ÖSTERREICHISCHES WELTRAUM FORUM
AUSTRIAN SPACE FORUM

Israel, Negev Desert, 04-31Oct 2021

AMADEE-20
Mission Report

Document Title	AMADEE-20 Mission Report
Tracking Nr.	n/a
Version/Date	V1.1 as of 08Jan2022
Book captain	Gernot Groemer
PUBLIC	

#SIMULATEMARS

oewf.org

TABLE of CONTENTS

The AMADEE-20 Mission Patch Heraldics

The mission emblem was designed by Sarah Feilmayr/OeWF media team (visuals). The gold symbolizes the desert and the sun, blue and white stand for the colors of the flag of Israel as well as the blue of Earth. The black stands for the vastness of space.

The olive branch is a symbol of peace in arab folk tradition, the olive tree itself is the national tree of Israel. Its six leaves stand for the six analog astronauts, the three olives for the scientific disciplines of biology/life sciences, geoscience and engineering.

Photographers for this report

- **Florian Voggeneder** (Expedition photographer)
- Claudia Stix
- Paul Santek
- Gernot Groemer
- Sophie Gruber
- Olivia Haider
- Judith Kuemmel
- Team members of the AMADEE-20 project

1. Important Contact Coordinates

Do not share this contact information outside the project – especially do NOT pass on this information to media representatives, private individuals, or other organizations without prior consulting the leadership.

Important postal addresses were

- **OeWF (Austrian Space Forum) Suitlab:** Etrichgasse 18, 6020 Innsbruck, Austria
- **OeWF Mission Support Center:** Dörrstrasse 85, 6020 Innsbruck, Austria
- **Israel Space Agency:** Derech Menachem Begin 52, 61000 Tel Aviv, Israel

Mission website: **amadee20.oewf.org**

1. A-20 leadership

Name	**Affiliation**	**Email & Telephone number**
Gernot Groemer	OeWF	Gernot.groemer@oewf.org
Sophie Gruber	OeWF	Sophie.gruber@oewf.org

2. OeWF key personnel

Name	**Position**
Willibald Stumptner Reinhard Tlustos	Lead flight directors
João Lousada Dpty: Inĩgo Munoz-Elorza	CDR flight crew
Judith Kuemmel Dpty: Florian Voggeneder	CDR OSS
Julia Weratschnig	MSC/ground support Lead
Nina Sejkora Dpty: Laura Bettiol	MSC/flight plan Lead
Seda Oezdemir Dpty: Christine Czakler	MSC/RSS team lead
Rochelle Ward Dpty: Lucas Rehnberg Sec: Andreas Zoller	BME team lead
Alexandra Hofmann Dpty: Sylwia Kaduk	Human factors lead
Monika Fischer Dpty: Reinhard Tlustos	Media team lead
Olivia Haider	Social media lead
Lukas Gradl Daniel Lee	OeWF IT team lead OeWF OSS-IT

3. Israel Space Agency key personnel (contact via A-20 leadership)

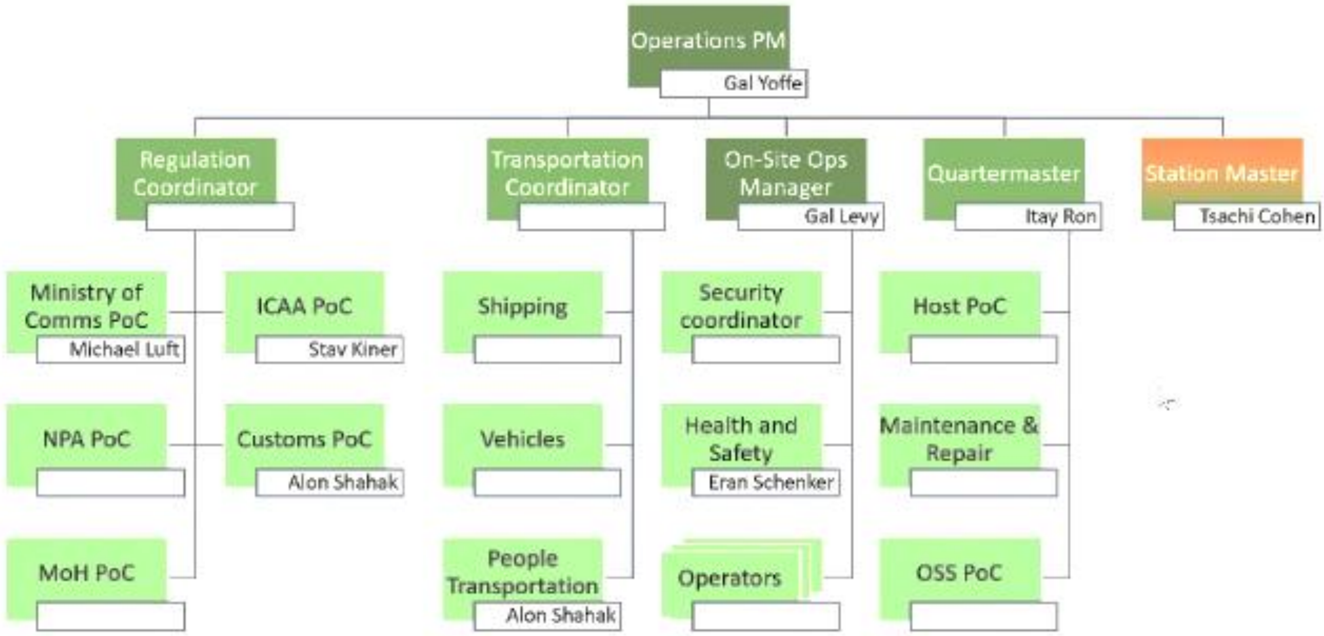
Name	**Affiliation**

Avi Blasberger (until 31Sep2021) Uri Oron (01Oct2021 onwards)	DG ISA
Itai Levy	ISA A-20 project coordinator
Shelly Ron Adiv	ISA A-20 education manager
Adi Ninio	ISA A-20 science liaison
Noa Barak, Ass: Minha Nopa	Ministry of Science spokesperson

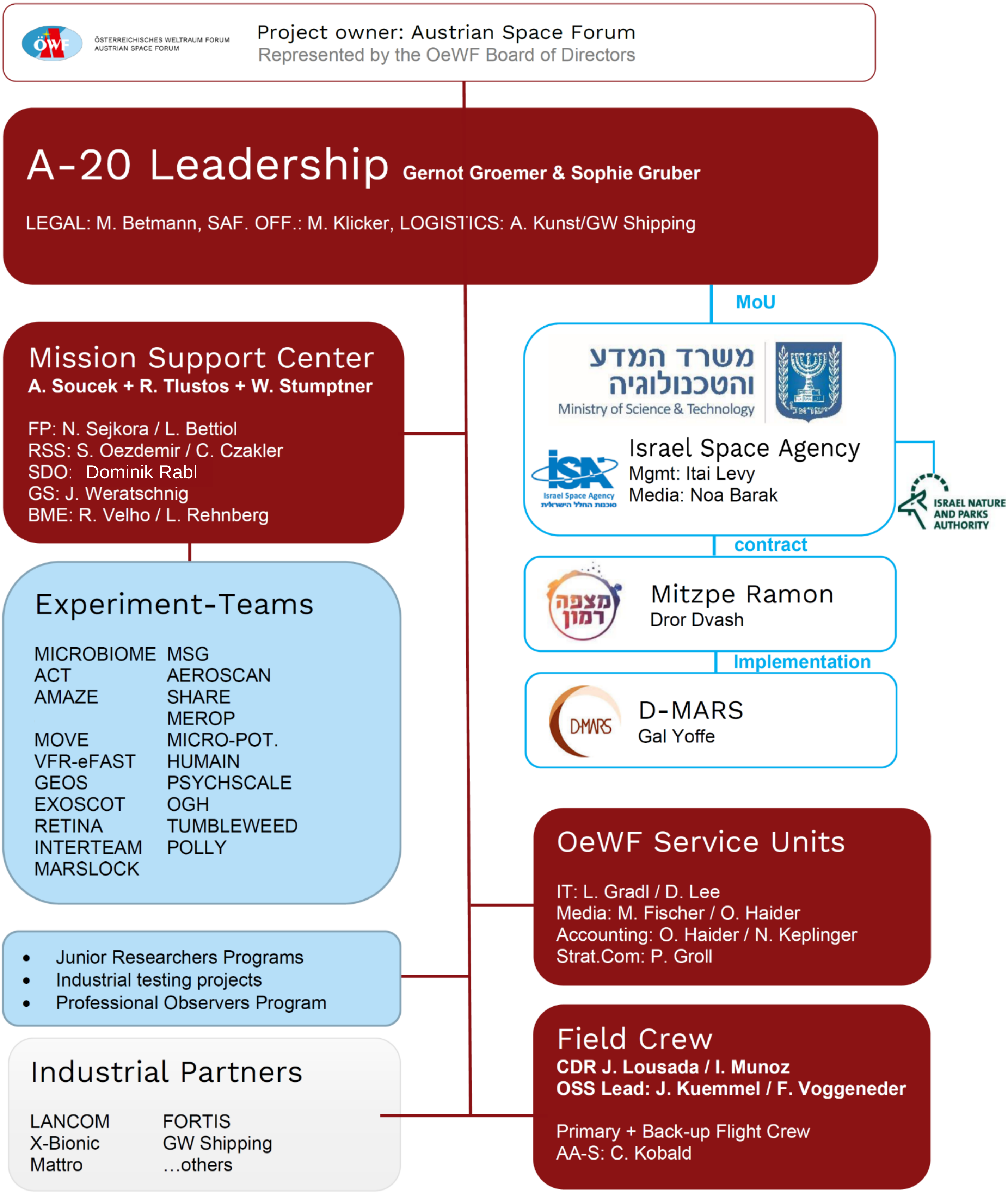
4. D-MARS key personnel

Name	Affiliation	Email
Gal Yoffe	D-Mars; A-20 project manager	gal.yoffe@d-mars.org
Hilel Rubinstein	D-Mars, CEO	
Shuly Shindel	D-Mars spokesperson	
Eran Schenker	D-Mars medical officer	
Zvika Gottlieb	D-Mars education projects	
Danny Dahan & Eli Israeli	D-Mars habitat IT liaison e.israeli10@gmail.com	

D-MARS Project Team (contracted by the Israel Space Agency)



2. AMADEE-20 Organizational Chart



3. AMADEE-20 aims

> *"AMADEE-20 was a Mars analog simulation in the Negev Desert, Israel, managed by the Austrian Space Forum hosted by the Israeli Space Agency"*

Simulating Mars human-robotic surface activities in terrestrial analogs has evolved into an efficient tool for developing exploration mission architectures. They facilitate to understand the advantages and limitations of future human planetary missions. Also, they add value for the development of remote science operations, helping to understand the constraints and opportunities of the technology and workflows.

The test site was selected for its geological and topographic similarity to Mars. The AMADEE-20 mission presented an excellent opportunity to:

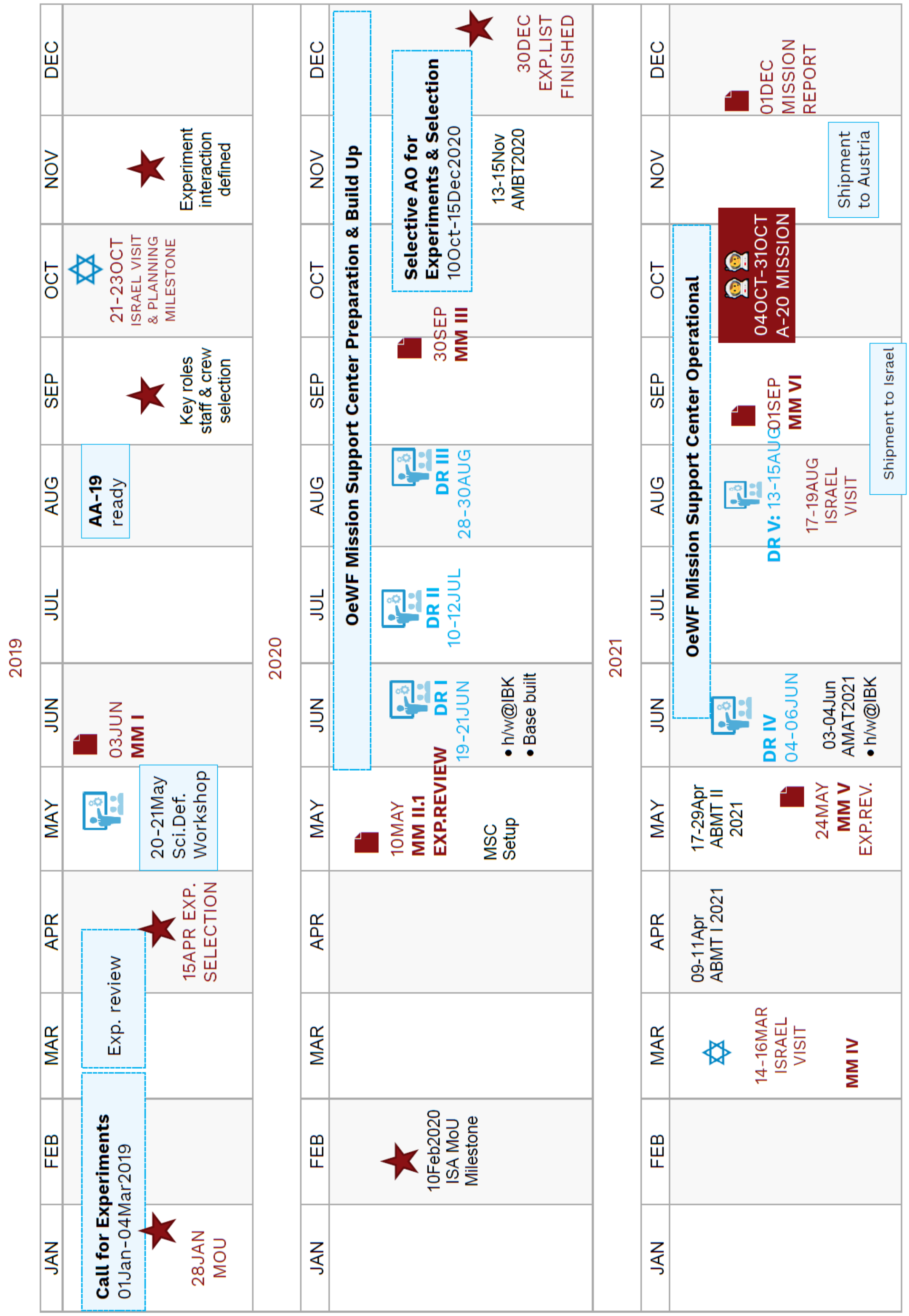
- Study equipment behavior involving the simultaneous usage of instruments with the option of humans-in-the-loop (via two high-fidelity spacesuit simulators, portable system, etc.)
- The development of platforms for testing life-detection or geoscience techniques, robotic support tools for human missions and concepts for high situational awareness of remote support teams.
- Studying the analog as a model region for their Martian counterparts.
- Serving as a catalyst to increase the visibility of planetary sciences and human exploration.
- Evolving the know-how of managing human missions to Mars deploying a realistic model for Mission Support center – Astronaut actions and the encompassing decision-making framework.

