently holds a M.Sc. in food processing. He is a guest scientist within the EDEN group and is currently working on his PhD thesis investigating the utilization of inedible biomass from plant cultivation by rearing mealworms (Tenebrio molitor L.), including efficient ingestion, digestion, mass gain, and fiber reduction.



ALEXANDER BAGDAHN is an Aerospace Engineer at DLR's Institute of Flight Systems. As an external PhD candidate within the EDEN Initiative, he develops a dynamic, nonlinear optimization method for lunar polyculture agricultural systems - maximizing biomass output, while ensuring healthy plant development to enable resilient food production and optimized production planning.

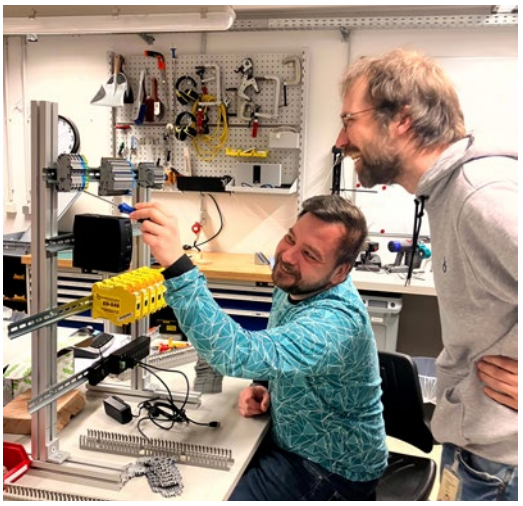
EDEN LUNA

MINECRAFT SYSTEMS ENGINEERING ... BUILD, BUILD, BUILD



Claudia Philpot, Lukas Wagner and Tabea Kayser in the workshop working for EDEN LUNA.

The year began with the preparation of the integration site for our engineers, which now includes a new tent providing effective protection of the equipment from adverse weather conditions. The Assembly, Integration, and Test (AIT) phase for EDEN LUNA in Bremen is now fully underway. It encompasses all major subsystems such as the integration of the Thermal Control System (TCS), the Atmospheric Management System (AMS), Lighting Control System (LCS) and plant observation and growth systems. One highlight was the TCS, designed, manufactured, and installed by the Swiss company Cerasus. The new rack system was connected with the internal cooling loops for the water recovery unit and the thermal removable system of the LCS. Also, significant progress has been achieved on the AMS assembly. Here the underfloor-, rack-, and the overhead air distribution ducts have been reworked and installed successfully. Core components such as fans, heaters, and new sensors have been integrated into the overall AMS. The data handling and control hardware as well as the power distribution unit have been assembled and integrated into the facility. The new distributed concept architecture, derived from the in-house satellite technology expertise, already showed design & operational benefits during first small tests. Better stability and easier user handling will be tested during a longer pre-delivery test campaign in Bremen. EDEN LUNA is planned to be attached to the LUNA facility in Cologne by early 2027.



Norbert Toth and Christian Strowik assembling power distribution and command and data handling hardware in the workshop.



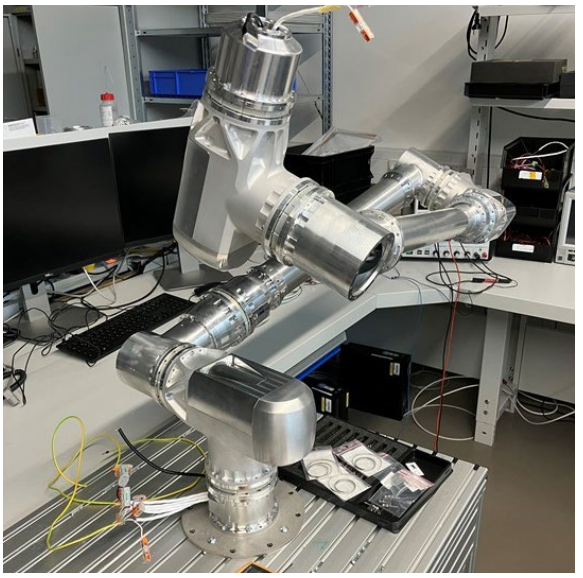
Tobias Korth in the Future Exploration Greenhouse.



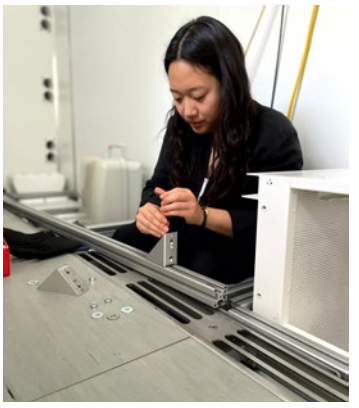
Vincent Vrakking installing air ducts inside the container.



Cecilia Ricci building up ITEM structures in the Service Section.



The EVE robotic arm in development at DLR Oberpfaffenhofen.

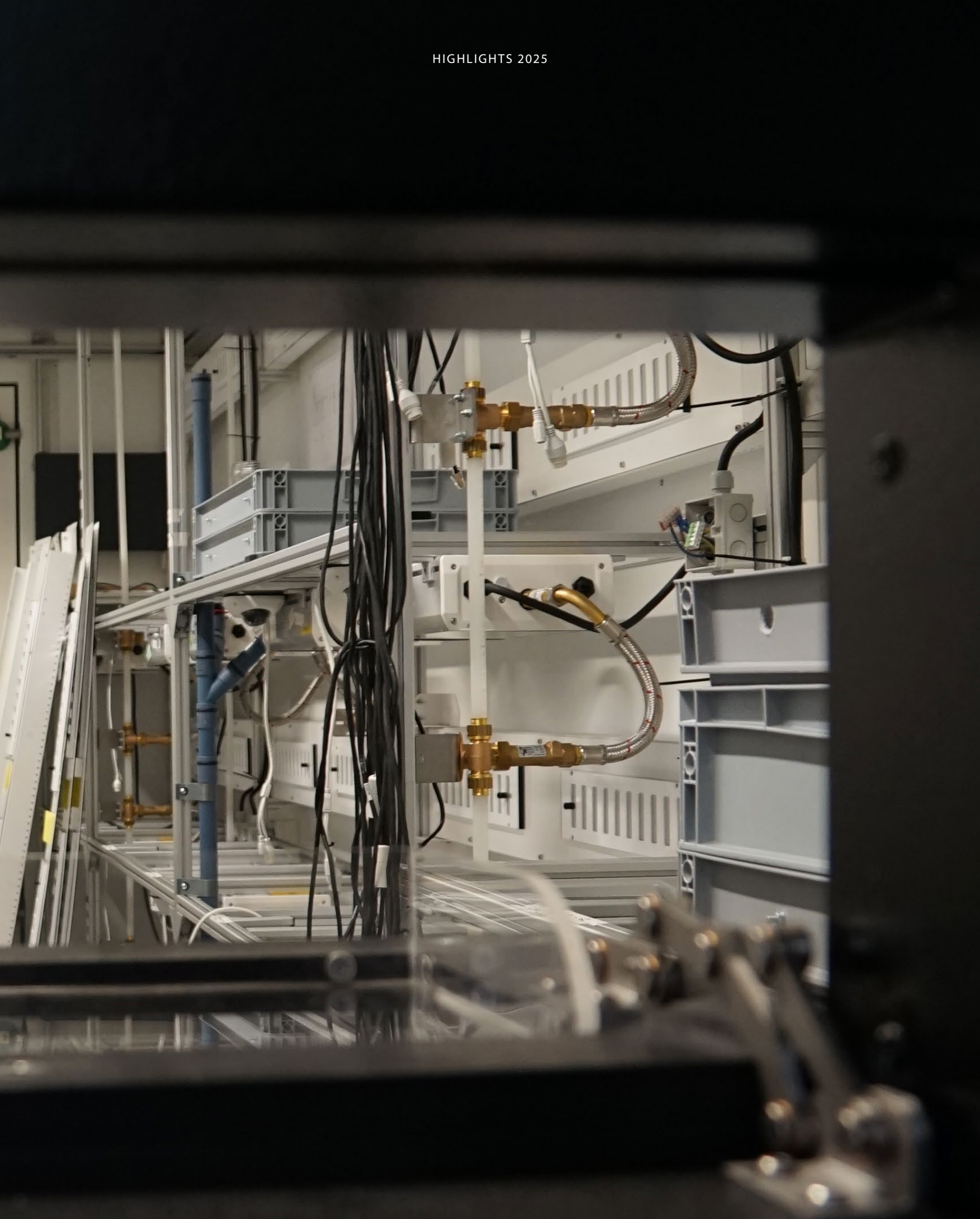


Jiwon Lee assembling the subsystem racks in the Service Section.

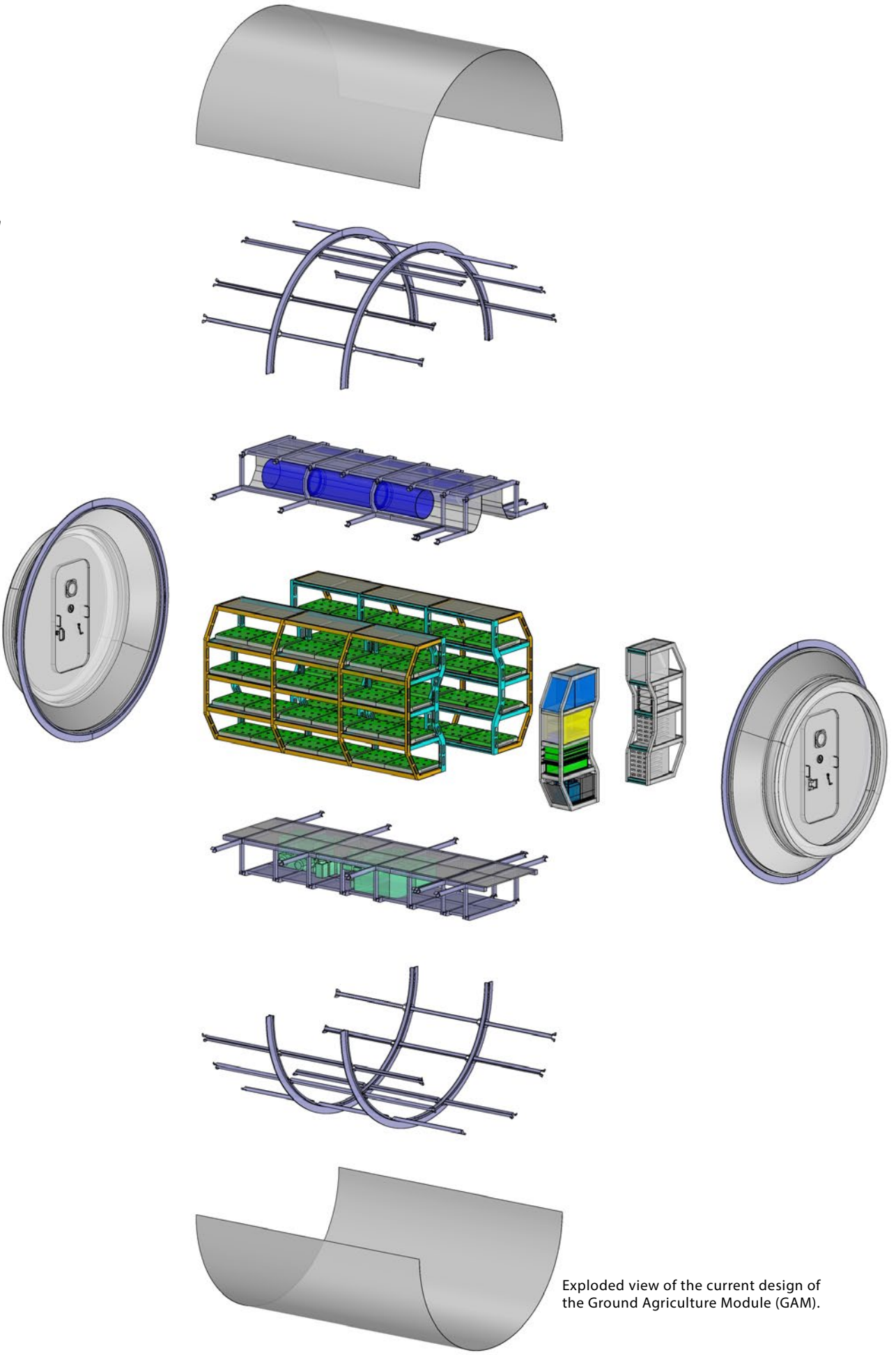


EDEN LUNA container and integration tent under construction.





