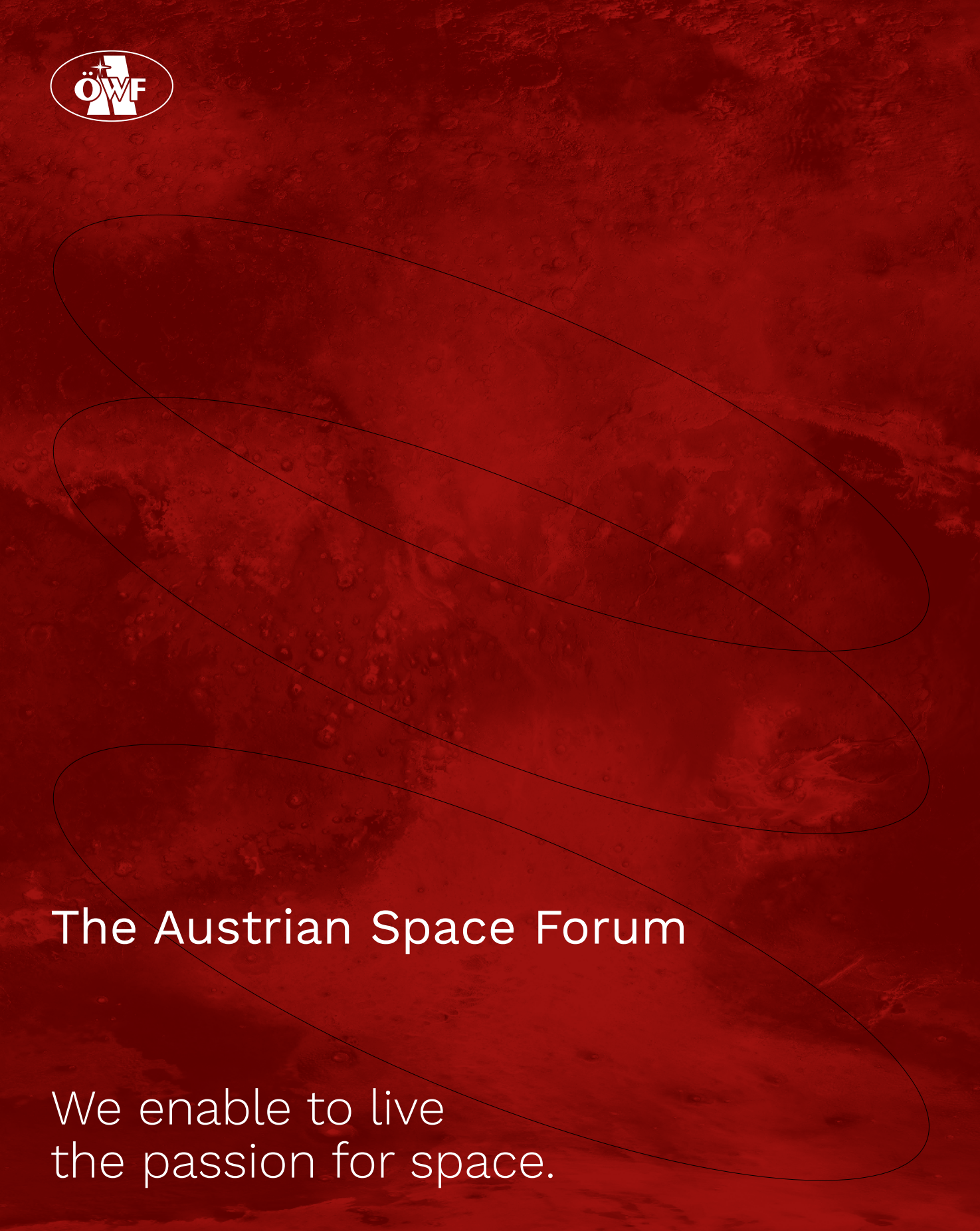
ÖWF
The Austrian Space Forum
We enable to live
the passion for space.

The Austrian
Space Forum

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PHOTOS

Österreichisches
Weltraum Forum

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THE AUSTRIAN SPACE FORUM

Österreichisches Weltraum Forum (OeWF) is one of the leading institutions conducting Mars analog missions, thus paving the way for the future human exploration of the Red Planet. Experts from a broad variety of disciplines as well as the spaceflight sector constitute the core of the OeWF's continued endeavor.