The AMADEE-20 test site

The test site was in the Negev desert in southern Israel within the erosion structures of the Ramon Crater: Although not an impact crater, but a rare form of erosion structures, it has a resemblance to various Mars surface features, and a variety of terrain types relevant to Mars exploration. The test site offered a wide range of sand and rocky surfaces combined with a broad variability in inclination.

The nearest city is Mitzpe Ramon. Temperatures at the test site in October were typically in the range of 10-29°C with no precipitation.

4. A-20 Roadmap



2022					
JAN	FEB	MAR	APR	MAY	JUN
A-20 data analysis				Publications start→	
h/w returns @IBK			01-03Apr Science Workshop		

Note/post-mission tour

Right after the field operations had concluded and the base station had been demobilized, a lecture and education/outreach tour was organized envisioned in the host country. (See chapter on post-mission activities for details)

Project end

The formal end of the AMADEE-20 project is defined by the conclusion of the A-20 Science Workshop in April 2022.

5. Mission architecture

Bridgehead phase (04-10Oct2021)

Before the crew arrived, preparatory measures were done, like breaking the customs seal on-site of the shipping containers etc. Starting with a small shakedown team of 2 OeWF team members, supported by a D-Mars team, the arrival of the bridgehead crew, including experiment team members and media crews was prepared between 01-03Oct2021.

Between 04-10Oct2021, the basic infrastructure was established, CRW trained at the base station and the OSS field office made operational. The station was not in fully operational conditions on 04Oct2021, so OSS team members were seconded to assist D-Mars crews to finalize the station setup. This period offered an opportunity for guest researchers and media to be present on site. Instruments that could not be operated by the OeWF field crew (e.g. due to the experiment sensitivity, operator training requirements etc.) were be operated by the researchers in the field. Selected pilot & calibration measurements were conducted.

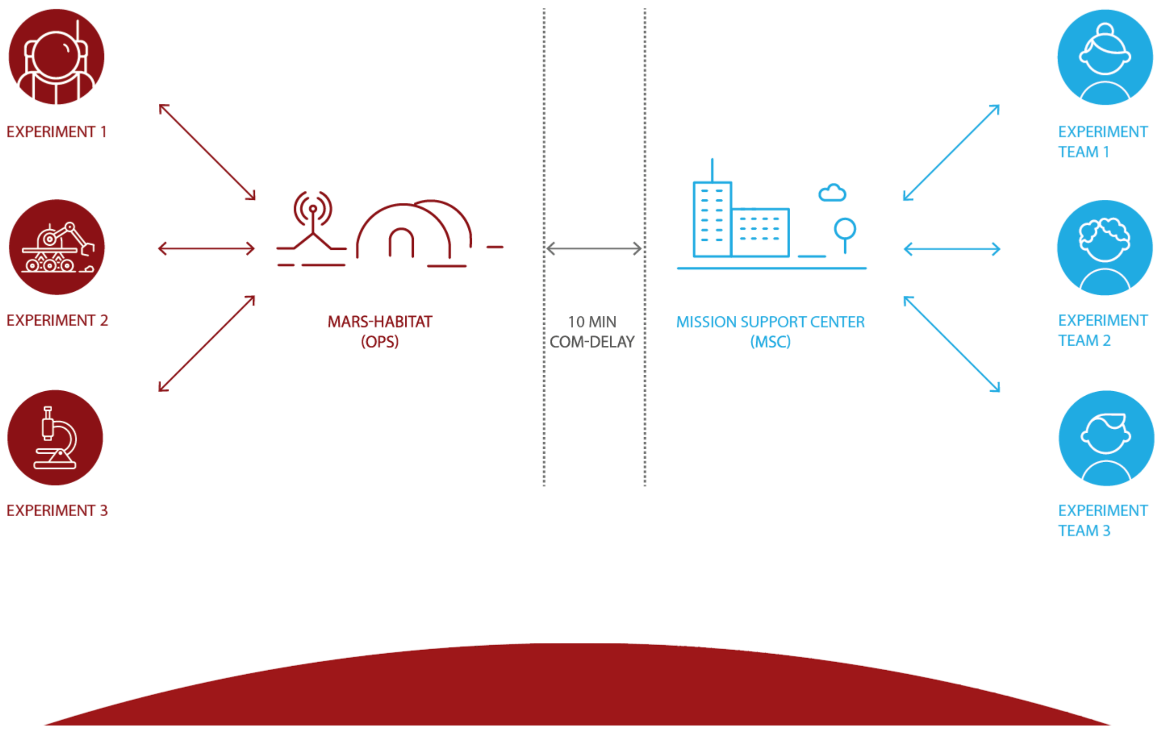
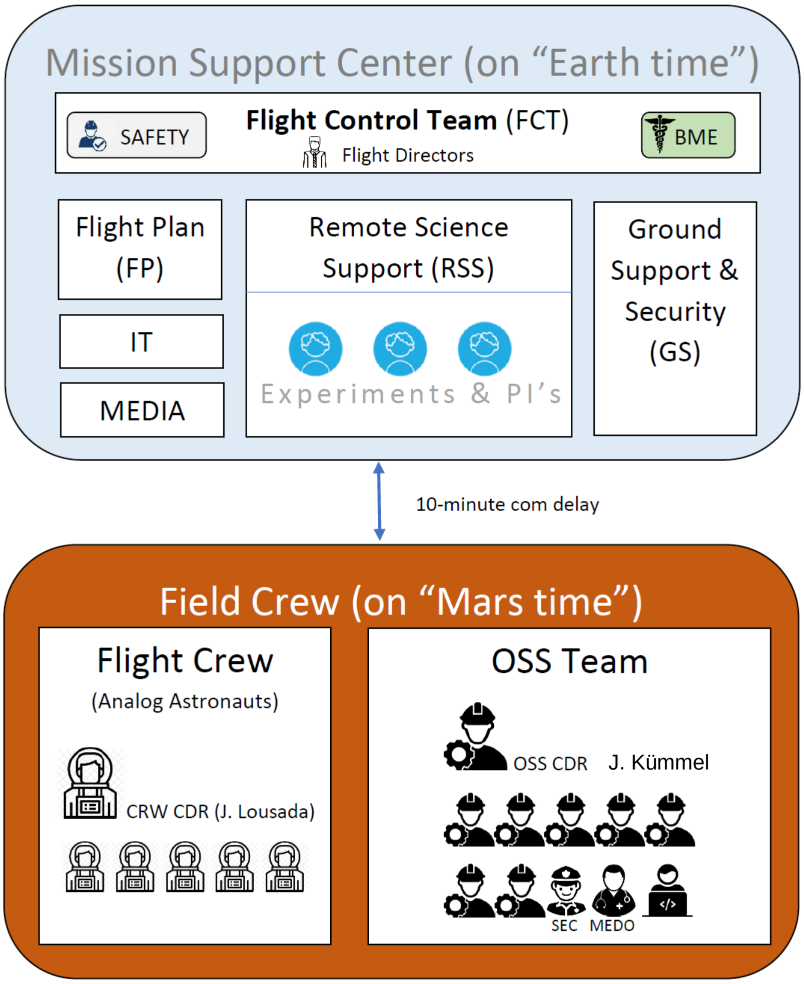


Figure 1. *Conceptual architecture of the AMADEE-20 expedition: A 10min time delay reflects the signal travel time between Earth and Mars. The MSC in Innsbruck/Austria is the single-line-of-contact between "Earth" and "Mars".*

Isolation phase (11-31Oct2021)

By 10Oct2021, external media and research teams had left the site, the Mission Support Center (MSC) Innsbruck/Austria now directed the crew limited to six crewmembers who were to conduct experiments according to a flight plan. The analog astronauts were supported by a small "On-Site Support"-team (OSS), performing activities necessary for the simulation, but not available on Mars (e.g. Safety, managing local W-LAN infrastructure etc). OSS did not directly interact with the analog astronauts. The field data were analyzed in near-real time by the remote science support team at the MSC Innsbruck in cooperation with the experimenters' teams. A 10 minute time-delay between "Earth" and "Mars" simulated the signal travel time between Earth and Mars.



Timeline

Nov2019	Experiment interactions defined, preliminary mission definition, release of the first iteration for the AMADEE-20 Mission Manifest (the main expedition planning reference document)
21-23May2019	Dress Rehearsal I: **Hardware had to be in Innsbruck for first hardware tests and procedure training**
10-12Jul2020	Dress Rehearsal II
28-30 Aug 2020	Dress Rehearsal III
04-06 Jun 2021	Dress Rehearsal IV: **Final version of experiment hardware had to be in Innsbruck**
13-15 Aug 2021	Dress Rehearsal V
Aug-Sep 2021	Hardware shipment to Israel
04-31Oct2021	**AMADEE-20 Field Mission**
Nov-Dec2021	Return of hardware to Innsbruck, shipment back to home institutions
01-03April2022	AMADEE-20 Science Workshop (Vienna/Austria)

Photo: Signing ceremony of the Memorandum of Understanding between the ISA, Austrian Space Forum and D-MARS in January 2019, Tel Aviv.

Science Definition Workshop in May 2019

Impressions from the five Dress Rehearsals in 2020 and 2021

6. Mission Risk Profile

A detailed mission risk analysis provided an important input to the planning of the expedition. The OeWF safety officer (Michael Klicker) was authorized to inquiry any mission element for its risk profile and may issue a No-Go on experiments, infrastructure use or even the entire mission.

This section provides a combination of managerial/administrative risks and environmental influences. This matrix does not cover scientific, financial, legal or mission-sim risks, numbers for severity and probability are only indicative and valid for the time of issue of the Mission Manifest 2. Severity is observed from the perspective of mission success, not from an individuals' perspective. Also, the list of lessons learned from the previous missions, especially from AMADEE-18 have been addressed in a structured manner.

Risk-Group	**Severity** 1/low - 5/high	**Probability** *1/low – 5/high*	Mitigation measures
Unfavorable weather, including flash floods and thunderstorms	3	2	Weather monitoring; habitat at elevated position; considering alternative access routes for evacuation; definition of abort parameters
COVID Situation	4	3	COVID measures according to OeWF contingency plans; regulatory measures according to the host country regulations.
Regulatory issues: • Land use restrictions • customs clearances, incl. biosample shipments, shipment delays	2	2	Detailed agreement on land use, trafficability restrictions and access rules. Detailed planning of shipment and involvement of customs authorities well in advance. Professional shipment handling team, early shipping dates with >2 weeks margin.
Aggressive/dangerous Flora & Fauna; crew medical incidents, risk of hygiene problems emerging	3	2	Awareness measures for crews and OSS. Definition of medical response workflows and involvement of local health services and medevac to country of origin, proper insurance contracts. Hygiene monitoring.
Aggressive visitors or acts of violence incl. terrorism	5	1	Restricted access to test site and continuous background monitoring of risk, involving Embassy of Austria and other institutions
Habitat and OSS facility readiness, incl. power and comm provisions	4	2	Close follow-up on habitat development, incl. design, implementation, testing and documentation; habitat design support where necessary; definition of pwr fallback solutions
MSC readiness, incl. IT infrastructure, staffing, SOP readiness and training level	3	1	Incremental readiness established well before the mission starts; staffing starts for MSC, OSS and CRW in early 2020. Three preceding AMBT and 1 additional AMBT course scheduled in advance
Experiment readiness not at level required for an efficient conduct during the mission	2	1	Exp.-specific support by RSS, FP and FCT liaisons since selection; hard deadline implementation for milestones, flagging system for experiment readiness

7. Test Site Description

The Ramon Crater is an erosive crater, 40 km long and 11 km wide. The crater rim altitude is around 1000 meter in the north-western side and the crater basin depth is around 300 meters. It unveils a geological window of most of the Mesozoic era starting down from Triassic and Jurassic formations (mostly sandstone and shales) at the crater base. This window is also characterized by the cretaceous formation (mostly limestone and dolomite) forming the crater wall, representing sediments of the Thetis paleo-ocean with several volcanic and plutonic episodes including paleo-volcanos and granites.