An inside look into the (under construction) laboratory module of Future Exploration Greenhouse (FEG) of our EDEN LUNA container.



Exploded view of the current design of the Ground Agriculture Module (GAM).



Team photo with members from CSA, DLR and Canadian partners.

EDEN NEXT GENERATION

PAVING THE WAY FOR CREWED MISSION TO THE MOON

For the EDEN Next Gen. Project, the key milestone of 2025 was the inter-agency workshop held November 18th – 21st at the Canadian Space Agency headquarter in Montreal, Canada. More than 30 participants from Germany, Canada, and the USA collaborated in person and online to refine the project's high-level requirements. The primary objectives were to conduct an internal Preliminary Requirements Review (PRR) to consolidate system requirements and resolve open trade-offs, review timelines and partner alignment (DLR, CSA, NASA, NRC, and subcontractors), and strengthen inter-agency collaboration in preparation for the first Lunar Agriculture Module.

Beyond the workshop, the team made significant progress in multiple areas such as general sub system maturation and the establishment of a first set of operational procedures. The progress included e.g. the development of a workstation concept for in-module crop post-processing, prototyping of a redundant Air Treatment Unit with dual HVAC systems, detailed HabSim system design and simulation for inter-module resource exchange, and the creation of a crop selection model to simulate O_2 production and CO_2 and water uptake. In parallel, a preliminary VR model and physical mock-up were developed within a PhD project, while post-harvest management and food storage concepts were investigated in another doctoral study. Regular bi-annual Technical Interchange Meetings (TIM), monthly All-Eyes-On sessions, and bi-weekly team meetings ensured technical coordination and resolution of high-level design trade-offs.



Physical mock-up and VR-model of a Lunar Agriculture Module (LAM).



Tomato crops growing in Bioloops rack.

BIOLOOPS

TURNING WASTE INTO GROWTH

CIRCULAR SYSTEMS FOR THE FUTURE



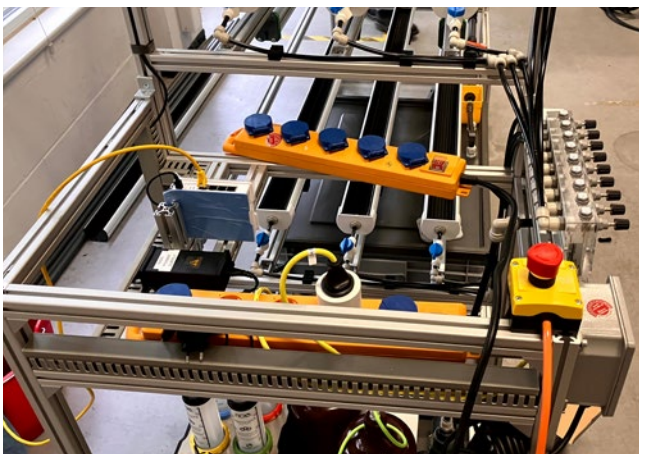
Jens Hauslage, Gerhild Bornemann, Markus Dorn & Luka Thies after delivering and integrating the Bioloops Test-stand to Cologne.

In 2025, the EDEN initiative reached an important milestone within the BioLoops project. The fully assembled experimental cultivation setup was successfully delivered to the Biobase at the DLR Institute of Aerospace Medicine in Cologne. The system, which was built in the workshop of the EDEN group, consists of three grow levels, each equipped with three individually controllable Nutrient Film Technique (NFT) irrigation channels. At the Biobase, the experimental setup was connected to the CROP loop, providing the urine-based nutrient solution. An integrated mixing computer enables exact control of the nutrient solution, provided the irrigation infrastructure.

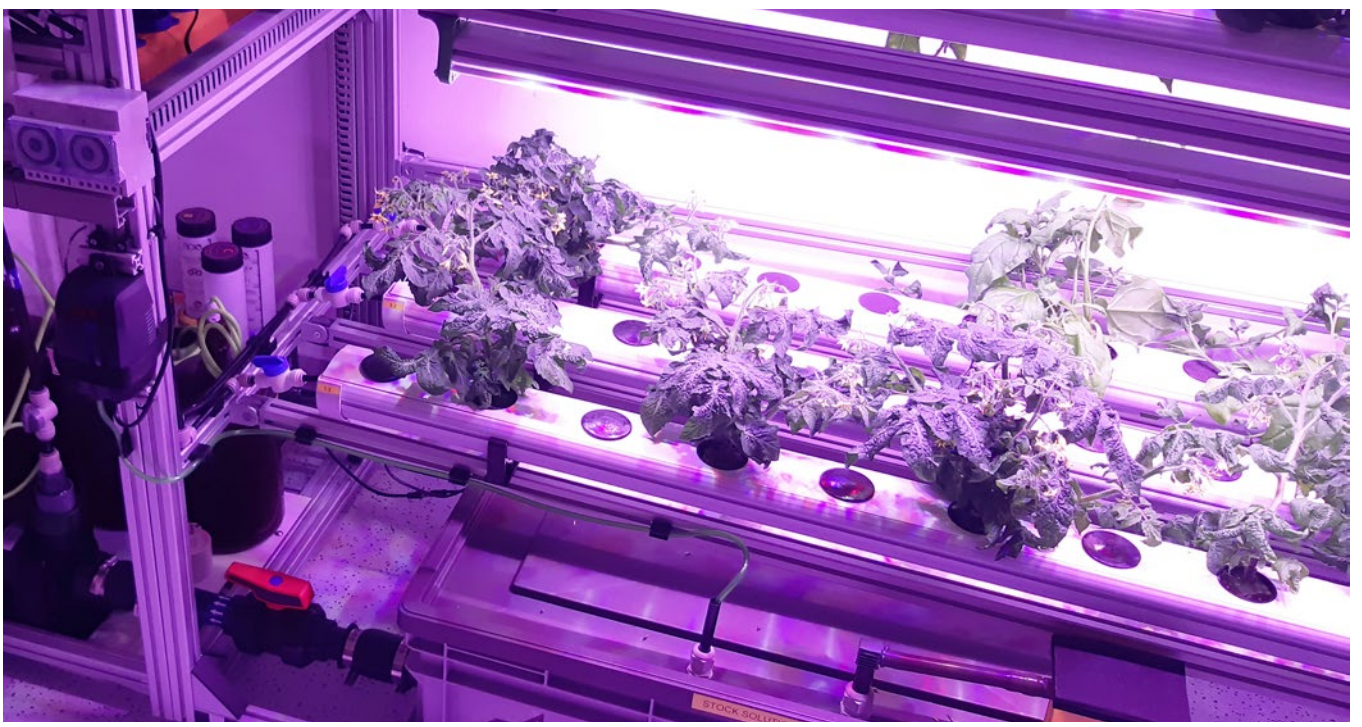
With the installation completed, the first plant growth trials were initiated. While the initial plan was to start with standard hydroponic nutrient solutions, the team in Cologne advanced more quickly than expected and already performed a successful cultivation test, using their own urine-based C.R.O.P.® solution. Tomato plants were grown under controlled conditions, demonstrating the functionality and flexibility of the new cultivation unit, representing a key step towards sustainable food production technologies for future habitats. Several research & validation campaigns are planned for the upcoming year.



Luka Thies taking final adjustments before packing the system for delivery to Cologne.

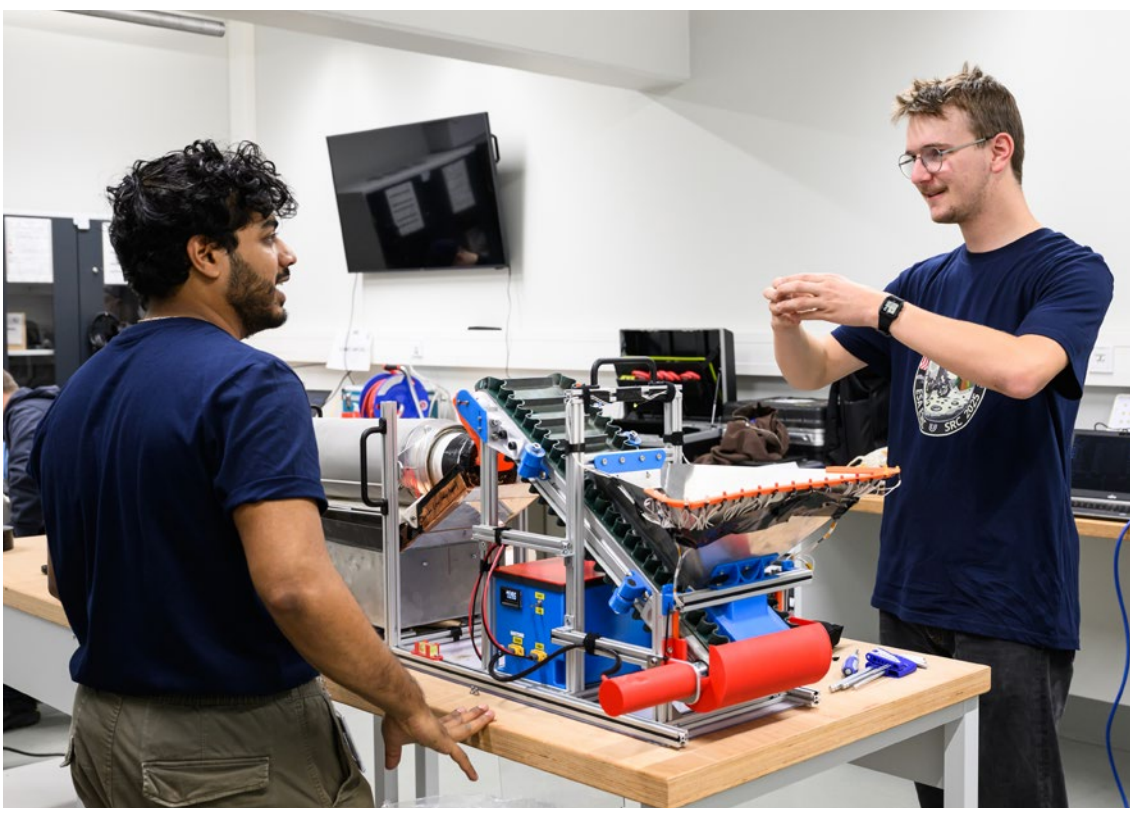


A closer look into the Bioloops control unit.



First growth of tomato crop after delivery of Bioloops to Cologne.