The OeWF in collaboration with national and international institutions from science and industry is working at the cutting edge of scientific research. In addition the OeWF also contributes significantly to inspiring and educating young people in the sectors of science, technology and engineering.

OUR ORGANIZATION ...

- **conducts cutting-edge interdisciplinary research:** We specialize on space sciences, (human) Mars exploration, Earth observation and Astrobiology. Our work is published in peer-reviewed journals, presented at scientific conferences and communicated to both to specialists and the public.
- **provides an interface for the Austrian space sector:** The forum builds bridges between the space industry, academia, policy institutions, decision makers and opinion leaders and the public. The OeWF is an independent and competent point of contact within the Austrian or European space sector.
- **initiates, supports, and connects careers:** We offer student internship, project involvements, supervise graduates at universities, and enable the participation in research and development projects.
- **builds and flies, we explain and inspire:** Hardware, hands-on projects, work in a laboratory or a workshop, and field experiments are the basis of the forum's programs. Activities for elementary school students, evening events with audiences (sometimes with hundreds of attendees), flying water rockets, street-science and consulting for space sciences – We love to do hands-on activities.

We enable to live the passion for space.

HIGHLIGHT ACTIVITIES

MARS 2013, northern Sahara, Morocco

Since the early 2000s, the Austrian Space Forum has been developing more than a decade of experience in analog planetary research.

This scientific discipline responds to the need to develop equipment, methodologies and strategies for future human and robotic planetary exploration. It involves scientific, engineering, operational disciplines as well as human-factors to be tested in representative simulation environments to maximize the missions scientific return, optimize operational safety and catalyze technology transfer. As part of its analog planetary research efforts, the Austrian Space Forum ...

... conducts international **planetary** (mostly Mars) **analog missions**: These expeditions are carried out in a planetary (Martian) terrestrial analog and directed by a dedicated Mission Support Center in Austria. A small field crew of highly trained analog astronauts with spacesuit simulators conducts experiments preparing for future human and robotic (Mars) exploration missions.

... builds **spacesuit simulators**: These prototypes emulate the restrictions of an actual planetary surface spacesuit, like weight, resistance or limited sensory input, whilst protecting the analog astronauts from the environment and keeping them alive. An elaborate human-machine interface, including a sensor network and specifically developed software assist the analog astronaut during planetary surface operations. The suits are developed to optimize interactions with other (robotic) components and to minimize the risk of human contamination. The spacesuit simulators are operated by carefully selected and trained analog astronauts of the Austrian Space Forum. The first prototype was the “Aouda” suit developed between 2009 and 2018, followed by the second generation “Serenity”.

AMADEE-18 Mars Simulation, Dhofar Region, Oman

... ensures efficient knowledge transfer through in-house **team trainings**: Analog Mission Basic (AMBT) and Advanced Training (AMAT) courses, provide a structured and standardized certification and training process for the MSC and analog research field crew personnel. During the AMBT, a basic knowledge about the modus operandi for analog missions of the Austrian Space Forum is taught. Building up on that, the AMAT is focused on deepening team specific expertise with emphasis on hands on training. A small corps of analog astronauts is selected typically every 3 years in a highly competitive call. They undergo a spacesuit specific training and have to maintain their active status throughout annual refresher trainings before entering the mission-specific training.