Climate

The climate in the region is semi-arid with dry summer (June – September) and mild winter (December-February). Most of the rainfall is concentrated in the transient seasons (October-November and March-May). The climate conditions within the crater are more severe relatively to the top of the crater rim. The average annual precipitation is 40-80 mm. Flash floods may be triggered by relatively small amount of rain (>5 mm). Snow fall may occur every few years for several days on the crater rim.

Flora

Sparse low perennial vegetation is growing on the high rim hillslope and wadis (dry streams). Small bushes can be found in the dry riverbeds in the crater bottom. During winter and spring, annual vegetation may appear in correlation to rain amount.

Logistics

Mitzpe Ramon is the only settlement in the area. This town is populated with 5000 inhabitants and located on the north crater rim. The main city is Be'er Sheva (80 km north to Mitzpe Ramon on route 40). Route 40 crosses the crater from north to south. The city holds a medical center (ambulance is available 24/7). The nearest Hospital is in Be'er Sheva. A supermarket is located in the city center (closed on Saturday). Fast food and cafés are available there as well. There are many paved roads inside the crater as well as accommodation options in the town.

The Ramon Crater is a national reserve. For tourists, the stay in the park during the night is prohibited except outside the designated camping areas. No off-road hiking or driving is allowed for the public. Driving is allowed only on marked dirt roads. Part of the national reserve is closed.

Hazards

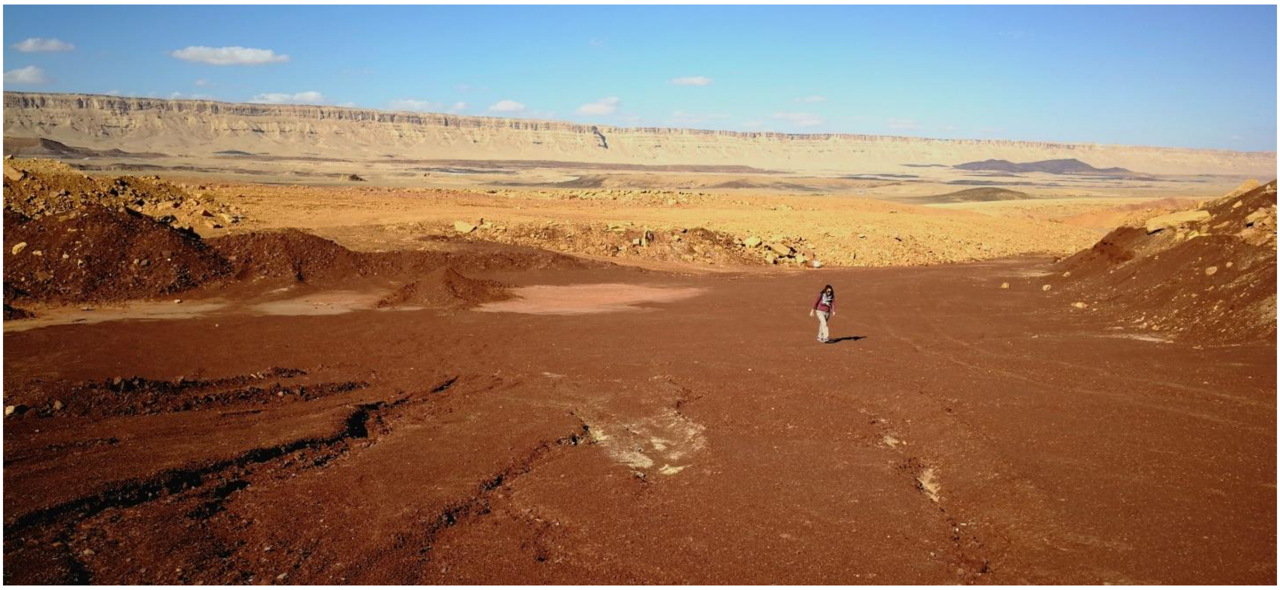
The area is populated by several venomous snake and scorpion species, although there have been no reports of fatal encounters in the recent years. The temperature gradient is high during day and night (the temperature in the high rim can be below 0°C during the winter. Summer can have up to 50°C and aridity. Flash floods may occur during winter and the transient season lasting typically 4-6 hours.

Medical Safety @ Soroka University Medical Center, Beer Sheva

The Soroka Med. Center is a state-of-the-art medical facility. The distance to Mitzpe Ramon is roughly one hour by ambulance (there is an ambulance station with 2 units in Mitzpe Ramon), and 15min flight time by Air Force helicopters (which are also used for medevac).

8. Representative photos of the test site

These images were taken at various sites during a scouting visit close to Mitzpe Ramon and are a good representation of the terrains covered.



9. Geological Context of the Test Site

Research teams were reminded, that we maintain an artificial blinding of the geoscience teams. That means, that we discouraged studying the literature about the test site and only use materials that would be available in an equivalent form on Mars.

The region has an upper mantle hotspot and their associated global thermal-tectonic activation spot. The area is composed by a central type volcano, lava flows, eruptive breccia's and tuffs that suggest extensive developments of explosive volcanism. Also, the complex presents a mosaic of sedimentary rocks and metamorphic associations.

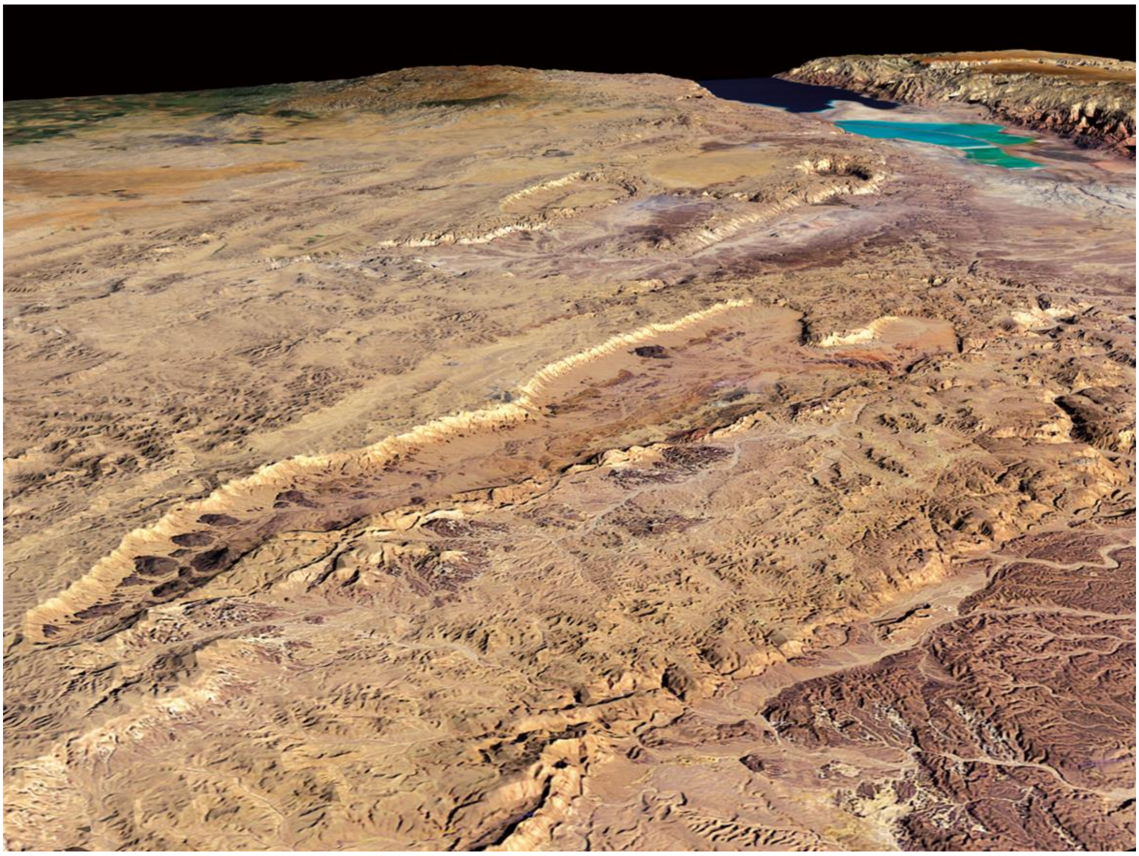
The activity of the winds created an erosion process that sharply reduced the thickness of the sedimentary deposits. Special consideration had to be taken to the tectonic phases that have affected the Ramon since the early Mesozoic.

Then, an Early Jurassic uplift of the southern part of the Ramon and a late Jurassic to Early Cretaceous uplift and intensive igneous activity is also observed; On the other hand, the system presents a late Jurassic to Early Cretaceous to Eocene folding and reverse faulting formation with a Neogene recent folding and strike-slip faulting (along the Ramon fault, the Sinai Negev shear zone and the Dead Sea rift).

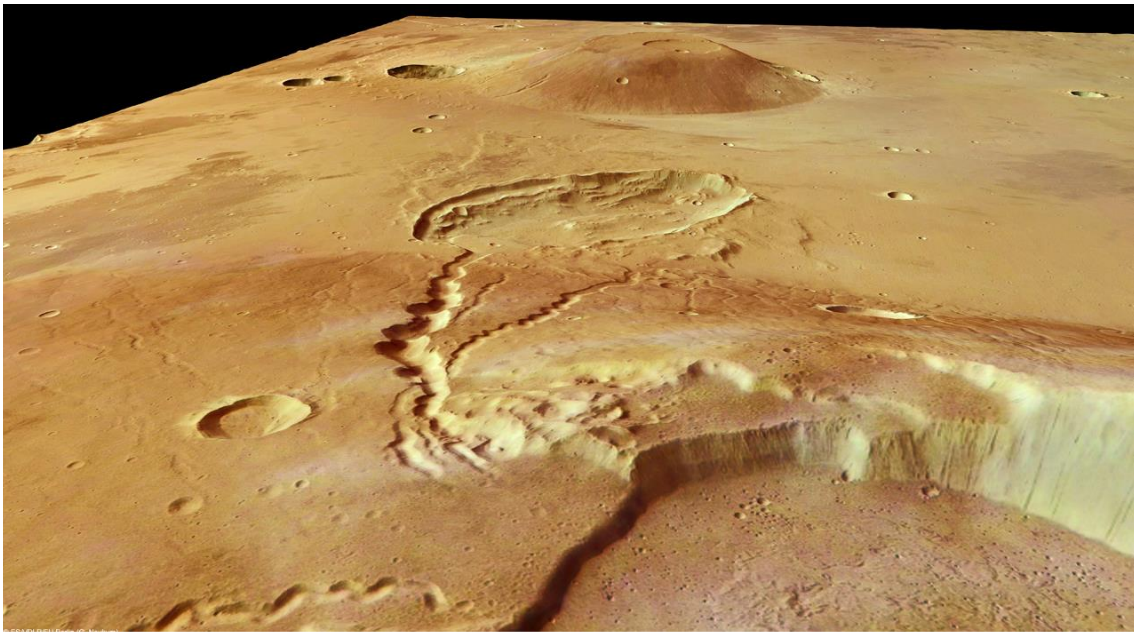
The terrestrial analog has similarity to Tharsis and Elysium volcanic provinces or Mars with large dikes. The searching for their formation has led in suggesting a mechanism of graben evolution akin to volcanic, tectonic models of terrestrial rifting.

In this sense, two main points had to be considered:

- The vast quantity of magma required to feed such reservoirs can be readily obtained by mantle adiabatic decompression and the thermal anomalies that have been involved in large Martian volcanic igneous provinces building.
- The dike swarms should exist on Mars, but it is likely that every graben displaying aligned volcanic morphologic features should have its dike swarm(s), for example, similar to the dikes have been found on Earth.



A 3D montage of Makhtesh Ramon and the other makhteshim, located on the highland edge above the Arava River segment of the great Rift Valley (Hatzav and Mazor) (Credits: Eyal Ben Dor et al, 2009)



Part of Tharsis region on Mars (Credits: Mars Express/ESA)

Mineralogy of the Region

The region is dominated by early tertiary mineralization such as alkaline basaltic, alkaline gabbroic and kimberlitic associations accompanied by explosive volcanism. In the primary mineral composition can be found olivine basalts, basanites, xenoliths and alkaline pycrites. The analysis carried out by other researcher shows the existence of chromium-diopsides, garnets, pyrope, ilmenite, perovskite, titano-magnetites, tourmaline and a substantial diversity of polymetallic minerals. On the other hand, the secondary minerals are quartz, feldspars, hydromicas, rutile, calcite, phosphates, sulphates and barites. The Major element geochemistry interpretations show that Negev dunes around Makhtesh Ramon Complex have SiO2 contents ranging from 80% to 95%, whereas Na2O (reflecting plagioclase) contents range from 0.24 to 0.83% and K2O contents (reflecting K feldspar) range from 0.50 to 0.93%.