SMU and DFKI team at the LUNA control room during ESA's Space Resources Challenge field test. (Credits ESA DLR @Kulkarni, Kunal @Zabel, Paul)

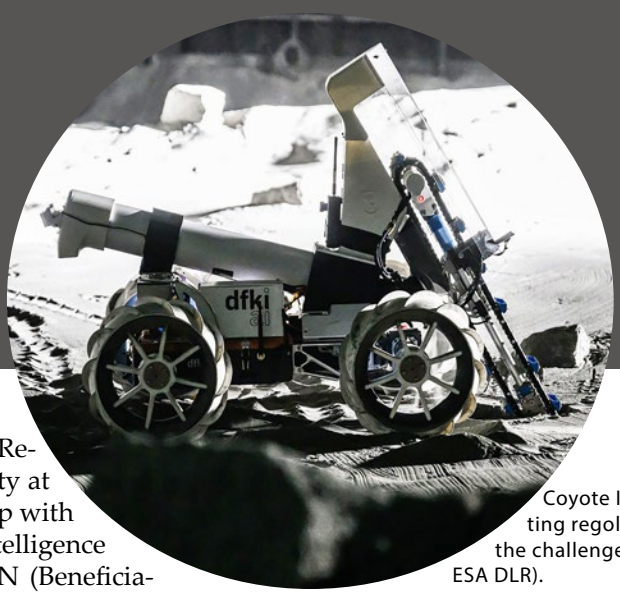


Kunal Kulkarni and Tim Gumbold assemble the equipment in LUNA's workshop prior to the field test.

DLR and DFKI team at DFKI's test facility with the fully integrated system. (excavation and beneficiation payload).

ESRIC CHALLENGE

FROM DUST TILL REGOLITH



Coyote III excavating regolith during the challenge (Credits ESA DLR).

The SMU group participated in the 2nd ESA Space Resources Challenge, held in the LUNA Analog facility at the DLR site in Cologne. The SMU group teamed up with colleagues from the German Center for Artificial Intelligence (DFKI). The consortium was called Team BREMEN (Beneficiation of REgolith and Mobile ExcavatioN). The ESA challenge was based on a future mission scenario in the 2040's when a permanent presence on the Moon has been established. The objective of the challenge was to test a realistic operational scenario for the collection and beneficiation (processing) of the lunar regolith as a precursor for future missions. The processed regolith can then later be used for extracting essential resources such as oxygen and metals.

As a part of this challenge, the goal was to excavate a minimum of 15 kg of surface regolith within 2.5 h and produce a beneficiated feedstock (in the particle size interval of 100 – 500 μm) of at least 5 kg. The maximum allowable system mass was 60 kg and the maximum allowable energy consumption was 300 Wh for all systems. Eight teams from different countries participated in the field test that took place from 13th – 17th October, 2025 in Cologne. Team BREMEN won the challenge and was awarded with an ESA contract of 500,000 € for further development of Regolith conveyance, beneficiation and transport technology.



DLR and DFKI team inside the LUNA hall at the end of the field test run (Credits ESA DLR).





Schematics of Aeolis' concept.

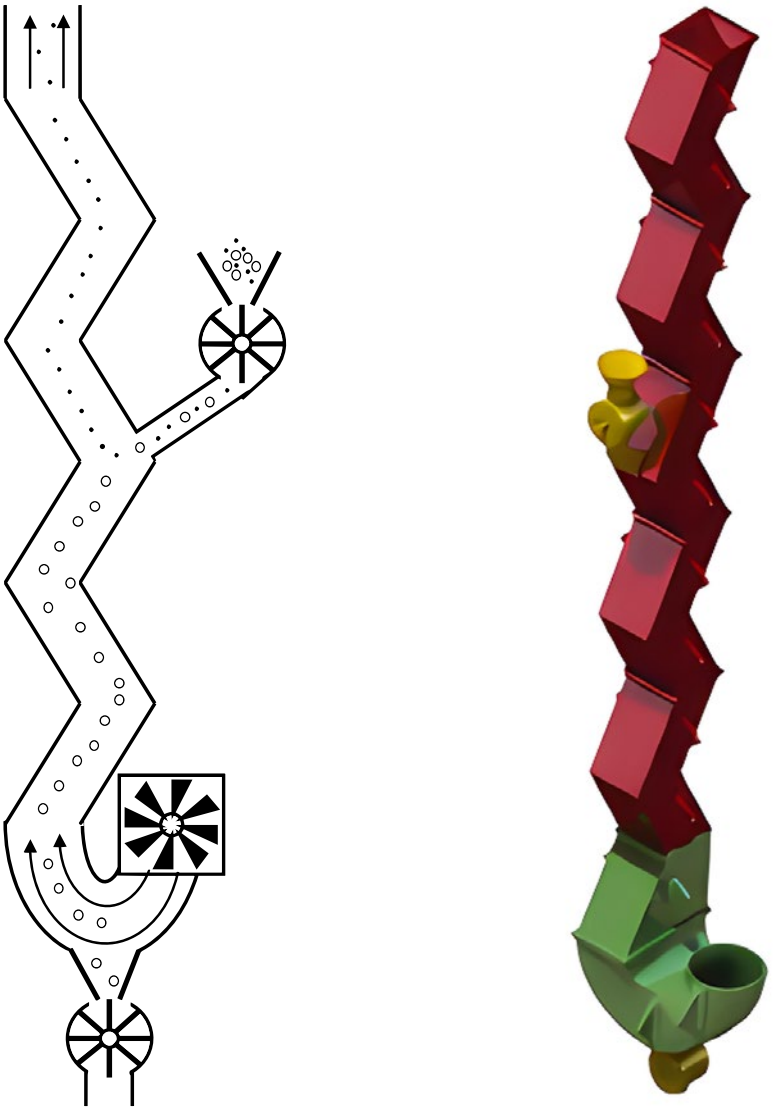
AEOLIS

HARNESSING THE MARTIAN BREEZE FOR SMARTER REGOLITH HANDLING.

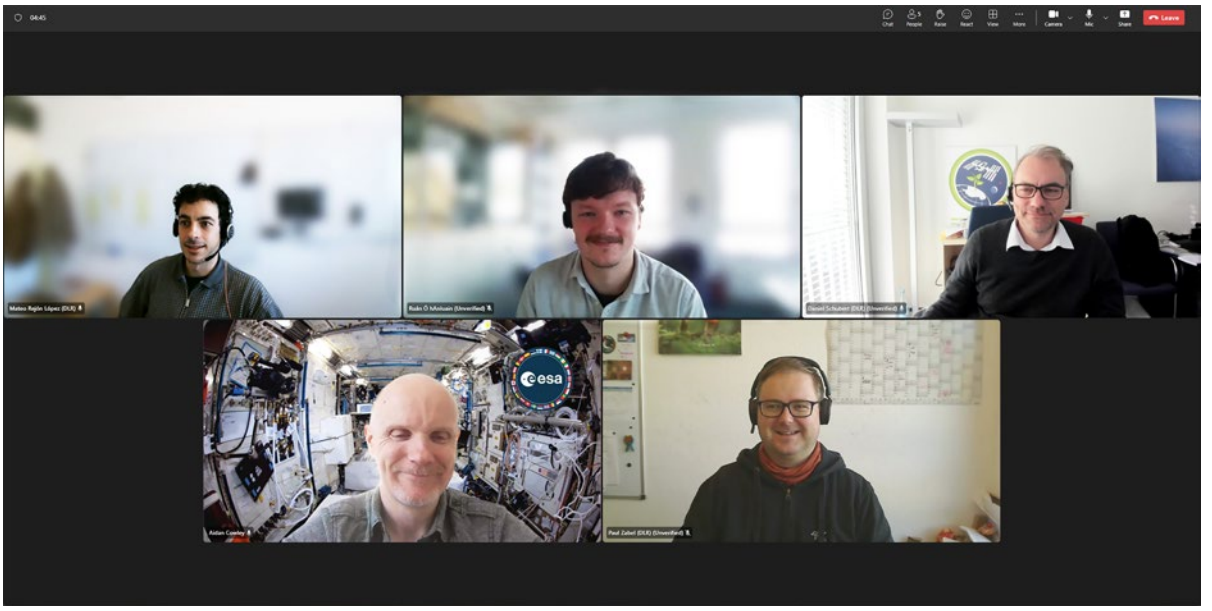
Unlike the Moon, Mars has a CO2-dominated atmosphere with an average surface pressure of 6 mbar, which has been mostly studied for oxygen extraction. However, gas flow has the potential of transporting regolith particles, and naturally sort it by size as smaller grains are more easily lifted and transported than larger ones. This process is known as saltation.

The Aeolis project explores an innovative approach: Can we adapt technologies like blowers, wind tunnels, air classifiers, and suction devices to leverage Martian atmospheric gases for fine regolith collection, size sorting, and vertical transport? Specifically, a modified suction device could capture fine regolith suitable for additive manufacturing, while blowers and wind tunnels could enable efficient transport and beneficiation to produce a well-defined feedstock for subsequent resource extraction processes. Funded via ESA-OSIP, the Aeolis project aims to explore the disruptive potential of this concept as a first step within the ISRU process chain.

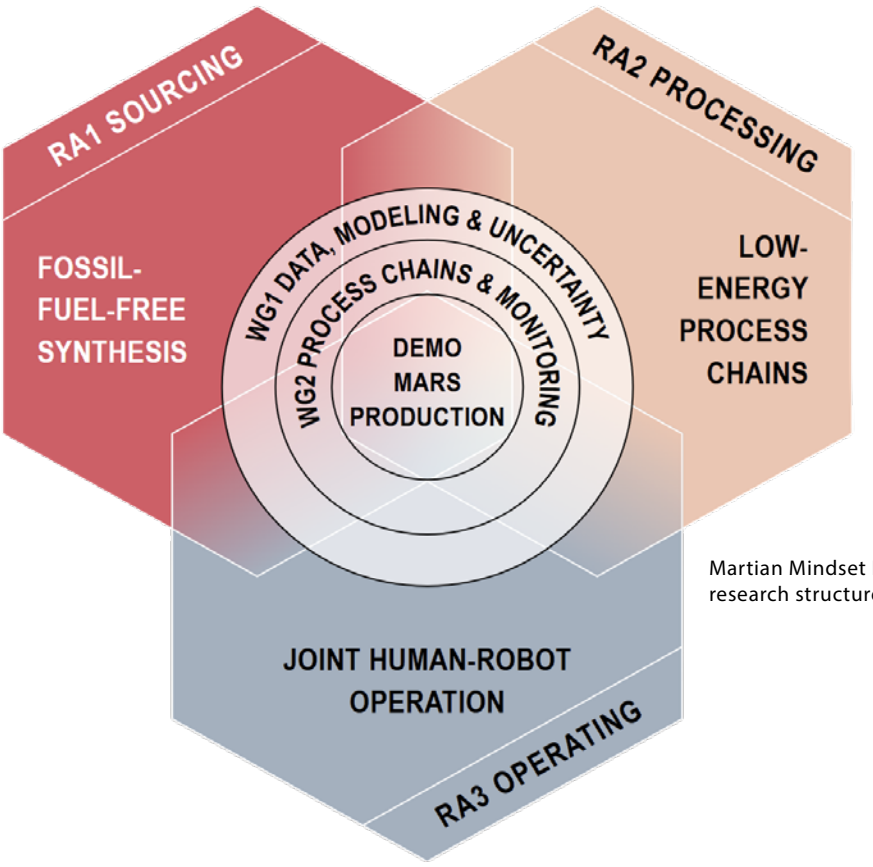
Throughout 2025, the team conducted simulations to evaluate the efficacy of pneumatic systems for the Martian surface. The computational results demonstrated that air classifiers offer a highly advantageous and versatile solution for sorting regolith by particle size. These findings were presented to ESA officials during the project's mid-term review on 3rd of November. The team aims to develop an experimental breadboard setup to validate these classifiers using Martian regolith simulant.