STATISTICS – THE OeWF IN NUMBERS

AS OF 2019

The Austrian Space Forum association has more than

200
members, from over

15
countries, located on

3
continents

As part of its analog planetary research, the OeWF has developed

2
generations of **spacesuit simulators**, operated by a corps of

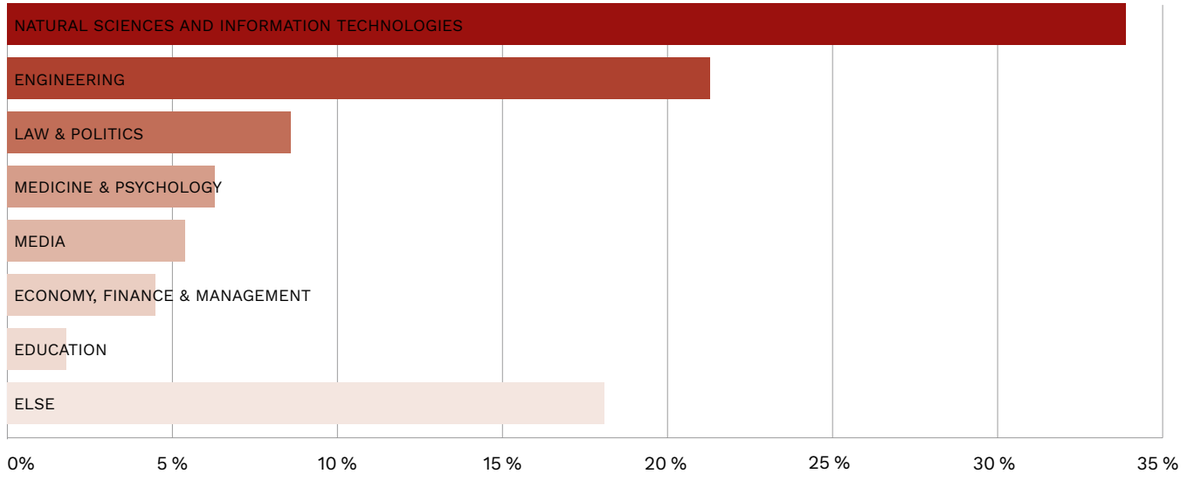
22
analog astronauts (active and retired), having conducted a total of

800+
Simulated **Extra-Vehicular Activity** (“spacewalk”) hours, over the course of

12
Mars analog missions.

Members by Profession

The professional backgrounds of the Austrian Space Forum’s members (as of 2018)



The Austrian Space Forum has more than

10

years of experience in **outreach and education** activities

40

1-day **workshops for children and teenagers** per year

20

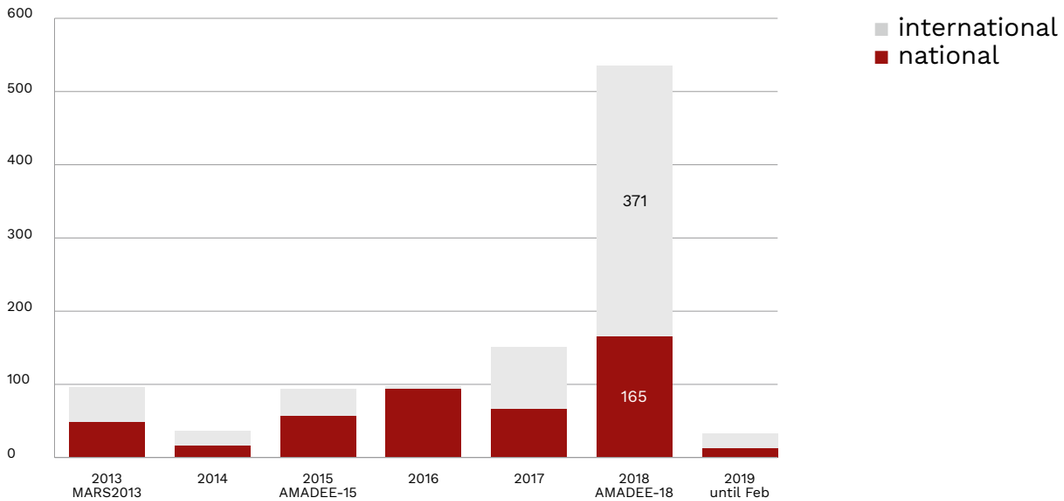
student internships per year.

1 Presentation on Space Exploration, Ars Electronica Center

2 Flight Director Simone Paternostro coaching young professionals at the OeWF Analog Mission Basic Training Course.

Press Reviews

The Austrian Space Forum in national and international press. Number of articles (print and online), TV and radio reports reporting on OeWF activities per year