Some selected outcrop could present varnished rocks consists of Fe and Mn oxides 20-30%, clay minerals 60%, and oxides of other trace elements. These varnish coatings show porous and permeable layers that can contain cracks that allow fluid to percolate into them. Indeed, they are an interesting paleobiomarker, useful tool or indicator for past aeolian activity and substrate for microorganism such as Archean bacteria.

Astrobiology potential

The two selected places present the extreme conditions in temperature, low nutrients status, high levels of incident UV radiation and strong winds. This combination leads to a unique adaptive place for microorganism being the more influential role in governing the surface and subsurface bioprocesses. In the specific case of the regions of Makhtesh Ramon Complex and Negev desert, they present topography of dunes, sandy soil and rocky highlands, a temperature range of 5-40 °C and a precipitation range of 100-300 (mm/yr).

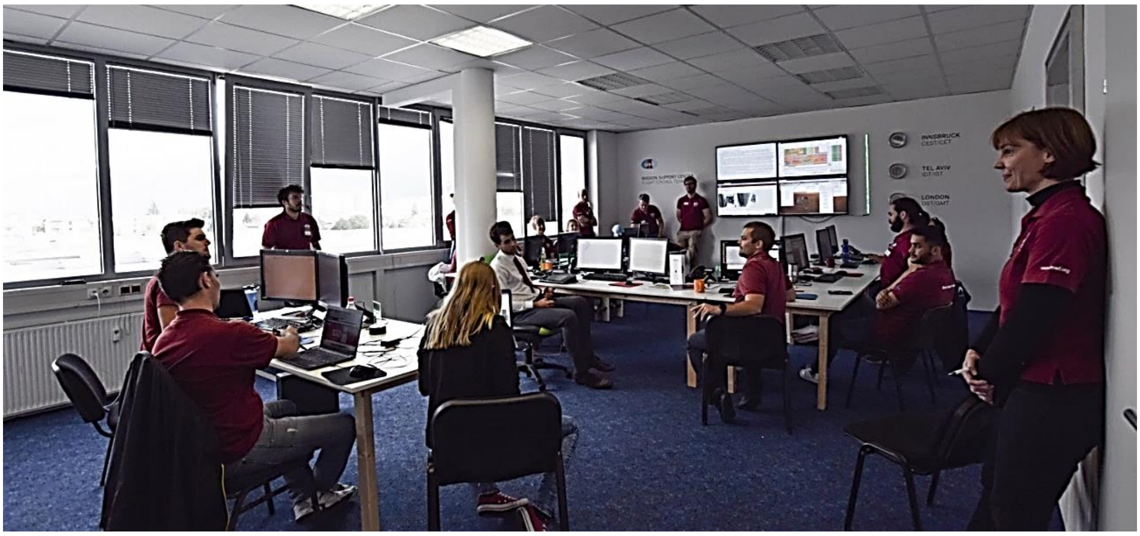
Table 1 – Main ecophysiological characteristics of soil samples from different types of soil formations of Makhtesh Ramon Crater (mean ± standard deviation, $n = 5$)

Type of soil	SM (%)	OM (%)	pH	EC ($\mu S\, m^{-1}$)	Ca^{2+} ($mg\, kg^{-1}$)	Na^{+} ($mg\, kg^{-1}$)	K^{+} ($mg\, kg^{-1}$)
Basalt	12.0 ± 1.6^{b}	0.10 ± 0.04^{a}	8.2 ± 0.08^{a}	0.8 ± 0.1^{c}	51 ± 1.0^{c}	296 ± 27^{bc}	23.6 ± 4.5^{a}
Limestone	8.6 ± 1.2^{c}	0.14 ± 0.02^{a}	8.2 ± 0.04^{a}	0.9 ± 0.2^{bc}	72 ± 19^{c}	300 ± 51^{bc}	21.6 ± 3.7^{a}
Sandstone	1.6 ± 1.1^{e}	0.24 ± 0.23^{a}	8.1 ± 0.21^{a}	1.9 ± 1.3^{b}	513 ± 500^{b}	226 ± 48^{c}	11.8 ± 5.0^{b}
Granite	4.0 ± 0.01^{d}	0.09 ± 0.05^{a}	8.1 ± 0.11^{a}	0.8 ± 0.2^{c}	78 ± 20^{c}	252 ± 58^{bc}	18.8 ± 7.0^{a}
Gypsum	15.6 ± 2.5^{a}	0.24 ± 0.10^{a}	8.1 ± 0.01^{a}	6.4 ± 0.3^{a}	1449 ± 57^{a}	335 ± 20^{b}	18.8 ± 2.2^{a}

SM, soil moisture; OM, organic matter; EC, electrical conductivity; cations: Ca^{2+}, K^{+}, Na^{+}. Significant differences ($p < 0.05$) between sampling terraces are indicated by different letters.

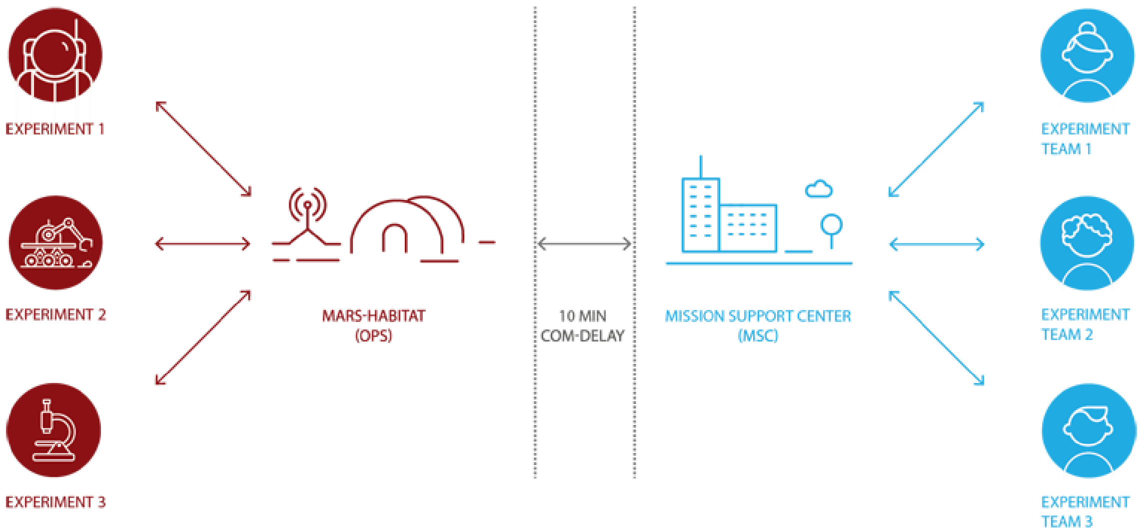
Credits: Stanislav Pen-Mouratov et al., 2008

10. Mission Support Center



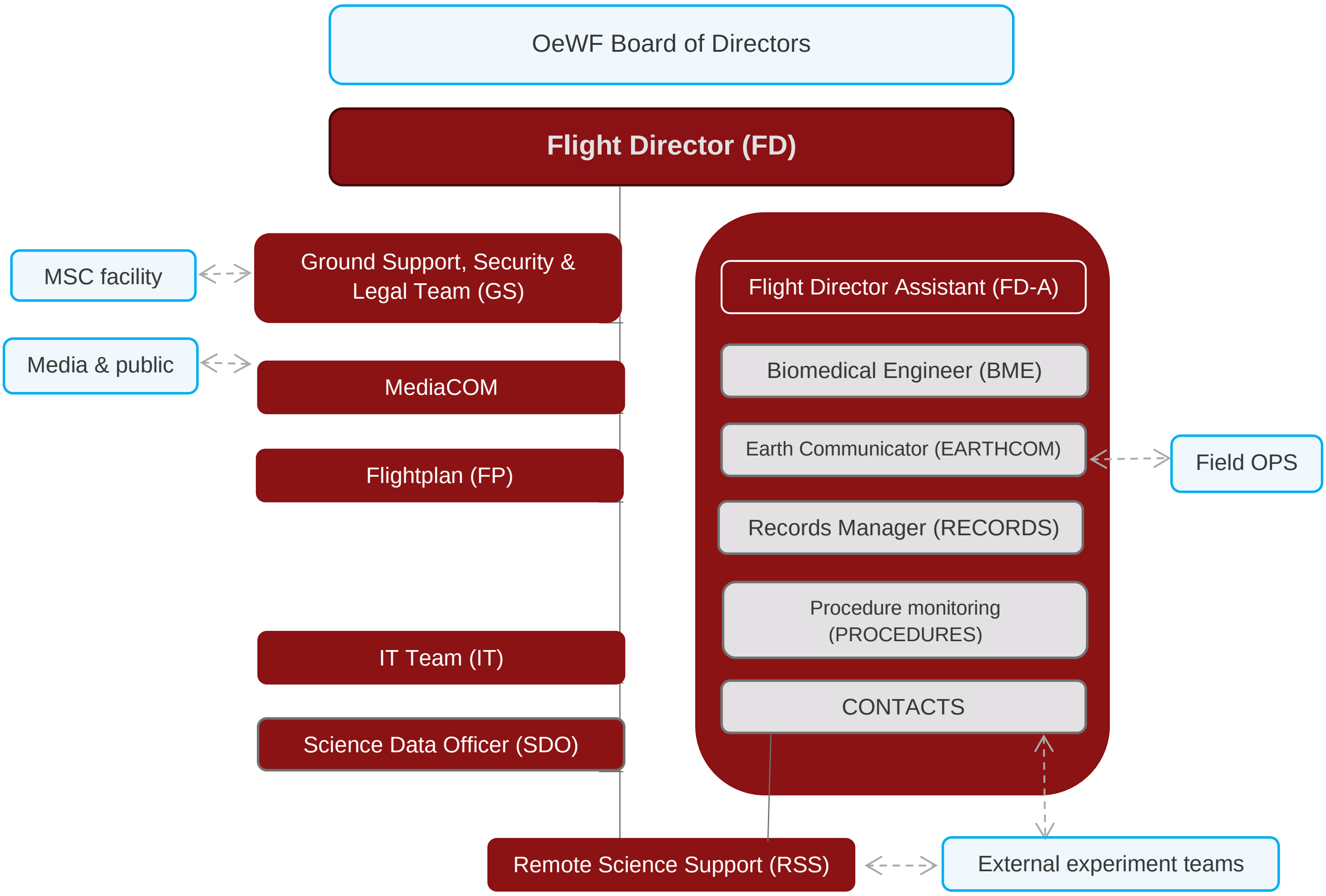
The Mission Support Center was located in Innsbruck/Austria in a dedicated facility. It was the centerpiece of the "Ground Segment" of the mission, interacting with numerous external organizations. It was the single point of contact for the field crew.

During the bridgehead-phase, the MSC was communicating with the field in real-time. During simulation starting after the mission start day on 11Oct2021, a 10-minute time delay was introduced, to account for the average signal travel time between Earth and Mars.



MSC organization and positions

The figure below represents the MSC configuration; designations were given in full and their abbreviation (e.g. Flight Director (FD) as "FLIGHT", which was also his/her call-sign). Boxes in blue represent external parties not present in the MSC together with their point of contact in the MSC respectively.



Flight Director (FD, call sign "FLIGHT")

The Flight Director (FLIGHT) was responsible for the overall AMADEE-20 mission operation. During mission/simulation preparation, the FLIGHT ensured (at a management-level, together with the mission leadership) that the resources of the MSC and the supporting operational ground segment were adequate to conduct mission operations. A designated Flight Director was on call 24 hours every day throughout the mission.

Flight Director Assistant (FD-A)

The FD-A acted as the "first officer" to FLIGHT. In principle, FLIGHT could delegate any task to the FD-A. However, the final responsibility and decision-making authority stayed with FLIGHT. During the mission, the Flight Director Assistant was responsible for updating the daily reports as part of the outreach activities of the MSC as well as to ensure the situational awareness for all MSC teams.

Biomedical Engineer (BME)

The Biomedical Engineer (BME) had the overall responsibility at the MSC for crew health related issues. The BME provided support for all issues related to crew health and medical data management, including monitoring of medical data, pre-flight preparation and post-flight rehabilitation. The BME also assisted in medical policy making.

Earth Communicator (EARTHCOM)

The Earth Communicator (EARTHCOM) was responsible for coordinating the communications between the MSC and the field crew (via chat during the time-delayed mission phase and optionally also via voice during the preparatory phases). The position gives the communications a necessary comradely touch amongst all the pressures of mission schedule. EARTHCOM also conveys to the field crew or MSC staff the respective point of view of the other group.

CONTACTS

The science console and contact manager (CONTACTS) was responsible for the communication between the FCT and the PIs and researchers (supported by the RSS team).
During ongoing experiments, CONTACTS supervised the connectivity and experiment readiness and a high level of situational awareness of the external parties. The decision on allowing external parties who are not experiment teams to access the telemetry stream beyond the public stream was taken by the Flight Director and the MediaCom.

Records Manager (RECORDS)

The Records Manager (RECORDS) ensured a continuous log file of what was happening in the field as well as in the Mission Support Center. This position was vital for the recording of the “as run flight plan”, which in turn was an element of the science data archive (maintained by SDO). The position also provided the input for updating the PIs on the progress of their activities. Biomedical recordings were NOT part of the RECORDS logfiles but were maintained by the BME due to their sensitive nature.