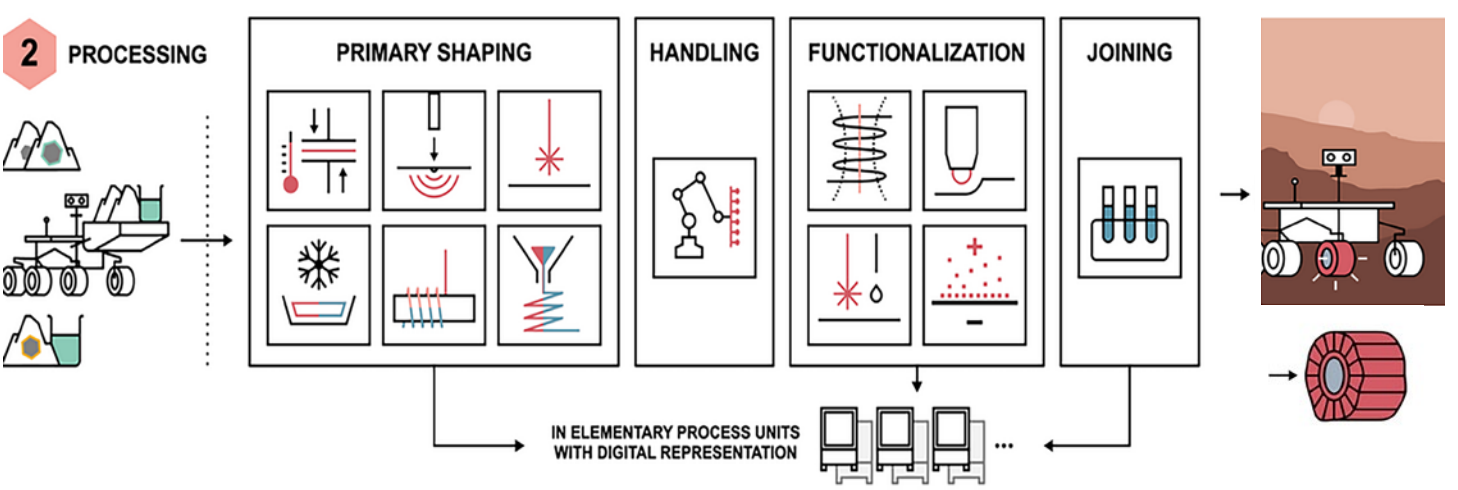
Zig-zag air classifier for regolith beneficiation schematics (+CAD rendering).



Mateo Rejon Lopez, Ruan O Hanluain, Daniel Schubert, Adain Cowley and Paul Zabel in the Aeolis mid-term meeting.



Martian Mindset Excellence Cluster research structure.



Martian Mindset research topics within research area 2 (processing) focusing on low-energy process chains.



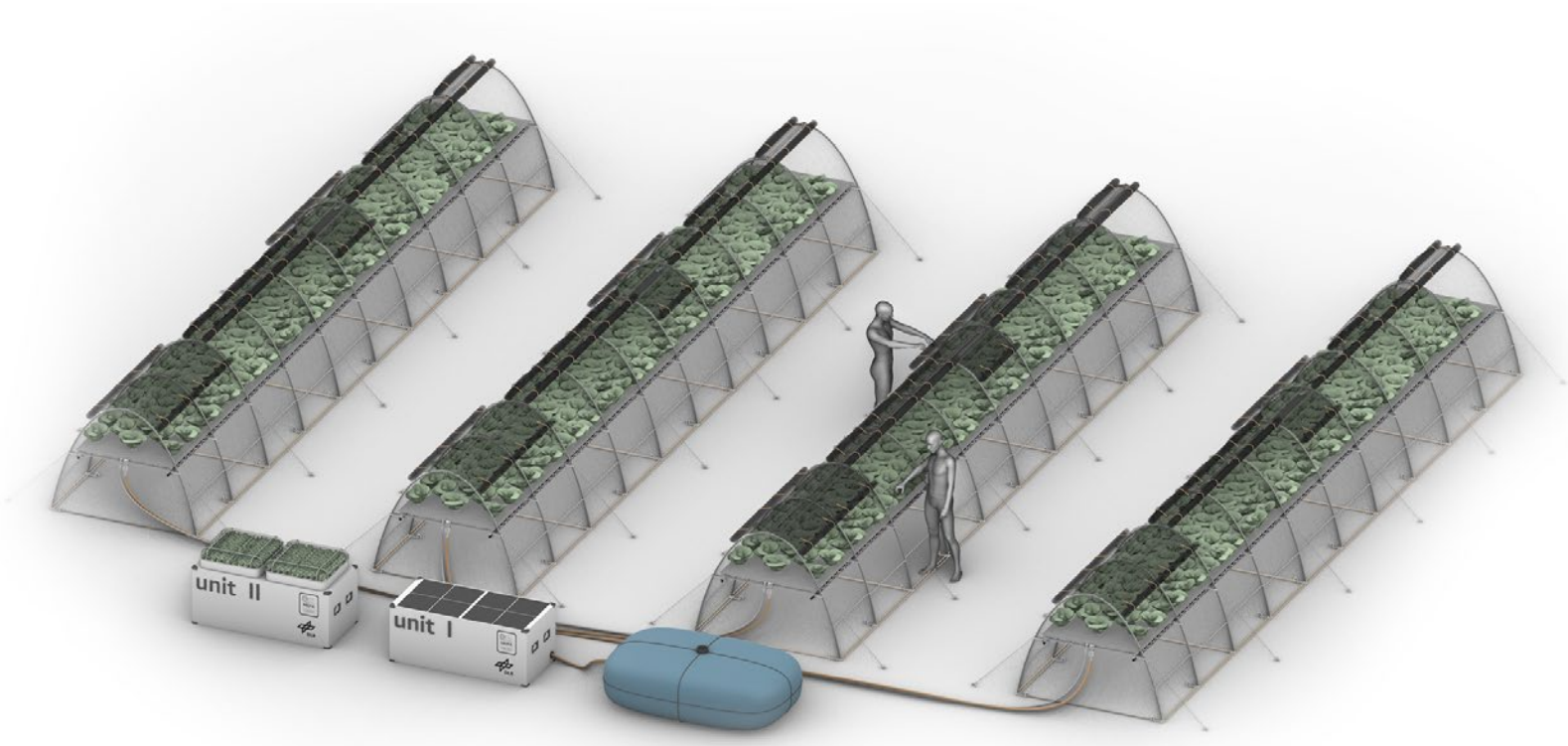
Martian Mindset PIs and contributors celebrating the selection.

EXCELLENCE INITIATIVE

MAKING MORE WITH LESS - RETHINKING PRODUCTION FOR A RESOURCE - SCARCE WORLD

After three years of preparing, the University of Bremen – with its partners - won the Cluster of Excellence proposal The Martian Mindset: A Scarcity-Driven Engineering Paradigm.
It argues that conventional Earth-based manufacturing, built on assumptions of abundant resources and fossil fuels, is unsustainable, and that Mars, with its scarcity of materials, energy, human labor, and information, provides the ideal testbed for a new paradigm. The Martian Mindset was selected to receive funding in May 2025 with a project start in 2026. The Cluster aims to develop methods for sourcing raw materials from Martian regolith, processing them into "enough-to-use" parts, and operating largely autonomous, remotely supervised production systems capable of coping with uncertainty.
The research program is structured into three Research Areas: Sourcing, focusing on electrochemical, microbial, and photocatalytic synthesis routes for metals, polymers, and chemicals; Processing, which develops low-energy, impurity-tolerant process chains; and Operating, which designs production systems run by human-robot teams under conditions of information scarcity. A central demonstrator will showcase the complete Mars-like production chain by fabricating enough-to-use rover wheels from locally sourced materials.
SMU's contribution to the Cluster is the development of an air classifier for regolith particle size classification using Martian atmospheric gases. Several different processes will be investigated and the most promising one will be transferred into a hardware prototype for experimental testing under laboratory conditions, but also under Martian atmospheric conditions inside one of the Dusty-Thermal-Vacuum Chambers of the MarsLabor at the ZARM of the University Bremen.

Universität Bremen



New and updated artist impression of the fully expanded MEPA unit. (≈50 m² of cultivation area).

MEPA

HELPING PEOPLE IN NEED SHOULD BE OUR GOAL, RIGHT!

Following a successful market analysis in 2024, the EDEN group continued developing the MEPA system (Mobile Emergency Plant-Growing Application) into a lightweight, fully deployable concept. Several master's theses supported the progress, including a detailed cost analysis and a primary market study that refined demand estimates. Based on these results, the team submitted the new MEPA+ concept to the DLR Transfer Call 2025 and won funding!
The new transfer project aims to advance MEPA+ to Technology Readiness Level 6. A key objective is reducing production costs, in line with price expectations confirmed by stakeholders such as the World Food Programme, THW, Red Cross, and NGOs. Another focus is identifying a strategic manufacturing partner for the Seed Cultivation Mat (SCM), the core component of the system. The long-term goal is envisioned as a spin-off, a planned DLR-based start-up developing and distributing mobile, solar-powered MEPA systems for autonomous food production in crisis regions. These systems provide humanitarian organizations with a rapidly deployable, sustainable solution for medium-term food security.