The research efforts of the Austrian Space Forum are published in about

5-15

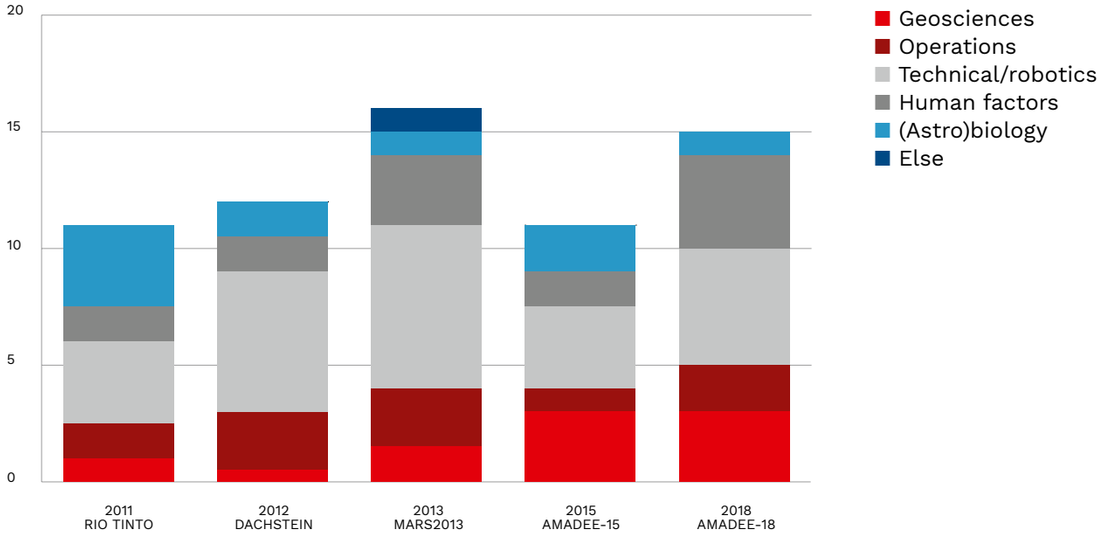
peer-reviewed publications
per year

3-5

academic theses
per year

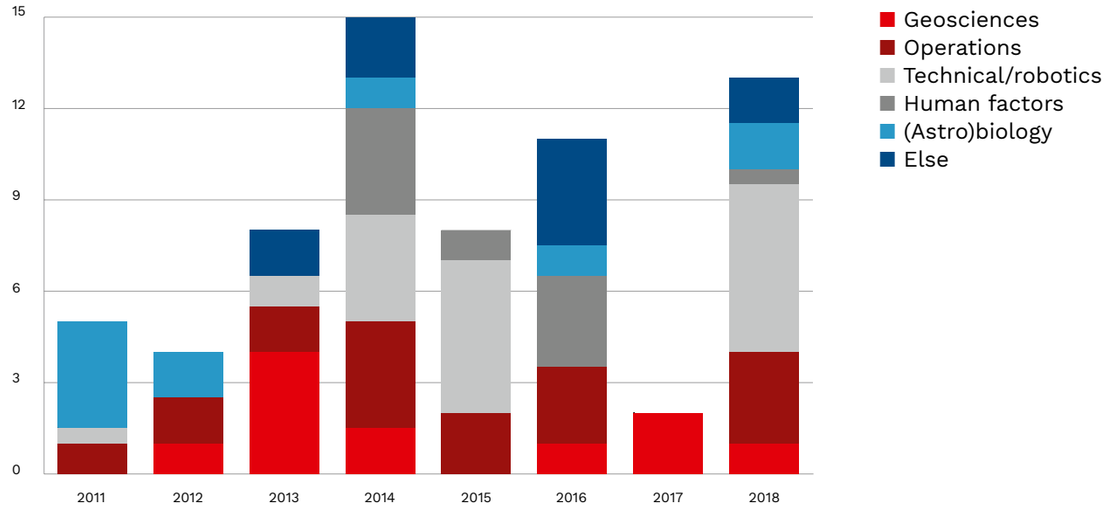
Experiment Disciplines

Scientific disciplines of experiments participating in OeWF analog mission simulations



Publication Disciplines

Number of OeWF affiliated scientific publications by discipline per year



PUBLICATION HIGHLIGHTS

G. Groemer, A. Losiak, A. Soucek, C. Plank, L. Zanardini, N. Sejkora, S. Sams: **“The AMADEE-15 Mars simulation”**, Acta Astronautica, vol. 129, pp. 277-290, December 2016. DOI: 10.1016/j.actaastro.2016.09.022