Procedure monitoring (PROCEDURES)

The procedure monitoring position (PROCEDURES) maintained the compilation of the standard operating procedures as well as experiment procedures to ensure that the field crew as well as the MSC had access to the most recent versions. During the simulation, PROCEDURES observed if the sequence of events is according to the given procedures and informs FLIGHT in case any deviations (both time- or procedure-wise) occur that might endanger the operations.

Human Factors (HF)

The Human Factors Team had the responsibility of supporting Analog Astronauts and the Mission Support Center. During mission, operational data addressing well-being, mental health, performance, attention, and sleep from the field, but also data related to intergroup communication and stress management in the Mission Support Center was analyzed and processed. HF provided support for all issues related to crew mental health and cooperated with BME on a daily basis. HF assisted the MSC in briefings, e.g. in terms of conflict management. HF also assisted in psychological experiments.

Remote Science Support (RSS)

The Remote Science Support (RSS) Team had the responsibility of supporting the experiments being conducted in the field as well as to represent research teams not present in the MSC. During missions, scientific data from the field was analyzed in near real-time and checked for its completeness and accuracy. Based on that analysis, RSS also provided input to the FP Team and served as the first point of contact for the CONTACTS position in case questions about the experiments arise.

In the preparatory phase of the mission, the RSS Team was responsible for the communication of the mission to the scientific community, via the Announcement of Opportunity, and was part of the experiment proposal reviewing process. After the mission, the RSS Team also ensured the scientific output of the mission and its experiments through workshops, publications in peer reviewed journals and conference participations.

Flightplan Team (FP)

The Flightplan (FP) Team scheduled the activities to be conducted in the field, based on the input from the Remote Science Support Team, external experiment teams and the Media Communication Team. The pre-mission planning included getting in touch with the Principal Investigators of the selected experiments. FP then compiled all operational requirements relevant for experiment conduction. Based on that information FP created the Mission Plan (MP), a rough schedule of all Field activities for the entire mission.

In-mission operations refined the activity plan to a more detailed schedule based on the Mission Plan. For scheduled EVA experiments a Traverse Plan (TP) specifyed where experiments were to be conducted and the optimal route to get there. Together with auxiliary information, these plans were sent to the field crew.

Ground Support & Security (GS & IT)

The Ground Support and Security (GS) Team was responsible for managing the MSC facility and ensuring a high level of security, necessary to support mission operations. GS also supported MediaCom in public outreach activities and visitor receptions. The GS team was responsible for staffing the entrance gate and handling access-control in the MSC.

The IT section was responsible for the operations of the IT infrastructure. Their tasks included server and electronic communication maintenance, security and defense from cyber-attacks, user account management and the administration of hardware assets.

The IT team was a core group of specialized IT operators, managing and safeguarding data flows at both the Mission Support Center and other OeWF facilities, outsourced server infrastructure as well as the field activities relevant to IT.

Science Data Officer (SDO)

The science data officer's (SDO) long-term responsibility is to ensure that all data collected during a mission (both experimental and operational) is archived to keep it safe and accessible to as many people as possible whilst maintaining controlled access. The SDO was working with the Remote Science Support team, the Flight Control team as well as the respective Principal Investigators.
He/She ensured that the data generated in the field were properly transferred and managed from the MSC perspective and stored in the Multi-mission Science Data Archive.
The SDO hence played a crucial role in transferring, managing and preserving the data acquired in the field, which might be relevant for future generations of researchers and students.

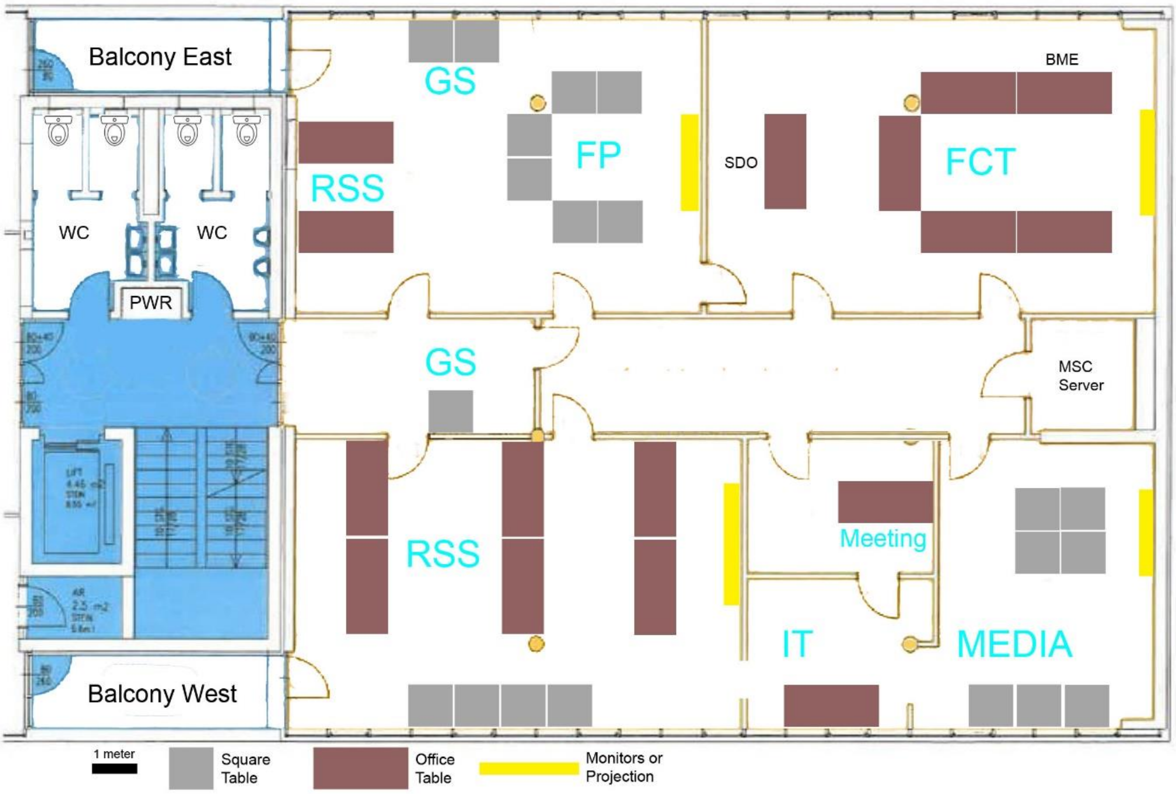
Media Communication (MediaCOM)

The Media Communication Team (MediaCom) was responsible for the coordination of media activities and the management of media inquiries. They generally handled the communication of the mission to the general public via social media channels and traditional press, together with the generation of imagery by the Visuals Team. MediaCom was also responsible for event planning, especially involving interaction with VIPs.

Physical layout of the Mission Support Center

Due to the COVID pandemic and contractual obligations, the MSC was relocated within Innsbruck/Austria in early 2021 to **Dörrstrasse 85, 6020 Innsbruck, Austria (South entrance, 3rd floor)**

FCT room during a code-orange simulation during Dress Rehearsal V in August 2021



MSC Floorplan (100 m² additional space to the west not depicted here.)

The MSC in Innsbruck offered ca 250 m² space, plus 100 m² DR training and media service rooms, and bathrooms. There were several supermarkets, restaurants and food booths in walking distance as well as a shopping mall in 10min driving distance.

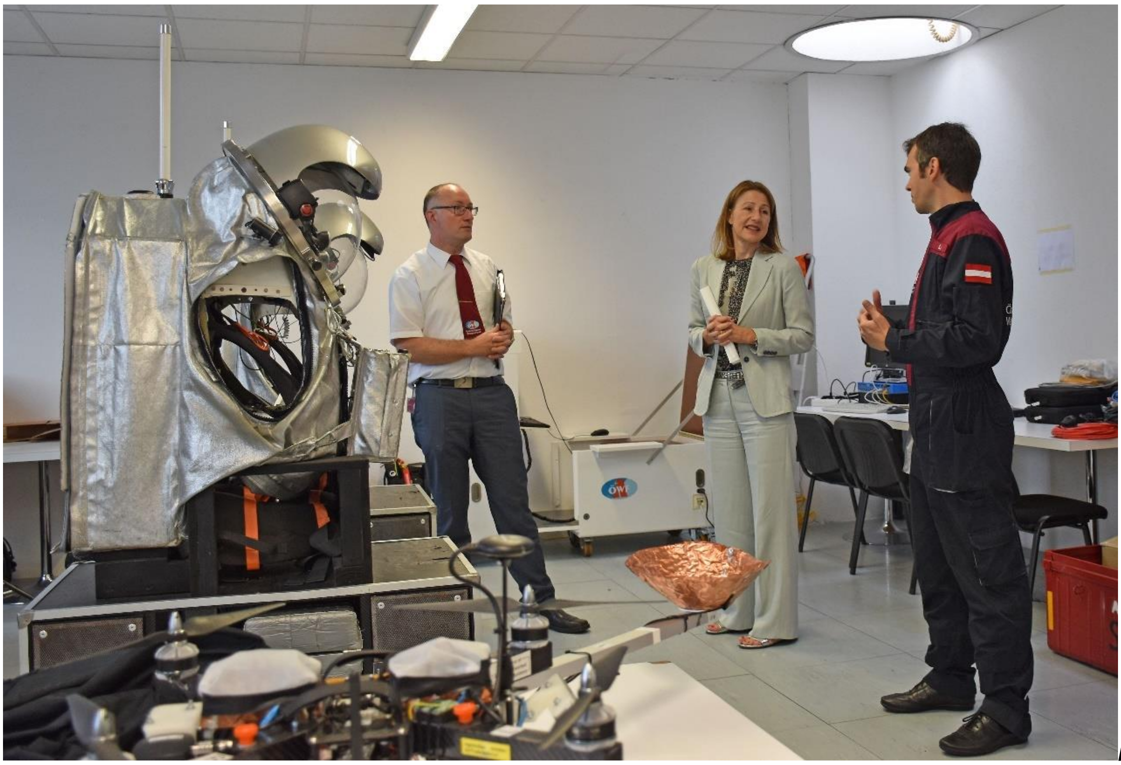


Photo: Formal visit of Mdm Counsellor, Anette Leja, State government of Tyrol, Austria.

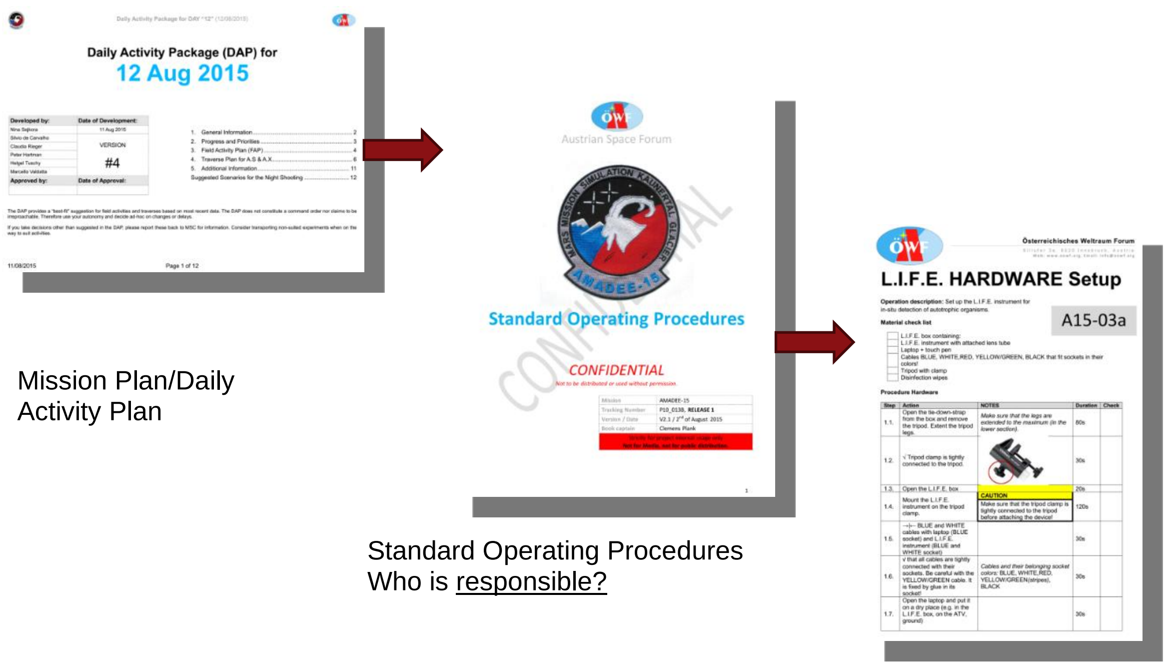
MSC Standard Operating procedures

All major workflows of the mission were defined via the OeWF Standard Operating Procedures (SOP). These were substantiated by experiment procedures and supported by background workflow documents of the respective science teams.

Several teams had extensions to the SOP's, such as the Biomedical Engineering Team or the Flight Directors, which would also allow access to privileged information (such as confidential medical records, or security-related matters).

The SOPs had been developed internally at the Austrian Space Forum and are documented in the AMADEE-20 SOP compendium, together with the experiment procedures, as well as the field crew rules and procedures.

The procedural hierarchy was as follows:



Mission Plan/Daily Activity Plan

Standard Operating Procedures
Who is responsible?