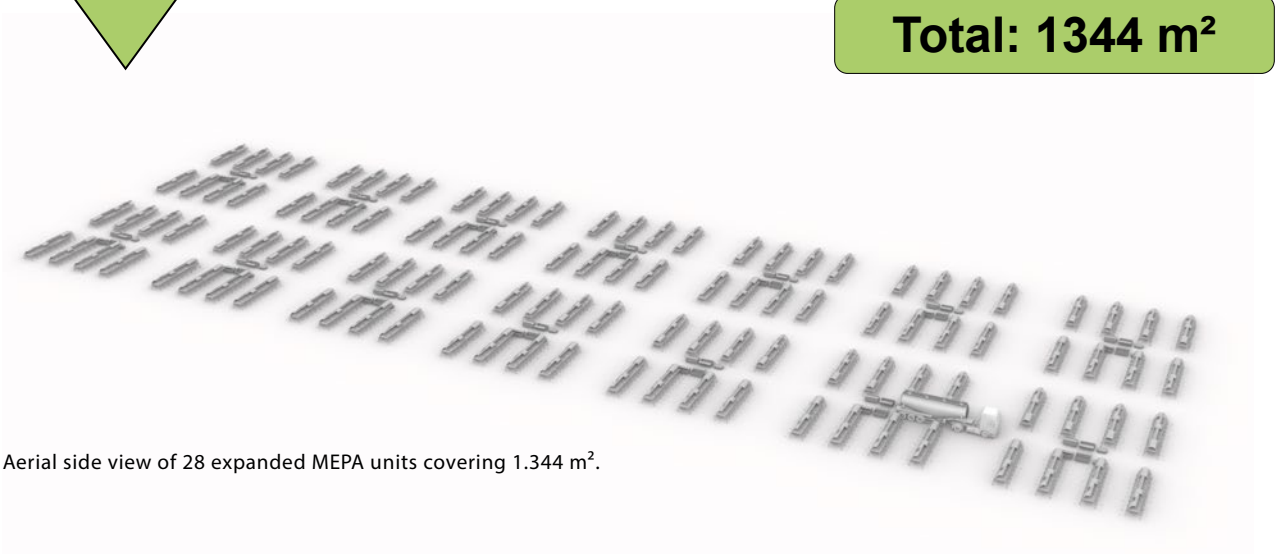




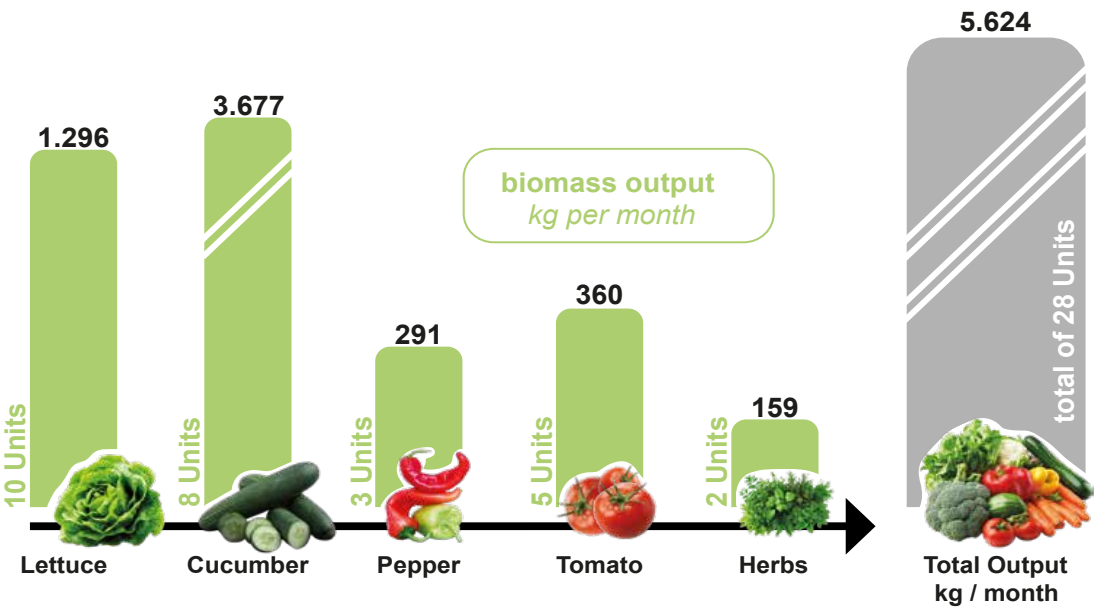
28 MEPA Units being unloaded from one 40' Container.

5,6 t per month
2800 people => Micro-Nutrients

Total: 1344 m²



Aerial side view of 28 expanded MEPA units covering 1.344 m².



Initial estimate of harvest potential from 28 MEPA units.



Artist's Impression of a MEPA Unit in a Refugee Camp Setting.


unit 1
MERA
t 2
MERA

FURTHER HIGHLIGHTS

FIND OUT WHAT ELSE HAPPENED DURING THE YEAR:



Kick-off meeting of the Deep Space Habitat Simulator (DSHS) project in Bremen.

DEEP SPACE HABITAT SIMULATOR (DSHS)

In 2025, the EDEN group began to work on a new third-party project, called the Deep Space Habitat Simulator (DSHS) – a pre-phase A study that investigates the derisking needs for Moon-Mars transfer vehicles. The project is scheduled to run for nine months and is conducted together with Spartan Space (Prime) and Liquifer Space Systems. The project was kicked off by a five-day co-engineering workshop in July at the Concurrent Engineering Facility (CEF), where the whole team met with ESA representatives in-person. Within the project, DLR is focusing on bioregenerative life support systems.

CHIBADAI INTERNATIONAL WORKSHOP

From 9 to 11 March 2025, the EDEN research team was invited, together with NASA and ESA, to the 1st International Workshop on Space Agriculture and Horticulture hosted by Chiba University. Established in January 2023, its Research Center for Space Agriculture and Horticulture advances autonomous and sustainable food production for lunar and Martian missions, in collaboration with Japan Aerospace Exploration Agency and multiple academic and industrial partners.
Kyunghwan Kim presented the EDEN Initiative's technological progress, highlighting validated Antarctic greenhouse operations, system automation advances, and the maturation of controlled environment agriculture for bioregenerative life support systems, while outlining the transition toward EDEN LUNA, LAM GTD, and EDEN.



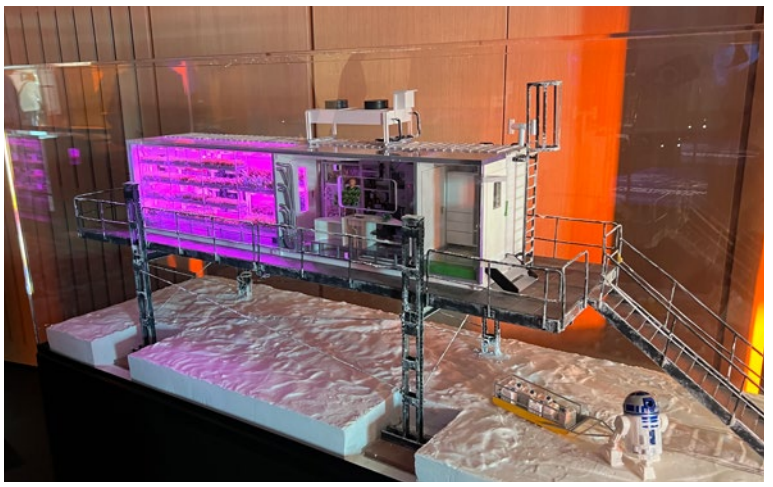
Kyunghwan Kim at the International Workshop on Space Agriculture and Horticulture in Chiba (Japan).

EDEN ISS @THÜRINGEN AUSSTELLUNG

At the Thüringen Ausstellung 2025 in Erfurt, the EDEN ISS mock-up was presented as an example of advanced greenhouse technology developed for extreme environments and space research. The exhibition, held from March 8 to 16, 2025, brought together more than 700 exhibitors and served as a major platform for showcasing innovation and future-oriented technologies. Prime Minister Dr. Mario Voigt attended the event and personally visited the exhibit, taking time to explore the mock-up and learn more about its applications.



Prime Minister Dr. Mario Voigt taking a look at the EDEN ISS mock-up at the Thüringer exhibition opening.



The current EDEN ISS Mock Up.

EDEN ISS AT GERMAN EMIGRATION CENTER

The EDEN ISS mock-up was exhibited at the German Emigration Center as part of the special exhibition “Verlockung Weltall. Auswandern auf Mond, Mars, Venus?”. The exhibition explored the idea of human migration beyond Earth, linking historical emigration with future space exploration. Within this context, the EDEN ISS mock-up illustrated how advanced greenhouse systems could support life in extreme environments and enable long-term missions in space.

LABORATORY UPDATE

In 2025, the Planetary Infrastructures laboratory made significant advances. Within the BLSS domain, the overall aeroponic system completed a year of operation, testing crops for the EDEN LUNA phase and providing insights under dynamic conditions. Various student projects explored new irrigation and cultivation methods. The improved telemetry & command system also increased automation and reliability. Within the ISRU domain, significant work for the ESA ESRIC Space Resources Challenge was conducted, demonstrating the stationary regolith beneficiation system. At the end of 2025, the ISRU domain will move to a new laboratory location. This way, both groups will have more lab space for conducting their research efforts.



Tagetes patula (Marigold) cultivated under controlled laboratory conditions.



Group photo including Claudia Philpot, Vincent Vrakking, Soichi Morix, Yoshitoki Tanakax, Hayato Okumax, xKyunghwan Kim, Tor Blomqvist, Michel Franke, Markus Dorn and Jiwon Lee.

GERMAN-JAPANESE WORKSHOP

The EDEN team at the DLR Institute of Space Systems hosted representatives from JAXA and JGC for an expert exchange on future collaboration in space agriculture and bioregenerative life support systems. Discussions focused on sustainable, resource-efficient food solutions for long-duration missions, inspired by Japan's Space Foodsphere consortium. The visit included updates on the LUNA and LAM-GTD projects, a tour of the EDEN facilities, and in-depth dialogue on joint perspectives for sustainable food production in human space exploration.

CEA FIELD FACILITY

At the beginning of the year, the EDEN group conducted a one-week Concurrent Engineering (CE) study on behalf of and together with the department of Automatic Control and System Dynamics of the TU Chemnitz under the lead of Prof. Streif. With a team of 33 experts from all over Germany an interdisciplinary technology platform for Controlled Environments Agriculture research in Saxony was developed. The conception focused on preliminary layout, automation, modelling and control of biological growth processes. The goal is a long-term, flexible and adaptable system (e.g. for plant, insect, fungal or algal growth chambers) that is scalable and can control and react quickly to all environmental conditions and dynamic changes.



Group photo: EDEN team and other participants of the CEA Field Study.



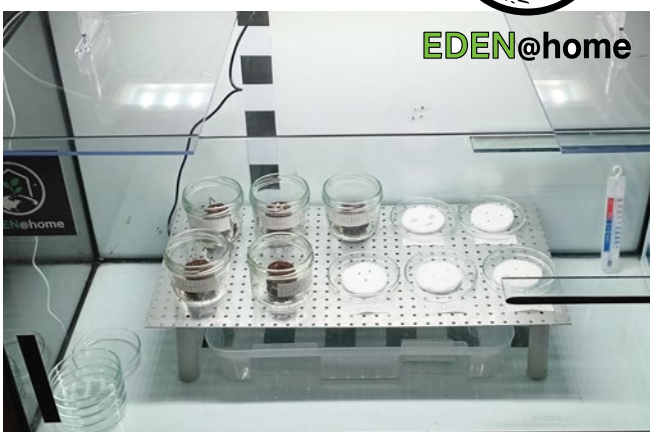
Participants of the EDEN LUNA User Workshop during a presentation.

EDEN LUNA USER WORKSHOP

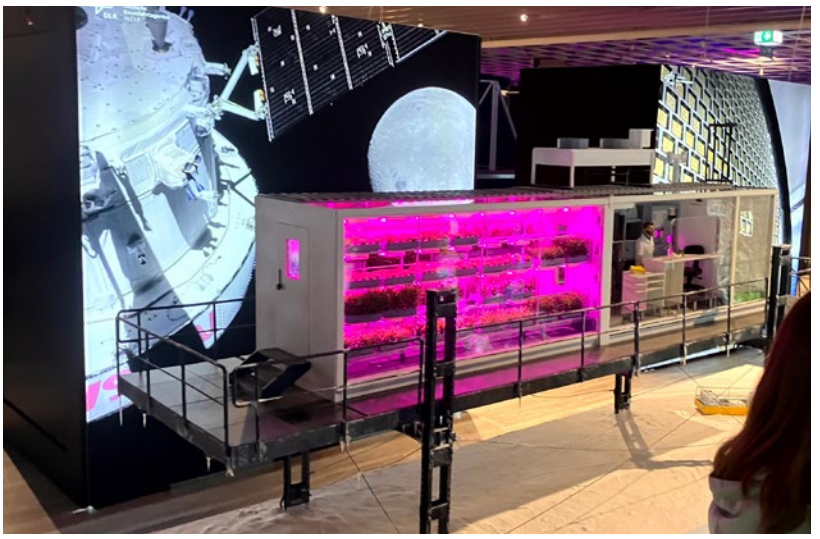
In December 2025, the EDEN LUNA project hosted a high impact utilization workshop that underscored our commitment to international and cross-sectoral collaboration. With presenters from academia, national space agencies and both the space and terrestrial private sectors, the event served as a global forum for identifying the many upcoming use cases for the LUNA facility. This synergy between diverse stakeholders is now directly informing the technical strategy and funding roadmap for our future food system demonstrators.