S. Dorizona, V. Ciarlettia, D. Plettemeierc, W.S. Benedixc: **“Performance validation of the ExoMars 2018 WISDOM GPR in ice caves, Austria”**, Planetary and Space Science, vol. 120, pp. 1-14, January 2016. DOI: 10.1016/j.pss.2015.10.008

Special Collection: **MARS2013 Field Campaign, Astrobiology**, vol. 14, May 2014

C. Orgel, Á. Kereszturib, T. Váczia, G. Groemer, B. Sattler: **“Scientific results and lessons learned from an integrated crewed Mars exploration simulation at the Rio Tinto Mars analogue site”**; Acta Astronautica (2013), doi:10.1016/j.actaastro.2013.09.014

G.E. Groemer, M. Storrie-Lombardi, B. Sattler, O. Hauser, K. Bickert, E. Hauth, S. Hauth, U. Luger, D. Schildhammer, D. Foeger, J. Klauck: **“Reducing biological contamination by a space suited astronaut: Laboratory and field test results from Aouda.X”**, Acta Astronautica (2010), doi:10.1016/j.actaastro.2010.08.018

Groemer, G.: **“AustroMars and PolAres: Measuring Forward Contamination During Mars-analogue Missions”**, Planetary & Space Sciences, Special Issue on Exploring Mars and its Earth Analogues (Ori et al.), Special Issue Planet. Space Sci. (2008), doi:10.1016/j.pss.2008.07.021

PROJECTS AND OUTREACH

Besides its Mars analog missions, and OeWF internal projects (see section highlight activities), the OeWF is working on international research projects and outreach initiatives, related to human and robotic space exploration.

1

2

3

1 Chris Hadfield presenting at the OeWF-managed Association of Space Explorers Conference Community Day, Austria

2 Analog Astronaut Carmen Koehler with students from the Oman Astronomical Association at the AMADEE-18 mission

3 Dignity – the OeWF Mars analog rover for outreach activities

THESE INCLUDE:

- **The development of novel test platforms and workflows** to study materials and textiles for planetary surface missions (e.g. PExTex project on the selection of the materials for the Moon surface spacesuit development of the European Space Agency)
- **R&D projects** focused on applications of space technology e.g. in medical disciplines with a high spin-off potential (e.g. iWalkU in response to the Cross4Health call, funded by the European Commission, which combines aerospace technology of the OeWF with biotechnologies.)
- **International conferences and science workshops** (e.g. ASE2016, which brought over 100 flown astronauts to Vienna, or EMC17, the annual conference for Mars research in Europe)
- **Over 10 years of strong (national) space education initiative**s (e.g. webinars and teacher training courses via the Europlanet initiative, leading to the Europlanet prize for public engagement with planetary science in 2011, involvement of children´s universities, BMVIT initiative “fti-remixed”, European Researchers Night and European Rover Challenge (Poland) etc.)
- **Operational experience** (e.g. through the operation of the ground station for the SPIRE satellite constellation)
- **Numerous collaborative projects and outreach activities with Austrian Science Centers** (in particular: Ars Electronica Center Linz, Audioversum Science Center Innsbruck, Natural History Museum Vienna, Planetarium Vienna);

MAPPING – NATIONAL, EUROPEAN AND GLOBAL

National and international industrial cooperation

The Austrian Space Forum collaborates with multiple industrial partners throughout Austria and globally. This includes joint projects with the research and development departments of major companies, each specialists in major branches like manufacturing and material research (e.g. Voestalpine), or power management and semiconductor solutions (e.g. Infineon) and co-operations with SMEs, which are for instance focused on electromobility (e.g. Mattro). Additionally, the OeWF entertains marketing relationships with multiple companies, for example Magenta, LANCOM, FORTIS or Swarovski.

National, European and global research collaborations

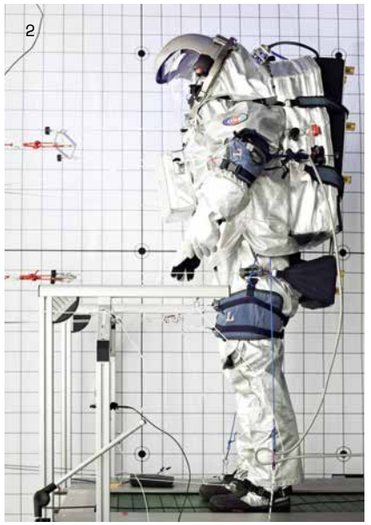
Within Europe, the OeWF has **research collaborations** with various Universities (e.g. TU Graz, TU Vienna, ETH Zürich/EMPA, TU München, (Med.) Univ. Wien, University of Innsbruck, University of Klagenfurt, etc.), as well as co-operations with national research institutes like the French national atmospheric research organization (LATMOS) or the Polish academy of sciences.