Experiment procedures
How to do it

11.AMADEE-20 Habitat Station

The crew habitat was provided by the Israel Space Agency and D-Mars, based upon the foldable D-Mars station design, complemented with a new module extension. A security check-point was located at approx. 500m distance to the habitat. All crew modules had illumination, windows, power outlets and air conditioning.

- **Command module (Hab II):** for operations & space for donning/doffing the spacesuits.
- **Engineering/Science container** for science and engineering operations
- **Crew quarters** for 6 people
- **Storage space container** for storing engineering equipment, samples etc
- **Mess:** kitchen & cantina space, including tables/chairs for 6 people and kitchen cutlery.
- **Hygiene module:** 1 field shower, 2 toilets, sinks and water provisions

Mapping provisions

- **Digital elevation model**
- **Georeferenced aerial photography** (< 1m resolution) in the optical bands

Photo: Steelframe construction of the new Habitat module→

The base station was located in a brown clay quarry, and included several compounds – the habitat complex, a parking for vehicles (rover, quadbikes, UAVs), power systems, visitors gathering area, antenna tower.

The crew module measured 6x12m (ca 52 m²), including six sleeping pods, a kitchen, recreation space, and shower & toilet unit. A short corridor (~2m long) connected the living unit to the working area unit. This corridor was used also as backup airlock unit with emergency exit.

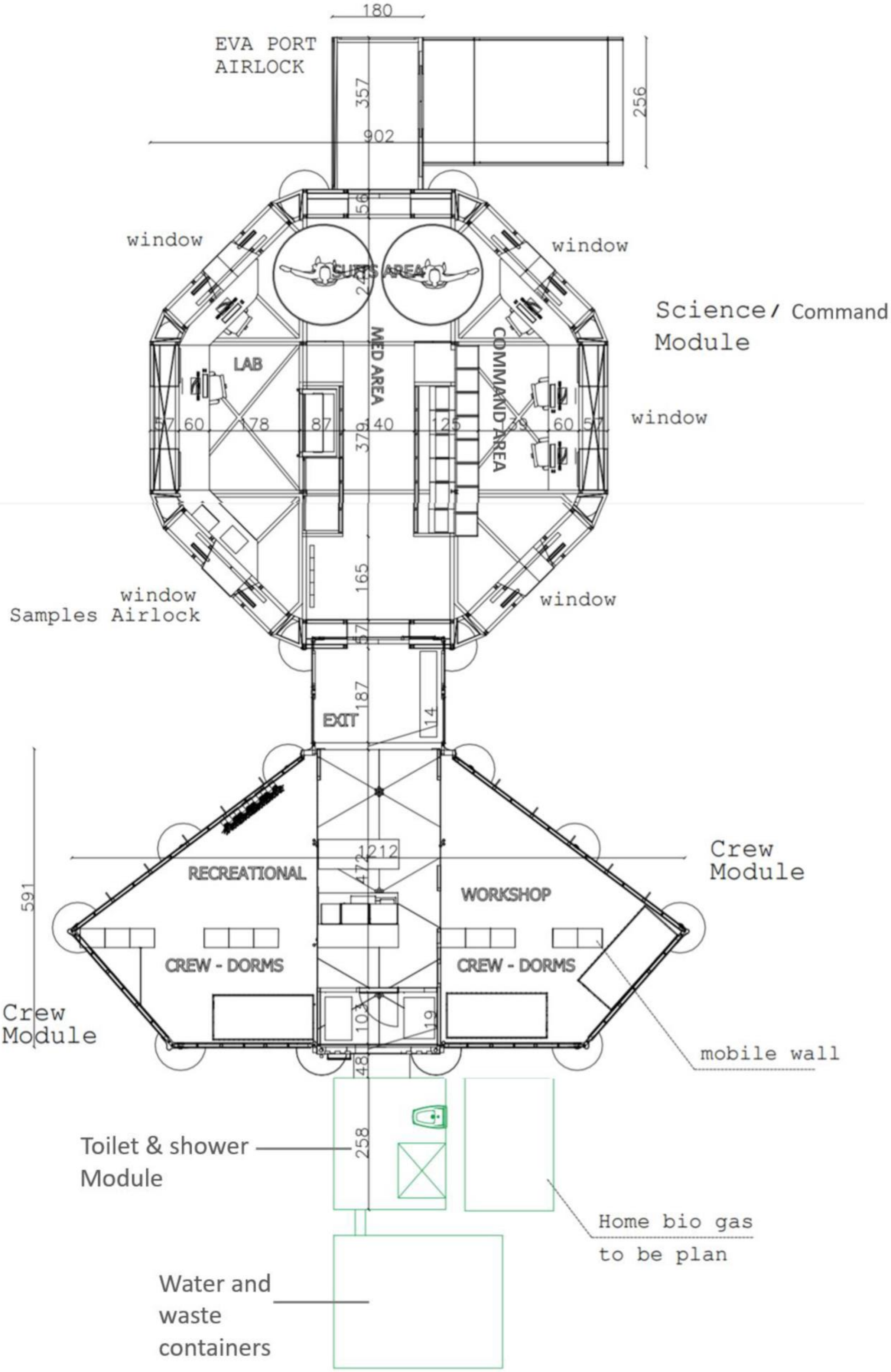
The working area (science and command module) radius was around 9m including a 70cm double wall simulating radiation protection. This unit included laboratory, command and control area, spacesuits donning & doffing area, airlock simulator, storage space, and infirmary space.

Station Subsystems overview

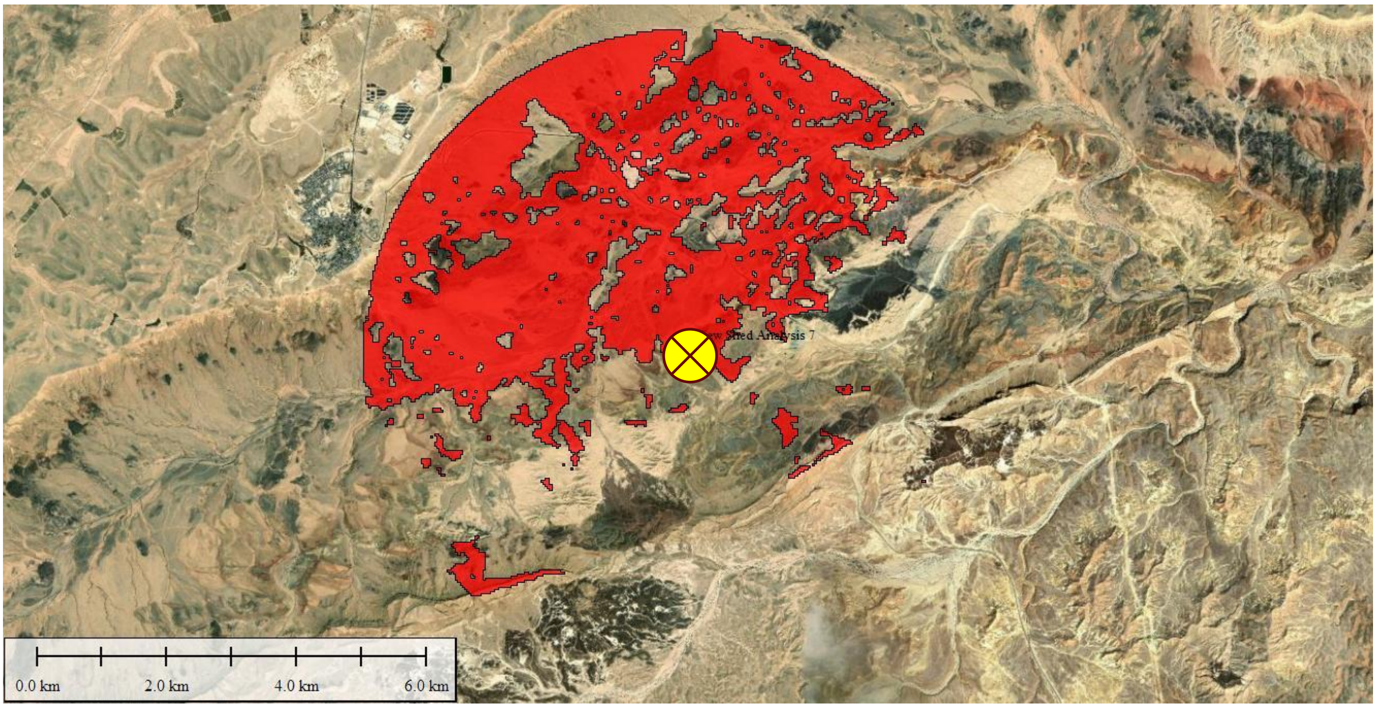
1. **Water:** Drinking water was separated from the overall water system, fed via 2 tanks with 2000 l capacity each (ca 5000 liters used during the isolation phase). The overall water was supplied water to the sinks (kitchen, toilet, lab) and to the shower. Water from the shower was recycled to be used for the toilet, using a 75l greywater cache tank. Toilet waste was be collected in a HOMEBIOGAS system. The blackwater tank had a capacity of 3000 l capacity, excess water would be drained into a soil dump.
2. **Toilets (2 units)** were operated with a handpump for filling and draining the toilet sinks.
3. **Air and thermal control:** two AC systems were implemented
4. **Power system:**
    a. A Diesel generator provided 60 kW with 24/7 capability (including hot refueling),
    b. A solar array providing 3 phases of 5 kW each, delivering 15 kW @ 24V in series. This was converted to 48 V for feeding into the batteries and then leading into a converter for 220V@50 Hz. Allowing for a 60% power drainage rate, this would provide 9 kWh for overnight low-power applications.
5. **Communication:** 'Mars-Earth' link was simulated using a satellite link, connected to an antenna located ~80m from the habitat at the top of small hill. The total bandwidth was as follows:

- Main Sat-Link: 55 MB/s down, 10 MB/s up (for OeWF telemetry and science data)
- LTE Router (for OGH and MSG station telemetry etc outside the OeWF network): 25 down/20 up
- Rovo2: 6,5 up/18 down (STATIC IP: 176.12.162.118)

Storage: In addition to the storage space within the habitat complex, two 20ft containers were located next to the habitat, which was also used as an operational space for the OSS.


180
EVA PORT
AIRLOCK
357
256
902
56
window
window
SUITS AREA
Science/ Command
Module
LAB
MED AREA
COMMAND AREA
window
57 60
178
87
379
140
125
39
60 57
window
Samples Airlock
165
window
57
187
EXIT
14
591
RECREATIONAL
1212
472
Crew
Module
WORKSHOP
CREW - DORMS
CREW - DORMS
Crew
Module
103
19
mobile wall
48
Toilet & shower
Module
258
Home bio gas
to be plan
Water and
waste
containers


9292
2092
Visitors
Parking
Pickup truck
Lava Tube
Optional
ATVs
RZR Parking
Light shelter
Droneport
Storage
Shipping
containers
Crew habitat
Generator(s)
Location accurding
Safety regulations
Solar
Panels
150 m
70m
45 m
Antenna Tower
Project : AMADEE 2020
Type of plan : Base Layout
Date : 29.12.19
Scale : 01:500
Location : Mactesh Ramon
S.E.F.A
space experience for all
Page : A1
N
SHIKA DESIGN COLLECTIVE



Projected line-of-sight area of the 4,5m high antenna mast next to the habitat.