EDEN @HOME

In 2025, the EDEN Group guided the nationwide student project “Digitale Drehtür” with an online holiday program on “Plants in Space.” Elementary students planted seeds in small closed chambers like aquariums, conducted experiments under extreme conditions such as constant light, darkness, or cold, and carefully recorded their observations. They also learned about plants, photosynthesis, and plant cells with a space-related perspective. Experts from EDEN ISS provided insights into real research, and students will soon experiment with “Mars sand” on their growth pads. The final presentation underlined the students’ engagement and the impressive results. The program continues in the year 2026 promising more exciting experiments and young researchers.



Experimental setup within the holiday education program “Plants in Space.”



Vision of an outer hull from the Lunar Agriculture Module (LAM).

SPACE HUB

From 17th October to the end of November 2025, the former Kaufhof building in Bremen was transformed into the interactive Space Hub Bremen exhibition, showcasing spaceflight, Earth observation, navigation, and communication. The exhibition was accompanying the ESA ministerial council meeting that takes place every four years. The EDEN group participated as a partner and displayed the EDEN ISS mock-up, demonstrating sustainable food production in closed systems for long-duration missions. The Space Hub emphasized Bremen’s role as a major aerospace center, with over 140 companies and 20 institutes involved in the space sector.

LUXEMBOURG VISIT

Between the 4th and 6th of November the SMU team took part of a collaboration meeting at the European Space Resources Innovation Center (ESRIC) in Luxembourg. ESRIC is the world’s first innovation center entirely dedicated to space resources and one of the key players in the field. During the visit, the team presented the research that is carried out in Bremen, learnt about the projects at ESRIC and explored collaboration opportunities, fostering the SMU’s position in the European space resources ecosystem. Furthermore, the team visited the premises of Maana Electric, a company based in Luxembourg that aims to develop solar cells from lunar materials.



SMU team: Kunal Kulkarni, Paul Zabel, Mateo Rejon Lopez and Luca Kiewiet in Luxembourg.

KEY FIGURES - 2025

JOURNALS

Fountain, Luke L., Gilliham, Matthew, Amitrano, Chiara, Arouna, Nafiou, Barker, Richard J., Böhmer, Maik, Braun, Markus, Brereton, Nicolas J. B., Brocato, Rebecca L., Bunchek, Jess Marie, Canaday, Emma L. J., Caplin, Nicol, Castaño, Paola A., Chamberlain, Christine, Decourteix, Mélanie, Del Bianco, Marta, De Micco, Veronica, Doherty, Colleen J., Franke, Michel Fabien, Fuentes, Sigfredo, Gilroy, Simon, Harrison, Lynn, Hasenstein, Karl H., Hauslage, Jens, Herranz, Raúl, Iyer-Pascuzzi, Anjali, Izuma, Dylan Shun, Kirima, Junya, Kiss, John Z., Legué, Valérie, LLoyd, James P. B., Maffei, Massimo E., Massa, Gioia D., Meyers, Alexander, Perera, Imara, Poulet, Lucie, Roychoudry, Suruchi, Sena, Giovanni, Shippen, Dorothy E., Stoochnoff, Jared, Takahashi, Hideyuki, Wyatt, Sarah E. and Blancaflor, Elison B. (2025) Expanding frontiers: harnessing plant biology for space exploration and planetary sustainability. New Phytologist, Seiten 1-14. Wiley. doi: 10.1111/nph.70662. ISSN 1469-8137.

Gaiser, Luis, Beblo-Vranesevic, Kristina, Van Houdt, Rob, Fahrion, Jana, Gillet de Chalonge, Louise, Bunchek, Jess Marie, Zabel, Paul, Schubert, Daniel and Rettberg, Petra (2025) The EDEN ISS mobile test facility microbiome changes by cleaning and continued use. Frontiers in Microbiomes, 4, Seite 1608732. Frontiers Media S.A.. doi: 10.3389/frmbi.2025.1608732. ISSN 2813-4338.

Wache, Henning, Kiewiet, Luca, Zabel, Paul and Blum, Jürgen (2025) Investigation of the Thermal Conductivity of Dry and Icy Lunar Regolith Simulants. Journal of Geophysical Research: Planets. Wiley. doi: 10.1029/2025JE009084. ISSN 2169-9097.

Ikeya, Kosuke, Guerrero-Gonzalez, Francisco J., Kiewiet, Luca, Cardin, Michel-Alexandre, Cilliers, Jan, Starr, Stanley and Hadler, Kathryn (2025) Hybrid lunar ISRU plant: a comparative analysis with carbothermal reduction and water extraction. Acta Astronautica. Elsevier. doi: 10.1016/j.actaastro.2025.02.004. ISSN 0094-5765.

Kiewiet, Luca, Svenja, Fälker and Zabel, Paul (2025) A Review of Lunar Water Extraction Technologies: Comparison, Classification, and Research Gaps. Space and Planetary Resources, 1. Springer Nature. doi: 10.1007/s44461-025-00005-4. ISSN 3059-4502.

PEER-REVIEWED CONFERENCE PROCEEDINGS

Korth, Tobias, Vrakking, Vincent, Philpot, Claudia, Schubert, Daniel, Franke, Michel Fabien, Toth, Norbert, Röser, Adrian, Strowik, Christian, Ksenik, Eugen, Aksteiner, Niklas and Bunchek, Jess Marie (2025) Environmental Control Systems for EDEN LUNA Plant Production Module. In: International Conference On Environmental Systems, ICES 2025. International Conference On Environmental Systems, ICES 2025, 2025-07-13 - 2025-07-17, Prague, Czech Republic.

Kim, Kyunghwan, Schubert, Daniel, Detrell, Gisela and Cowley, A. (2025) Human Factors & Behavioral Performance Evaluation Framework for Intravehicular Activities under Simulated Lunar Gravity: Focus on the Lunar Agriculture Module (LAM). In: SpaceCHI 2025, 130. Dagstuhl. SpaceCHI 2025, 2025-06-23 - 2025-06-24, Cologne, Germany. doi: 10.4230/OASIcs.SpaceCHI.2025.14.

Zabel, Paul, Kiewiet, Luca, Kulkarni, Kunal Mandar, Rejon Lopez, Mateo and Fälker, Svenja (2025) ISRU Technology Developments at the DLR Institute of Space Systems. In: International Conference On Environmental Systems, ICES 2025. International Conference On Environmental Systems, ICES 2025, 2025-07-13 - 2025-07-17, Prague, Czechia.

Kim, Kyunghwan, Vrakking, Vincent, Bunchek, Jess Marie and Schubert, Daniel (2025) Developing Operational Procedures and Experimental Design for the Lunar Agriculture Module-Reduced Gravity Simulator (LAM-RGS). In: 54th International Conference on Environmental Systems. 54th International Conference on Environmental System 2025, 2025-07-13 - 2025-07-17, Prague, Czech Republic.
Stoochnoff, J., Zeidler, Conrad, Franke, Michel Fabien, Vrakking, Vincent, Maiwald, Volker and Schubert, Daniel (2025) Canadian Food Production Subsystem Designs for a Lunar Agriculture Module - Ground Test Demonstrator (LAM-GTD). 54th International Conference on Environmental Systems, 2024-07-13 - 2024-07-17, Prague, Czechia.

Bullard, Savannah, Shelton, Annie, Tucker, Rachel, Meyers, Alexander, Fritsche, Ralph, Blomqvist, Tor Adrian, Gobel, Dane and Herblet, Angela (2025) Feeding The Final Frontier: Lesson and Actions Derived from the Deep Space Food Challenge. In: Proceedings of the International Astronautical Congress, IAC. International Astronautical Federation (IAF). 76th International Astronautical Congress (IAC), 2025-09-29 - 2025-10-03, Sidney, Australia. ISSN 0074-1795.

Fonseca Prince, Andre, Specht, Caroline, Friedl, Werner, Klüpfel, Leonard, Manaparampil, Ajithkumar Narayanan, Philpot, Claudia, Schubert, Daniel and Leidner, Daniel (2026) EVE: A Preliminary Study of an Autonomous Robotic Assistant for Plant Cultivation in Future Lunar Greenhouses. In: 2025 International Conference on Space Robotics, iSpaRo 2025. IEEE. International Conference on Space Robotics (iSpaRo 2025), 2025-12-01 - 2025-12-04, Japan.

NORMAL CONFERENCE PROCEEDINGS/ PRESENTATION

Gross, C., Al-Samir, M., Bishop, J. L., Poulet, F., Postberg, F., Schubert, D. and Walter, S.H.G. (2025) Reconnaissance of in-situ resources for future crewed missions to Mars. 56th Lunar and Planetary Science Conference, 2025-03-10 - 2025-03-14, Houston, USA.

Kulkarni, Kunal Mandar and Zabel, Paul (2025) Targeted mineral beneficiation of lunar regolith: Feasibility assessment and next steps. In: Space Resources Week. Space Resources Week 2025, 2025-05-19 - 2025-05-21, Luxembourg.

Rejon Lopez, Mateo and Kiewiet, Luca (2025) LUWEX Preliminary Results: Water Extraction, Capturing, and Purification from Lunar Icy Regolith Simulant. Space Resources Roundtable XXV, 2025-06-03 - 2025-06-06, Golden (CO), USA.

Kiewiet, Luca, Zabel, Paul, Rejon Lopez, Mateo and Kulkarni, Kunal Mandar (2025) LUWEX Highlights: A Complete Process Chain Demonstration of Lunar Water Extraction and Purification. Space Resources Week 2025, 2025-05-19 - 2025-05-21, Luxembourg.

Kulkarni, Kunal Mandar, Zabel, Paul, Gumbold, Tim, Fälker, Svenja, Reershemius, Siebo, Rejon Lopez, Mateo, Zhao, Zhongqian, Yüksel, Mehmed, Dominguez, Raúl, Bresser, Andreas, Meder, Manuel and Suresh, Amrita (2025) Beneficiation of REgolith and Mobile ExcavatioN (Team BREMEN). In: 18th Symposium on Advanced Space Technologies in Robotics and Automation (ASTRA-2025). Zenodo. 18th Symposium on Advanced Space Technologies in Robotics and Automation (ASTRA-2025), 2025-10-07 - 2025-10-09, Leiden, Netherlands. doi: 10.5281/zenodo.17313903.

Blomqvist, Tor Adrian (2025) Centralized Testing Facility for Space Food Production, Handling, and Bioregenerative Processes. 2025 The MELiSSA conference: current and future ways to closed life support systems, 2025-10-07 - 2025-10-09, Granada, Spain.

Vrakking, Vincent, Philpot, Claudia, Schubert, Daniel, Aksteiner, Niklas, Strowik, Christian, Ksenik, E., Sasaki, Kaname, Toth, Norbert, Korth, Tobias, Bunchek, Jess Marie, Bornemann, Gerhild, Holbeck, Ilse Marie, Fonseca Prince, Andre and Rewicki, Ferdinand (2025) EDEN LUNA - Science and Technology Demonstration Platform. 2025 MELiSSA Conference - Current and future ways to close life support systems, 2025-10-07 - 2025-10-09, Granada, Spain.