Beyond that, the OeWF is integrated in several **international research networks**, such as the European Astrobiology Networking Association, Europlanet, the Science Center Network, the European Mars Societies, the International Space University, etc. With initiatives such as the Professional Observers program during AMADEE Mars simulations, scientists and opinion leaders are invited to observe the work at the OeWF and hence further expand the network of the OeWF. The projects of the OeWF are further recognized on a global level through invited talks of OeWF officials at international meetings and conferences, as for instance the AM6 conference 2018 in Washington D.C, or articles in reports like the "**Humans to Mars Report**" 2018, which lists the AMADEE-18 Mars simulation of the OeWF alongside programs from NASA or ESA with the common goal to facilitate the human exploration of Mars.

The OeWF is also the secretary organization for the **Vienna Statement on Analog Planetary Research**, which is an international policy initiative, outlining the importance of Analog Planetary Research (APR). Its more than 20 signatories are composed of researchers from leading institutions across the globe, who are actively promoting the field of APR.

Furthermore, the OeWF administers several **Memoranda of Understanding** with comparable institutions, such as the Space Generation Advisory Council. The research conducted at the OeWF also involves numerous international R&D co-operations, mainly with partners from Europe and north America. In particular, partners are/ were amongst others:

1 Field tests with the Eurobot Ground Prototype during the Rio Tinto 2011 Mars analog mission



2 Spacesuit test at the ESA/DLR Vertcial Treadmill studying gait patterns

NASA Jet Propulsion Laboratory, (e.g. µEVA experiment during the MARS2013 Mars analog mission to investigate contamination vectors)

ESA European Space Agency (e.g. Spacesuit-tests, Consultations for the future LUNA-facility, tests for the EXOMARS WISDOM Radar, field test with the Eurobot Ground Prototype-see Figure 1, etc.)

Italian Space Agency (e.g. HORTEXTREME growth experiment on hypertonic microgreens during AMADEE-18 Mars analog mission)

DLR German Aerospace Center (e.g. Institute of Aerospace Medicine, studies with the vertical treadmill)

„The OeWF is well connected, collaborating globally and contributing to analog research world-wide."

OUTLOOK – THE AMADEE PROGRAM

Implementing the Vienna Statement on Analog Planetary Research VSAPR, the AMADEE program is the successor to the PolAres heritage and was initiated with the AMADEE-18 analog mission in February 2018, a 25-nation Mars analog simulation in the Dhofar-desert in the Sultanate of Oman. The new goal is to project an “exploration cascade”, that is a comprehensive workflow ranging from orbital remote sensing, surface reconnaissance to in-situ and laboratory science to detect putative biomarker signatures. Therefore, the assets developed in the course of the PolAres research program of the OeWF are deployed to test strategies for the exploration of both the (sub) surface of Mars, as well as other solar system locations with an astrobiological potential.

Within a timeframe of 10 years, analog missions are conducted every two to three years, together with scientific co-operations leading to tests and experiments between those major missions.

While analog missions are the main output of the AMADEE program, several quantifiable milestones and measurable success criteria correlated to the mission itself are defined. Those ensure a programmatic planning and preparation as well as a high scientific output and long-term evolution after the mission.

The products of the **AMADEE-program** include:

- Field tested and established workflows for life detection on planetary bodies
- Data bases and expertise in field operations
- Selected hardware developments (such as spacesuits and expedition infrastructure)
- A strategic dissemination of the knowledge gained, both for the entities in the OeWF network as well as the general public
- A skilled, experienced and motivated team for analog missions, embedded in a network of scientific, industrial, educational and policy institutions

Through the AMADEE program the Austrian Space Forum responds to the need for cutting edge analog research to prepare and enable the human exploration of our solar system. It provides independent analysis and advice on analog research to both the scientific community, mission architects and decision makers.

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AMADEE-18 Mars Simulation, Dhofar Region, Oman