Lukas Plazovnik/OSS during setting up a WIFI router in the field

List of scientific cameras used during A-20 in the field

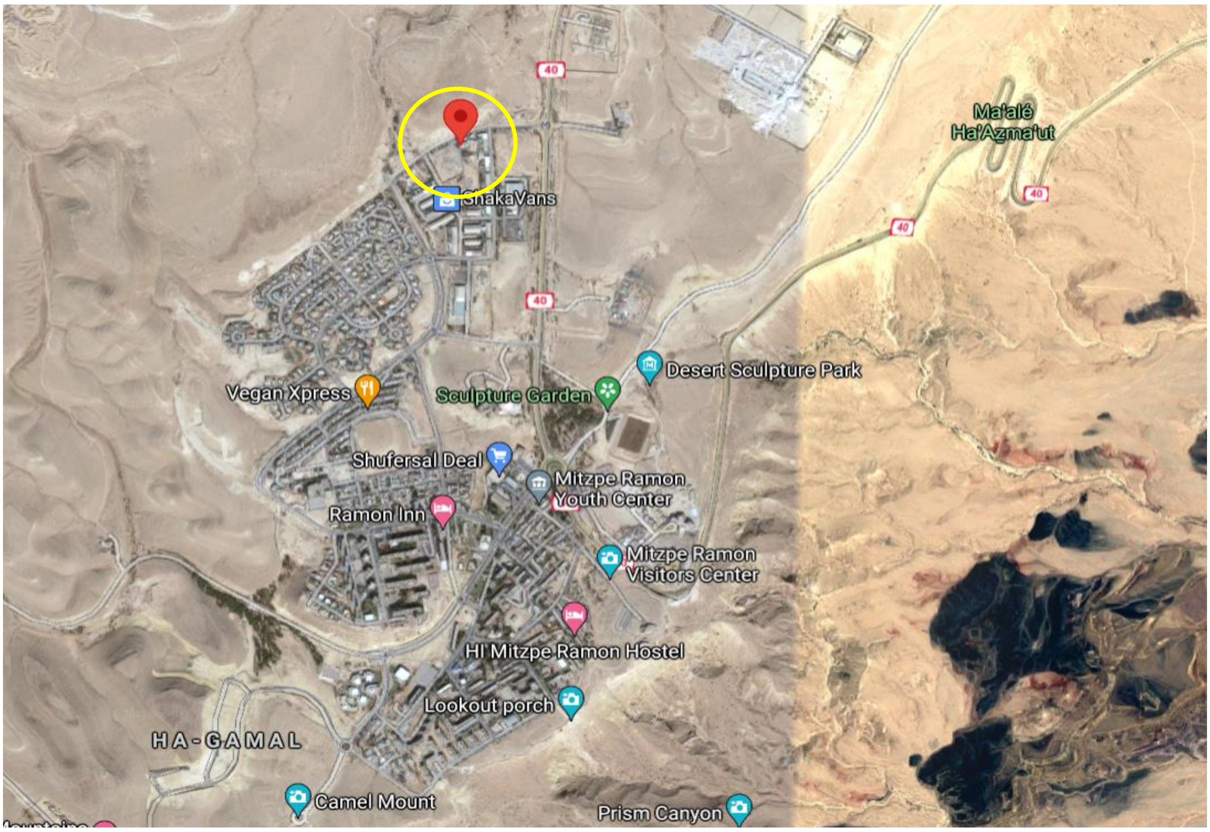
Experiment	Camera type	image resolution	positioning
AEROSCAN	Mapir camera Frontal camera	Mapir: 12 Mpx (4,000 x 3,000 px) for photos and a 2160p24 for video, RAW+JPG, JPG (RAW@ 12bit/channel, JPG@8bit/channel)	on drone
AMAZE	IDS UI-3270LE RealSense T256	2056 x 1542 px 848 x 800 px	on drone
MERCATOR rover	1x Fixed Stereo setup on a camera rig 2x ZED2 stereo cameras	720 x 480 px, RGB, 20 fps lower resolution than navigational sensors, gray scale images, 10 fps	camera rig, pylon-cameras on rover
GEOS	GoPros on AA suits, mounted when needed		Base (sample pictures) (maybe GoPro on suit)
MEROP	Sony HDR-CX240EB & HD VideoCam	1920 x 1080/50 px	currently: wall mount setup (Base)
MICRO-POTENTIAL	Canon Digital IXUS 110 IS	12,1 Megapixel, max. 4000 x 3000 px (4:3, .jpeg)	Base (sample pictures)

- Plus: GoPro from FORTIS film team WTF, including professional microphone

Photos: Impressions from station life (during the bridgehead phase)

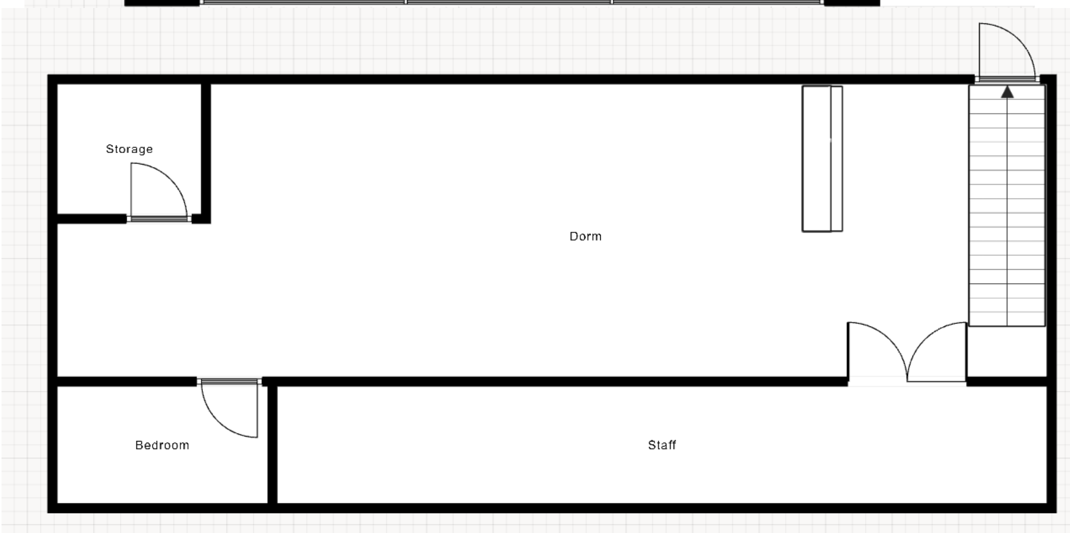
12. A-20 OSS Field office

The OSS Field Office hosted the On-Site Support, including the BME monitoring station. It was located at the Pangea Center in Mitzpe Ramon; Address: 3, Har Oded St, Mitzpe Ramon, Israel
Coordinates: N 30.621375, E 34.801050



OSS Field Office, Ground Floor

OSS field office, basement

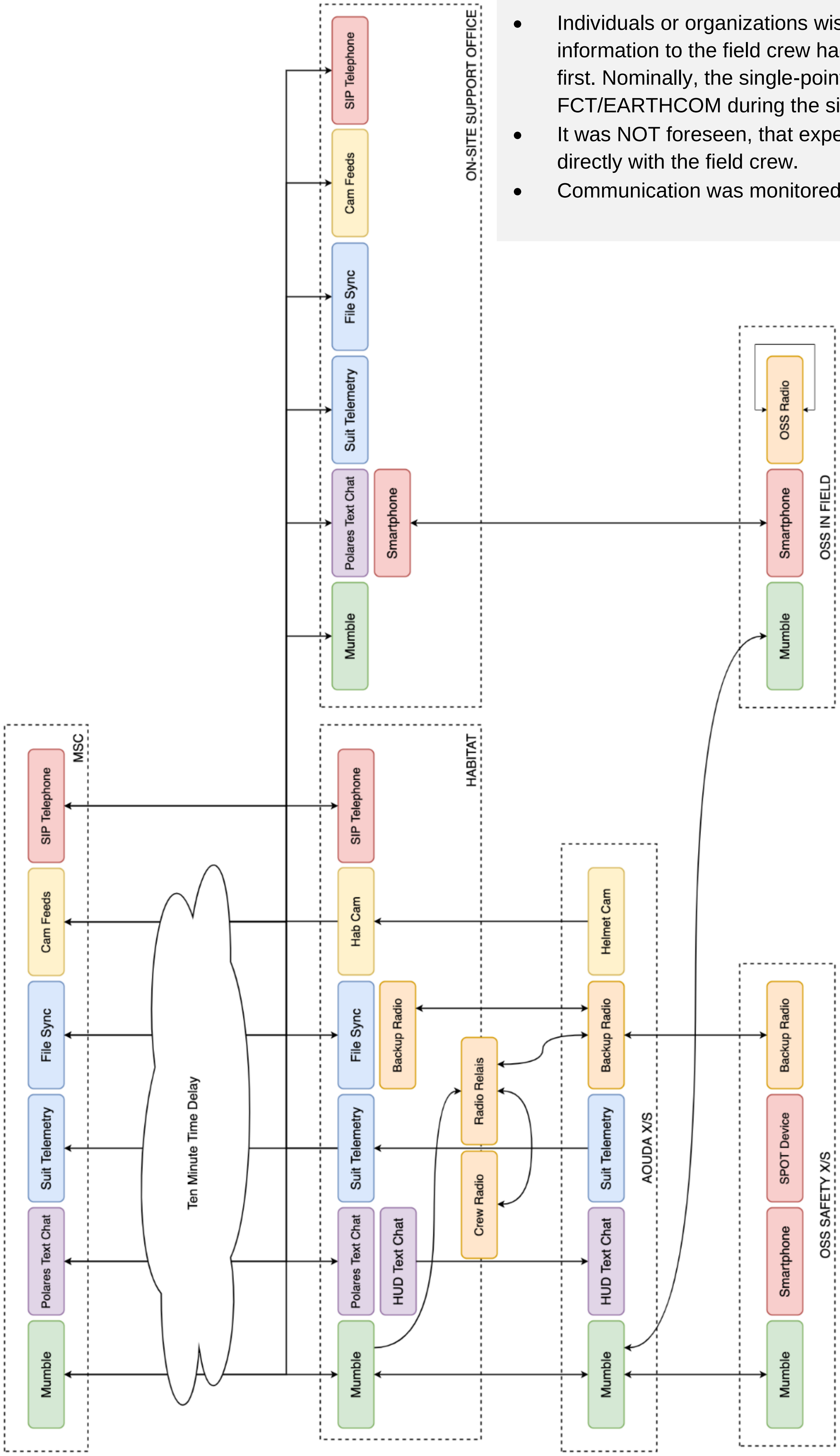


For field mobility, both two 4x4WD off-road cars, as well as 2 razor vehicles were used. In addition, a teleoperated Rovo2 vehicle with 300 kg payload capacity will be deployed.

Communication with/within the field

Notes

- Individuals or organizations wishing to relay information to the field crew had to contact MSC first. Nominally, the single-point-of-contact was FCT/EARTHCOM during the simulation.
- It was NOT foreseen, that experiment teams interact directly with the field crew.
- Communication was monitored by the MSC



Impressions from OSS field life (incl field crew teambuilding with Neta Parnas-Vizel)

13. Field Crew (Flight & OSS)

The field crew was split into two teams

- Analog Astronaut-only **flight crew** (6 crew members)
- **On-Site Support** ("OSS", ca 12 crew members, supporting the flight crew with activities, not to be conducted on Mars (e.g. SAFETY, or relocating WLAN infrastructure)

The flight crew were also subject to a rigorous nutritional and fitness training starting several months before the mission to ensure they mainained physiological performance required for analog missions.

- **Nutritional specialist: Klaus Nigl,** Univ. Of Applied Sciences for Health Services Upper Austria, Dietology branch, klaus.nigl@fhgooe.ac.at
- **Exercise specialist: Guillermo Rojo**, Spanish athlete and sports & training professional, guillermorojogil@gmail.com

All analog astronauts' activities, including public appearances, science training etc were managed by the Analog Astronaut Support team (AA-S)

- **AA-S teamlead: Claudia Kobald,** Claudia.kobald@oewf.org

Flight Crew / Commander (CDR) Joao Lousade (Dpty: Inigo Munoz-Elorza)

The Crew Commander (CDR) had overall responsibility for all simulation field operations, including overall activity planning and scheduling tasks. The OSS was managed independently by the OSS commander, and they were in direct contact with the Flight Director (FD) outside the simulation, e.g. during contingency situations, managing policy or administrative issues. The CDR had final authority on all decisions to be taken in the field, particularily in the case of contingency situations. The CDR was responsible for maintaining contact with local authorities and onsite media teams.

Operations Station (OPS)

OPS (red jacket) similar to the FD-A at MSC, coordinates the operational activities as directed by the CDR and EARTHCOM. This position was in unison with the MSC EARTHCOM, usually communicating in time-delay mode via text protocol. Off-Sim and during emergencies, OPS were able to real-time audio communication if required. This position represented the "extended eyes and ears" of the MSC, thus providing a continuous update on field activities.

SciOPS

As an extended arm, the RSS had a liaison function available in the flight crew. This position, called "SCIOPS", managed the scientific activities during EVA's. SCIOPS was aware of all scientific activities carried out at any given moment, including what activities had been accomplished, where the samples were obtained, and what conditions the instruments were in. SCIOPS assisted the SDO in maintaining the scientific data flow.

FLIGHT CREW

CDR: João Lousada (Portugal, Class of 2015)

João Lousada was born in Portugal in 1989. He completed his master's degree in Aerospace Engineering at the Instituto Superior Técnico of Lisbon. He worked as an Electrical Assembly, Integration and Testing Engineer for the Meteosat Third Generation Project for ESA at OHB System AG in Bremen, Germany. Presently he works as STRATOS flight controller and ISS Columbus Operation Systems Engineer at the German Space Operations Center in Munich, Germany. Lousada is a certified parachutist and rescue diver and is fluent in English, Spanish and Portuguese, and has conversational proficiency in German and French.

Dpty-CDR: Iñigo Muñoz Elorza (Spain, Class of 2015)

Iñigo Muñoz Elorza was born in Spain in 1979. He studied aerospace engineering at the UPM in Madrid, Spain and Astrophysics at the Valencian International University, Spain. He was linked to operations, as Operation Engineer at E-USOC, Madrid, for the Columbus module (ISS), and as an Astronaut Instructor at the European Astronaut Center in Cologne. Mr. Muñoz Elorza worked at HE Space Operations GmbH, serving as Galileo Mission Operations Preparation Engineer at DLR GfR (Galileo Control Centre) in Weßling. Currently he is the Training Manager at the Galileo Control Centre in Oberpfaffenhofen, Germany. Mr Muñoz Elorza is fluent in Spanish, German, English and speaks Italian. He is a certified skydiver, paraglider pilot, and diver.

Anika Mehlis (Germany, Class of 2019)

Born 1981 in Germany, Anika Mehlis studied biology with a focus on Microbiology at the Free University of Berlin, as well as Engineering for Environmental Technology and Recycling at the University of Applied Sciences Zwickau. During her second university degree, she worked as chemical-technical assistant at an environmental lab and as lecturer for Biology at the University of Cooperative Education Plauen. Apart from her PhD studies in Public Health at Bielefeld University, she works as a team leader in "infection protection and environmental medicine" in the Health Department Plauen, Germany. She is mother to three daughters. Anika Mehlis is fluent in German and English, and has basic knowledge of French, Spanish and Latin.