Zhao, Zhongqian, Yüksel, Mehmed, Kulkarni, Kunal Mandar, Dominguez, Raúl, Fälker, Svenja, Gumbold, Tim, Bresser, Andreas, Suresh, Amrita, Zabel, Paul, Rejon Lopez, Mateo, Reershemius, Siebo and Meder, Manuel (2025) Beneficiation of REgolith and Mobile ExcavatioN (Team BREMEN). In: 18th Symposium on Advanced Space Technologies in Robotics and Automation (ASTRA-2025). Zenodo. 18th Symposium on Advanced Space Technologies in Robotics and Automation (ASTRA-2025), 2025-10-07 - 2025-10-09, Leiden, Netherlands. doi: 10.5281/zenodo.17313903 .

INVITED TALKS

Kim, Kyunghwan (2025) The EDEN Initiative at the German Aerospace Center (DLR). Seminar for Kyung Hee University, 2025-07-11, Online (South Korea).

Kim, Kyunghwan (2025) The EDEN Initiative at the German aerospace center (DLR). CHIBADAI International Workshop on Space Agriculture and Horticulture 2025, 2025-03-09 - 2025-03-11, Chiba, Japan.

Kim, Kyunghwan (2025) Human in Space: Designing for Exploration. Lecture at TU Munich, 2025-04-29, Munich, Germany.

Zabel, Paul (2025) Synergetic Material Utilization - ISRU activities at the DLR Institute of Space Systems - Regolith Beneficiation and Water Extraction. Course about Life Support Systems and ISRU, 2025-07-01, Stuttgart, Germany.

Zabel, Paul (2025) Synergetic Material Utilization - ISRU activities at the DLR Institute of Space Systems - Regolith Beneficiation and Water Extraction. Seminar for PhD candidates, 2025-04-24, Munich, Germany.

Bunchek, Jess Marie (2025) From space to Antarctica: plant testing to support crews in extreme environments. 7th Plants & People Conference, 2025-09-09 - 2025-09-10, Potsdam-Golm, Deutschland.

Philpot, Claudia (2025) Auswandern auf Mond, Mars? EDEN LUNA a science and technology demonstration. [sonstige Veröffentlichung]

Philpot, Claudia (2025) Bio-Regenerative Life Support Systems Example EDEN Analog. [sonstige Veröffentlichung]

DIPLOM-/ MSC.-/ BSC.-THESIS

Guastavino, Paul (2025) Development of the Atmosphere Management System for the Lunar Agricultural Module - Ground Test Demonstrator LAM-GTD. Masterarbeit, Technical University of Munich.

Moos, Niklas (2025) Conceptual system design of a Habitat-Simulator (HabSim) for the operation of the Lunar Agriculture Module-Ground Test Demonstrator (LAM-GTD). Diplomarbeit, Technische Universität Dresden.

Erlinghagen, Ruth Tabea (2025) Optimizing Lunar Crop Systems: Selection and Cultivation Models for Leafy Greens and Microgreens. Bachelorarbeit, Hochschule Osnabrück.

Weser, Saskia (2025) A Multidisciplinary Framework for Managing Plant Health in Extraterrestrial Horticulture. Masterarbeit, Hochschule für Technik und Wirtschaft Dresden (HTW Dresden).

Chobert-Passot, Prève (2025) Human-Centered Design of a Workstation for the Lunar Agriculture Module. Masterarbeit, International Space University.

POSTER

Kulkarni, Kunal Mandar (2025) Lunar Regolith to Oxygen: Advancing Oxygen Extraction for In-Situ Propellant Production. International Conference on Environmental Systems, 2025-07-14, Prague, Czech Republic.

SPECIALS

Zabel, Paul: Reviewer for journal „Space and Planetary Resources“, ISSN: 3059-4502.

Kiewiet, Luca, Reviewer for: „Applied Thermal Engineering“, ISSN: 1359-4311.

Zeidler, Conrad: Co-organizer of the SpaceCHI 4.0 A Conference on Human-Computer Interaction for Space Exploration, (2025)

Kiewiet, Luca:, Reviewer for „International communication in heat and mass transfer“, ISSN: 0735-1933.

Schubert, Daniel: Member of the ICES International Committee 204 ‚Bioregenerative Life Support'.

Kiewiet, Luca: Reviewer for: „ Advances in Space“, ISSN: 0273-1177.

Vrakking, Vincent: Review activities for the „54th International Conference on Environmental Systems (ICES) “, Prague, Czech Republic (2025)

Zeidler, Conrad: Review activities for paper submission of the „SpaceCHI 4.0 A Conference on Human-Computer Interaction for Space Exploration“, European Astronaut Centre (2025)

Kiewiet, Luca, Reviewer for: „Acta Astronautica Review“ (4x), ISSN: 0094-5765.

Rejón López, Mateo: Review activities for paper submission of the „54th International Conference on Environmental Systems (ICES)“ (2x), Prague, Czech Republic (2025)

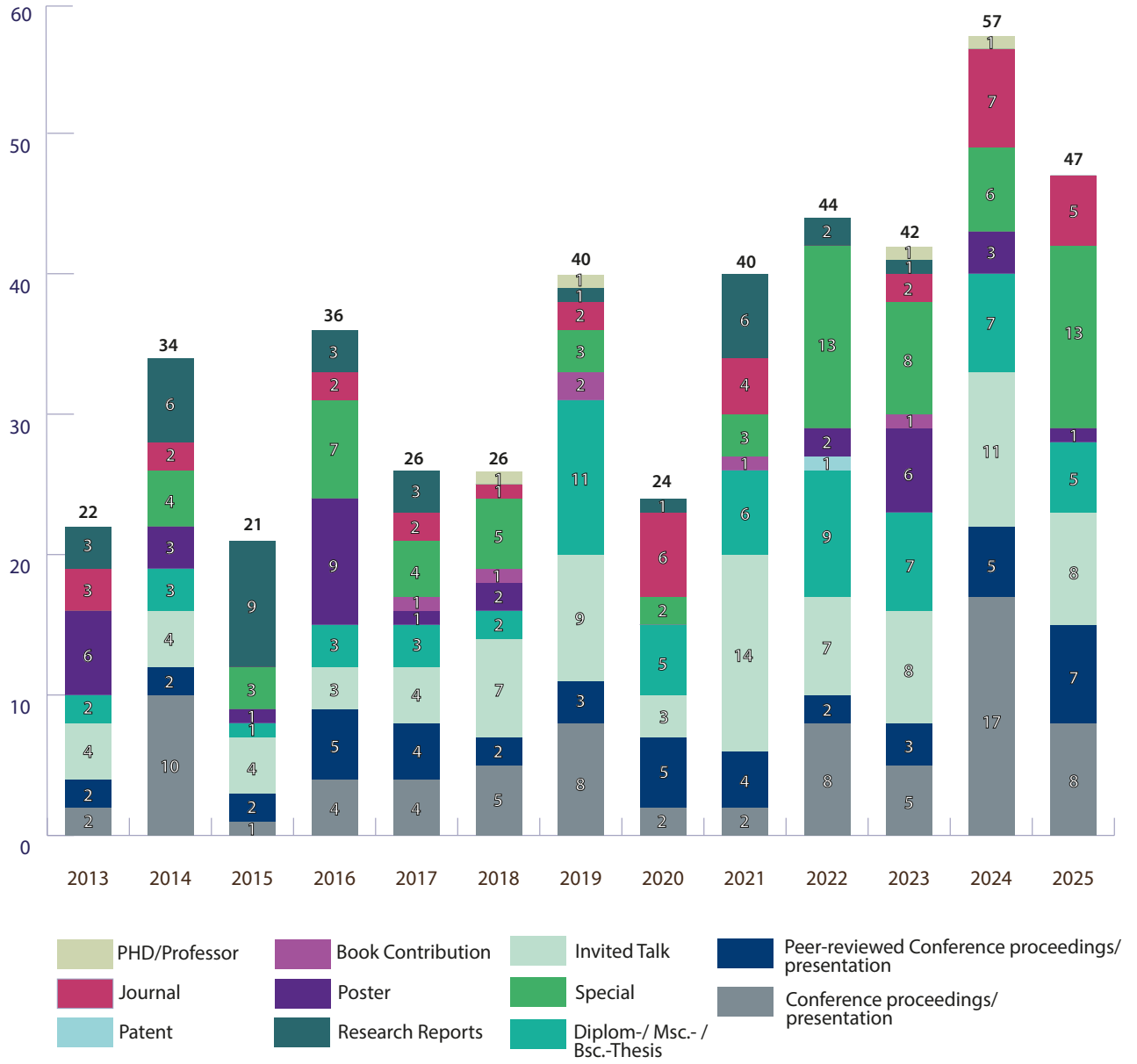
Zeidler, Conrad: Review activities for paper submission of the „54th International Conference on Environmental Systems (ICES)“, Prague, Czech Republic (2025)

Kulkarni, Kunal: 2nd ESA Space Resources Challenge, 14 - 18 October 2025, LUNA Analog Facility, Cologne, Germany.

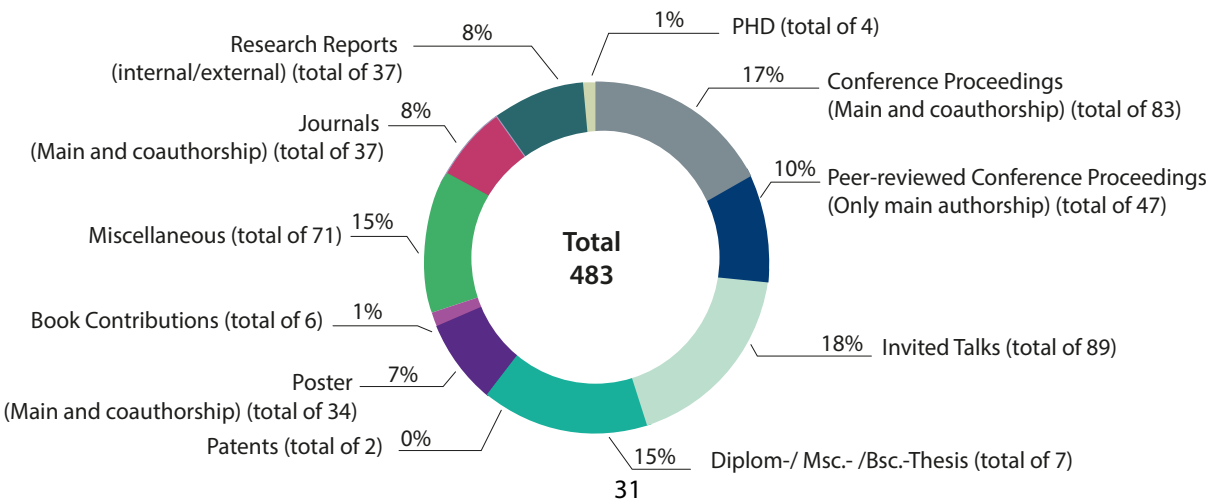
Kulkarni, Kunal: Review activities for paper submission of the „54th International Conference on Environmental Systems (ICES)“, Prague, Czech Republic (2025)

SUMMARY KEY FIGURES

PUBLICATIONS & KEY FIGURES 2013-2025

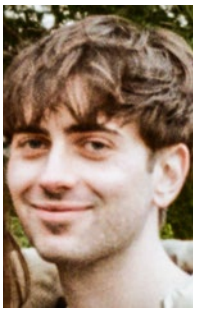


TOTAL PUBLICATIONS & KEY FIGURES 2011–2025

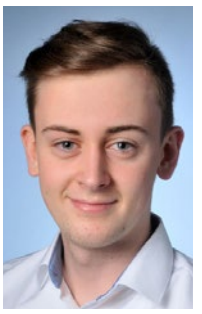


PLANETARY INFRASTRUCTURES

Without the assistance and help of highly-motivated students, the success of the EDEN Initiative would not have been possible! Therefore, the entire EDEN team would like to say thank you. See below what the student's tasks were and what they are doing now:



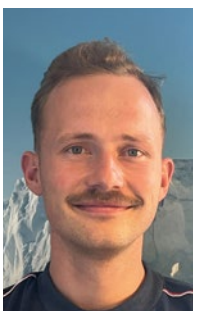
JULES GÖTTE studies communication, media, and cultural studies at the University of Bremen. He joined the EDEN team in June 2024, focusing on PR and outreach. With a background in videography and media, he enhances the team's presence on digital and analog platforms, working on social media, video, and print while reaching out to individuals, companies, collaborators, and other DLR departments.



BJARNE KOPECNY, a student of production engineering specializing in aerospace at the University of Bremen, joined the DLR team in late 2022 through a university project. Initially involved in developing a business plan for a startup focusing on a terrestrial application of space greenhouse systems, Bjarne transitioned into a more hands-on role as a student assistant, focusing on the development of a new control system for the MEPA system as part of his bachelor's thesis.



LUKA THIES is a master's student in Space Engineering at University Bremen. After discovering his passion about bio-regenerative life support systems during his bachelor's program at FH Aachen, he joined the EDEN team as a student assistant in May 2024. Supporting the team in the EDEN laboratory, the MEPA project and the EDEN LUNA project, he is assisting with engineering tasks and in the workshop. Additionally, he is also helping to maintain the 3D-printing farm.



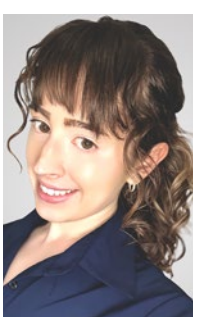
SIERT HAMERS, a Space Engineering student at TU Delft, who has joined the EDEN LUNA team for an internship. He is focused on developing innovative methods to enhance plant health monitoring systems. A significant part of his work involves upgrading camera technology to more effectively detect signs of plant stress. In addition, Siert is responsible for maintaining the 3D print farm, ensuring all equipment operates smoothly.



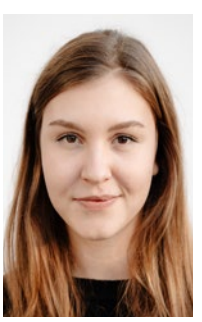
SVENJA FÄLKER completed her dual studies at Hochschule Bremen in 2021 and is currently studying aerospace engineering at master's level at TU Dresden. She joined the Group in July 2023 and uses her previous work experience to support the LUWEX project. There she supports the development, design and testing of a stirring mechanism for lunar regolith and the programming of a LabView software for the data handling and control system of the extraction and liquefaction subsystem.



ALWYN SAJU is an M.Sc. Space Engineering student at the University of Bremen, focusing on "Human space exploration and habitation." In 2022, he began a DLR project on terrestrial applications of space greenhouse technology. Since 2024, he has been a student assistant with the Planetary Infrastructures team, contributing to projects MEPA, EDEN Next-Gen and BIOLOOPS.



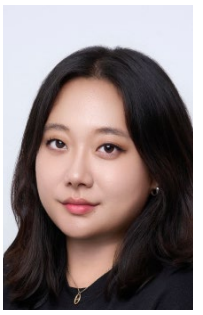
JENNIFER GÖTTE studies communication, media and law at the University of Bremen.
She joined the EDEN team in February 2025 as a student assistant and is responsible for various tasks related to PR and outreach. With a background in creative writing, law and video editing, she supports the team with designing layouts for print products such as the yearly highlights, managing social media accounts, and communicating with companies and collaboration partners.



SASKIA WESER is a master's student in Horticulture at the University of Applied Sciences Dresden (HTW Dresden), with a strong interest in extraterrestrial plant production and advanced cultivation systems. As part of her master's thesis, she is developing a comprehensive plant protection concept for space greenhouses to ensure the supply of fresh food. She is also responsible for all horticultural tasks in the laboratory and conducts experiments to cultivate less-explored plant species and varieties in the aeroponic system at the EDEN Lab.



CECILIA RICCI studies Aerospace Engineering at Politecnico di Torino, specializing in aeromechanics and systems. She contributed to the EDEN team by working on the development and optimization of the Nutrient Delivery System and the Light Control System (LCS), improving technologies for plant growth in space environments.



JIWON LEE studies Aerospace Engineering at the University of Stuttgart as a Master's student. She joined the EDEN team in February 2025 as a student assistant supporting system engineering activities. Within the EDEN LUNA project, she contributes to Assembly, Integration, and Verification (AIV), mission operations, and overall system engineering tasks.



NATHALIE BEGER studies biology at the University of Bremen. She officially joined the EDEN department in November 2025, but was supporting the team in the ESA Space Resources Challenge since May 2025. With a background as an electronics technician, she is now working on the EDEN LUNA project, assisting in the electronics field.



TABEA KAYSER studies mechanical engineering with a specialization in aerospace engineering at the Dresden University of Technology. She joined in February 2025 for an internship in the EDEN LUNA project. After that, she contributed to the LAM-GTD project by working on the Air Exchange Unit for her diploma thesis.



MARTINA FRANCESCA LICANDRO is a master's student in Space Engineering at TU Delft. She joined the SMU Group in September 2025 as a student intern, contributing to the validation activities of the LUWEX project. Her work focuses on simulations using COMSOL Multiphysics and the validation of experimental data, supporting the development of a validated model that can be used to explore and assess alternative design approaches.



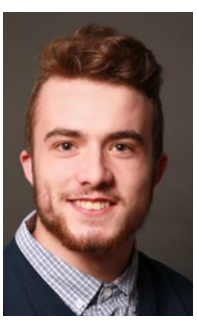
NIKLAS MOOS studies aerospace engineering at Dresden University of Technology (TUD) and is currently writing his Diploma Thesis at DLR to finish his studies. Starting in March 2025, he joined the EDEN team and develops a System Architecture for the Habitat Simulator (HabSim), which is part of the LAM-GTD. In his work, he focuses on a measuring system between the Airlock Module and the Ground Agriculture Module.



MAX POHL is currently writing his master's thesis within the LAM-GTD under the supervision of Kim Kyunghwan and Daniel Schubert. His work focuses on "Mobile Working Platform Design for Lunar Agriculture Module", aiming to facilitate and optimally support the work of operators within the module.



DAVID HAEFNER is an aerospace engineer (B.Sc. from TU Dresden) and master's student in space engineering at the University of Bremen. He works as a student researcher at the German Aerospace Center (DLR) in Bremen, contributing to the LUWEX project, which focuses on lunar water extraction and beneficiation technologies for mining lunar regolith to produce in-situ oxygen and metal feedstocks.



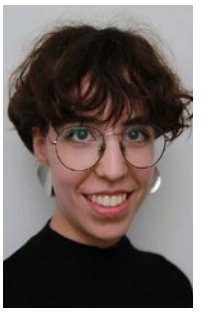
LUKAS WAGNER studies aerospace engineering at the University of Stuttgart. He joined the EDEN team in October 2025, focusing on setting up experiments in the EDEN LUNA project. With a background in life support systems and mechanical engineering, he contributes to developing and optimizing experimental setups that support plant cultivation under lunar analog conditions.



RUÁN Ó HANLUAIN studies Space Engineering at TU Delft in the Netherlands. He joined the SMU team in September 2025 for a six-month internship, primarily working on the Aeolis project and as well as supporting the ESRIC ISRU challenge. His daily routine involves investigating pneumatic regolith collection systems and trying to find ways to apply them on Mars, as well as assisting the preparations of hardware for the ESRIC challenge alongside DFKI.



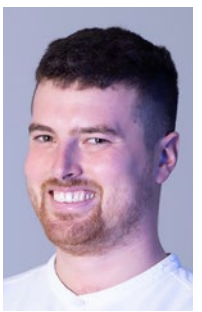
RUTH TABEA ERLINGHAGEN is studying Applied Plant Biology - Horticulture (B.Sc.) at the Osnabrück University of Applied Sciences. She is an intern at DLR and writing her bachelor thesis at the institute. In her work she is involved in plant cultivation in the EDEN Lab and helps with experiments on plant cultivation in hydroponic systems. The purpose of the research there is to ensure the supply of fresh food as part of projects such as MEPA, EDEN LUNA and EDEN Next Gen.



PRÈVE CHOBERT PASSOT studied architecture in Paris and pursued a Master of Space Science (MSc) from the International Space University (ISU) in Strasbourg. At DLR, she is writing a thesis on the design of a workstation for EDEN Next Gen. She also supported the EDEN LUNA Team, primarily by creating renders.



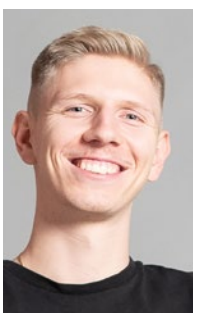
KILIAN ORYSIK studies aerospace engineering at the University of Applied Sciences Bremen. He joined the DLR Institute of Space Systems in July 2025 as a working student. His work is focused on assisting in the daily running of the EDEN laboratory.



PAUL GUASTAVINO is a multidisciplinary Engineer currently studying Earth Oriented Space Science and Technology at the TUM. Graduated from studying Civil and Environmental Engineering at Cardiff University and Environmental Engineering and Sustainable Energy at the URV.



LUIGI BERTHOLD is currently studying Architecture in the Master's program at the University of Innsbruck in Austria, where he is working on his master's thesis, which focuses on living and researching in extreme environments. He joined the M.E.P.A. team in 2024 and is responsible for the Design and Visual Task. His work focuses on the design and development of a system for rapid food supply in humanitarian emergency situations such as natural disasters, political unrest, or crises driven by climate change.



SIMON SCHWEINSTETTER is a Master's student in Architecture at the University of Innsbruck, where his research focuses on living in extreme environments and future-oriented extreme scenarios. Since joining the M.E.P.A. team in 2024, he has been responsible for design and visual strategy. His work concentrates on developing food supply systems for humanitarian emergencies, including natural disasters, political conflicts, and climate-induced crises.



STAY TUNED FOR 2026

During the Bioloops integration campaign. This picture was taken in the old wind tunnel, which is now the Biobase at DLR Cologne.

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DLR at a glance

DLR is the national aeronautics and space research centre of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport and security is integrated into national and international cooperative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the federal government for the planning and implementation of the German space programme. DLR is also the umbrella organisation for the nation's largest project management agency.

DLR has approximately 8000 employees at 20 locations in Germany: Cologne (headquarters), Augsburg, Berlin, Bonn, Braunschweig, Bremen, Bremerhaven, Dresden, Goettingen, Hamburg, Jena, Juelich, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Oldenburg, Stade, Stuttgart, Trauen, and Weilheim. DLR also has offices in Brussels, Paris, Tokyo and Washington D.C.

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Address:
Robert-Hooke-Str. 7
D-28359 Bremen
Phone: +49 (0) 421 24420-1136
Fax: +49 (0) 421 24420-1150
E-mail: daniel.schubert@dlr.de
http://www.dlr.de/irs/desktopdefault.aspx/tabid-11287/

DLR.de

Editors:
Prof. Dr. Daniel Schubert
Dr. Paul Zabel
Dr. Conrad Zeidler
Vincent Vrakking
Michel Franke
Kunal Kulkarni
Claudia Philpot
Luca Kiewiet
Markus Dorn
Jess Bunchek
Tor Blomqvist
Tobias Korth
Kyunghwan Kim
Christian Schnorr
Alexander Bagdahn
Mateo Rejon Lopez

Design:
Jules Götte
Jennifer Götte

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