Dr. Thomas Wijnen (The Neatherlands, Class of 2019)

Born in the Netherlands in 1986, Dr. Wijnen completed his bachelor's degree in mathematics and Physics & Astronomy at the University of Utrecht, the Netherlands. Followed by a research internship at the Universidad de Valparaiso, Chile, a master's degree with distinction, and a PhD in Astrophysics, he is captain in the Royal Netherlands Air Force Reserve and engaged in projects on space situational awareness for the Dutch Space Security Center. He currently works at the Technical University of Delft on satellite tracking. Dr. Wijnen holds a PADI scuba-diving and a parachute license and is fluent in Dutch and English. His language skills include intermediate Spanish as well as basic French and German.

Dr. Robert Wild (Austria, Class of 2019)

Born in 1982, from Innsbruck, he completed his BSc in Physics at the University of Arizona and his PhD in Physics at the University of Colorado. Dr. Wild's research topics have included matter wave diffraction, the quantum mechanics of ultracold atoms, and laser-based trace gas detection. Currently, his focus is on laboratory studies of interstellar ions as a postdoctoral researcher at the University of Innsbruck. He has published in scientific journals, is a trained Wilderness First Responder, Advanced Open Water Diver, fluently speaks English and German, and has good command of Spanish.

Alon Tenzer (Israel, Class of 2019)

From Israel. Bachelor of Science in Mathematics, Computer Science and Aviation Science at the Ben-Gurion University of the Negev, and Master of Science in Neuroscience at the Weizmann-Institute of Science, Israel. Alon Tenzer is a veteran of the Israeli Air Force, where he served as a software developer & team leader, among other positions. He also worked as a researcher and data-scientist at Weizmann-Institute of Science. Mr. Tenzer currently works as senior AI engineer where he leads artificial-intelligence-based industry projects in various companies in Singapore.

BACK-UP FLIGTH CREW MEMBERS

Liad Yosef (Israel, Class of 2019)

Liad Yosef is from Israel, he completed his bachelor's degrees in Mathematics at the Hebrew University Jerusalem and in Economics at the Tel Aviv University. He served in the Israeli Air Force (Talpiot Project) in the rank of Captain. In 2018 he took part in the ISU Space Studies Program which aims for international cooperation in space related fields and activities. Currently he is an architect at Duda, Inc. He participated in a Mars analog mission in Israel as an analog astronaut as part of the DMars organization and is currently studying artificial intelligence in a study program in Israel. Besides Hebrew, Mr. Yosef is fluent in English and has good knowledge of Spanish.

Dr. Carmen Köhler (Germany, Class of 2015)

Carmen Köhler was born in Berlin, Germany, in 1980. She studied mathematics and meteorology at the Free University of Berlin. She is traned in Constructive Conflict Management and Intercultural Mediation. Currently, she is founder and CEO of P3R GmbH, a company which works in the sectors of AI programming, photovoltaics and public relations. Within the "Stiftung erste Deutsche Astronautin GmbH" and "Astronautin GmbH" she works as Education & Outreach Scientist und as an Astronaut Support. She is also a board member of Full Stack Embedded e.V., empowering students in West Africa. Dr. Köhler is fluent in German and English, and speaks Spanish and French.

On-Site Support (OSS)

OSS CDR: Judith Kuemmel, Dpty CDR: Florian Voggeneder

This team was a mix of analog astronauts, experienced field crew members and representatives of D-Mars who supported the flight crew. They were coordinated via the Mission Support Center and usually did not interact with the flight crew. OSS is synchronised with the flight crew (time-delayed as they were on Mars-time), except for when interaction with local partners (e.g. for logistics interactions).

Their responsibilities included maintaining safety, communication infrastructure, site security, conducting scientific experiments and coordinating visitors during the bridgehead phase.
Team lead of the D-MARS OSS: Gal Yoffe (D-Mars project manager fr AMADEE-20), Dpty: Gal(loy) Levy

14. Crew isolation protocol

Aims of the isolation protocol

To provide a realistic platform for the experiments, observing isolation protocols were enacted, ensuring the best scientific output. As some of the experiments were conducted by both CRW and OSS, a separate protocol addressed the joint usage of experiment hardware. From a simulation perspective, the OSS team reflected a future capability representing e.g. autonomous, robotic or AI systems during an actual Mars mission.

Assumptions

- **Isolation enacted:** 04-10Oct2021: bridgehead phase with no isolation protocol enacted, visitors on-site; 11-31Oct2021: full sim-day
- **TEAM SIZE:** 6 analog astronauts as CRW inside the base station, 8-12 persons On-Site Support (OSS, coordinated via the MSC/FP), 20-60 persons MSC
- **In-Sim**:
    - time delay 10min one-way between Field & MSC, no time delay between OSS & CRW (both OSS and CRW are operating in “Mars time”).
    - 2-way text chat communication between Field & MSC; MSC & OSS is passively listening in into voice loop(s)

Protocol applicability

- The isolation protocol applied to the FLIGHT CRW only, i.e. OSS and MSC applied the isolation protocol only with respect to the CRW
- In case of emergencies affecting CRW or OSS members, including those back home, the isolation protocol would have been immediately terminated

Basic rules

- Emergencies back home or at the station were excluded and messages were relayed as soon as possible.
- AA’s were only allowed to leave the base station whilst wearing a spacesuit during EVA’s. Overall-suited walk-outs were only allowed if directed by MSC (e.g. emergency retrieval of a hardware item). Selected unsuited experiments were supported/conducted by OSS according to the experiment setups.
- In-Sim: defined by sim-start/end according to SOPs (“mostly” during daylight, night-time EVA’s were possible but not conducted during AMADEE-20); no 24/7 simulation (Out-of-sim communications nevertheless were limited as it impacted in-sim operations during the day)
- Maintenance, servicing and minor repairs were first attempted by the CRW as trained and directed by MSC, and OSS support was activated only if necessary. Base station’s IT setup was physically accessible from the outside, but this scenario did not occur.

CRW Limitations

SERVICE / Comm-Channel	In-Sim ("Day")	Out-of-Sim ("Night")	Black-Day
Time-delayed chats	Yes, 10min one-way delay	Not active/not required (except immediately before going in/out of sim as per SOP)	No
Real-time chats for private use (eg Whatsapp-chat) & Email	No	Yes	Yes
Spacesuit telemetry	Yes, 10min one-way delay	Yes, eg for maintenance	Yes (if suit is activated)
Experiments: data to MSC (except for regular daily data dumps)	Yes, as foreseen by experiment planning (eg automated time-delayed transfers)	Yes, eg for maintenance	No, unless specifically planned for eg long running updates)
Telephone & Internet-based voice communication in real-time (Mumble, Skype, VoIP, Whatsapp, etc)	No	Yes, but some technical restrictions might apply (bandwidth limitation etc)	Yes
Being able to access the web (eg for news)	No, unless authorized by CRW CDR (eg in case of LoS with MSC for checking weather)	Guideline/Recommendation: 30min/personday	Yes

OSS – FLIGHT CRW Interaction

- In case of an emergency (e.g. code-red situation), the isolation would have been terminated
- In general, no direct physical, verbal or non-verbal interaction between OSS and CRW in the field would not be allowed (OSS might be in sight (not hiding out), but not interacting unless planned)
- CRW communicates with OSS via text chat only.

Communication notes:

- OSS was in the same loop as CRW; MEDO had access to Back-up radio (MEDO part of OSS). Also, the spotters for robotic assets were on the backup loop for interactions with the AA's when necessary (e.g. aborting a roll maneuvre of a rover teleoperated by an AA)
- SAFETY was part of the OSS team.
- OSS-specific maintenance activities (e.g. technical issues with the spacesuits):
    - If h/w could be moved to the airlock, OSS would have retrieved it to the shipping container, where pwr, comm and basic workshop were available.
    - If h/w could not be moved and physical repair inside the station was required: OSS would have been able to access it in order to carry out the necessary steps, e.g. during AAs out-of-sim hours or a simulated radiation alert (e.g. AAs restricted to sleeping quarters)
    - Handover of hardware was possible and utilized via "orbital drops", to move items via the airlock without contact between OSS and AAs.

15. Media Activities

AA Liad Yosef during the "walk-out" media event on the 31Oct2021

The OeWF was coordinating the media and outreach efforts based on a communication plan, detailing the media milestones, key messages and workflows as well as the management of crisis situations. The media plan had been developed in close collaboration with the ISA representative. The official wording was:

> *"AMADEE-20 is a Mars analog simulation in the Negev Desert, Israel, managed by the Austrian Space Forum hosted by the Israel Space Agency"*

Both the AMADEE-20 partners and the OeWF and their respective partners could communicate to the public, using mission-specific items. These included mission insignia, training and mission-specific photography and videos, authorized statements from key personnel, sponsoring agencies, research entities and industrial partners.

The media team had prepared supplementary material available at: https://amadee20.oewf.org and, until the start of the mission, press photos from previous missions could be used from: https://oewf.org/en/press/photos/ Once a basic set of videos and photos had been produced during the bridgehead phase, this raw material, including HD-format B-roll footage, was made accessible for external media teams to avoid redundant filming.

In communicating to the public, the following applied:

1. Any communication had to be authorized by the AMADEE-20 media team. In case of a dispute, the AMADEE-20 leadership would take a final decision.
2. All public communication (press releases, social media activities, photos/videos etc.) as well as media clippings were registered in a media archive managed by the OeWF.

3. The OeWF would compile a press kit in English, including mission description, partner listings, quotable statements and contact staff members both from the Israeli and Austrian side. The Israel Space Agency would provide a Hebrew version.

Social media hashtags were **#simulateMars** and **#AMADEE20**
The mission tagline was **"Exploring tomorrow. Exploring Mars."**

Facebook: spaceforum **|** Twitter: @oewf **|** YouTube: oewf **|** Instagram: oewf_org **|** Flickr: oewf

Media authorization

The content, which has to be authorized, had to be sent to the OeWF Media Team lead Monika Fischer (monika.fischer@oewf.org), and copied to the AMADEE-20 leadership Gernot Grömer (Gernot.groemer@oewf.org) and Sophie Gruber (sophie.gruber@oewf.org).

In order to approve the content, the following information was needed:
- When would it be published?
- When would be the approval deadline?
- Where and through which media would it be published?
- In case the content is neither in English nor in German, a description in either of those languages shall be attached.

Media milestones

Date	Event	Description	OeWF Media Activity
16Dec2019	Mission badge release	Communication of A-20 mission insignia	Social Media with blog post
Feb2020 tbd	Crew training starts	Mission specific training for Analog Astronauts	Pre-production (pre-mission interview series, group photos etc.)
March2020	Crew announcement	Information regarding Analog Astronaut crew (flight crew and back-up crew) released	Social Media Coverage, Press release (international, tbc)
19-21Jun2020	Dress Rehearsal I	1st Dress Rehearsal, qualification test of experiment hardware, Team familiarization; MSC first operational test	Social Media Coverage Preproduction (experiment h/w videos + photos + PI interviews)
Jun-Oct		Presentation of experiments via social media AND press releases	
10-12Jul2020	Dress Rehearsal II	2nd Dress Rehearsal, PIs, AA s and Team members @ Innsbruck, experiment hardware ready	Social Media Coverage
28-30Aug2020	Dress Rehearsal III	3rd Dress Rehearsal, PIs, AA s and Team members @ Innsbruck, procedure & contingency training	B-roll footage shooting; photography
0406Jun2021	Dress Rehearsal IV	Recap training teams / integrated	Social Media Coverage
13-15Aug221	Dress Rehersal V	Integrated sims of all teams	Press release "The game is on again"
20Aug2021	Mission GO announcement	Release of mission trailer	
Sep2021	Shipment AUT→ISL	Hardware containers leave Innsbruck	Social Media, B-roll footage shooting
04Oct2021	Start of Bridgehead phase	Preproduction, B-roll shoots, Sponsor shootings	
11Oct2021	Mission start	Start of the Isolation phase, from then on: interaction with AAs only via MSC Innsbruck	Press release, Live-coverage both at Mission Support Center and Israel
31Oct2021	Return to Earth	Crew leaves station; celebrates return & reflects on mission	Social Media Coverage Post-mission press conference Israel + Start of student lectures across Israel - tbc
ca 10Nov2021	Last crewmembers return to Europe; communication of first pilot results	Social Media Coverage Post-mission press release Austria + International post mission press conference Austria-tbc	ca 25Nov2021
09-11Apr2022?	A-20 Science workshop	Discussion of science results within research teams	press release Austria + International

16. Media Reports Summary

This section provides a small subset of the actual media response – just a few highligths are mentioned.

Austrian National Press

- 03Nov2021: DerStandard, Zurück von der Marsstation im roten Wüstensand, online
- 28Oct2021: Servus TV, Was lernen Forscher von AMADEE-20?, TV Beitrag, 5.46 Min.
- 25Oct2021 ORF Studio2, Marssimulation mit österreichischer Beteiligung, TV Beitrag 5.28 Min.
- 22Oct2021: ORF 2, Mary's Magazin – Wissen für alle, Marsmission "Amadee 20", TV Beitrag, 5.14 Min.
- 17Oct2021: OE1.ORF,at, Ö1 Quiz mit Fragen zur ÖWF Mars Simulation im Ramon Krater in Israel, Radio Quiz
- Tiroler Tageszeitung (Sonntags Magazin), Ein Funkspruch aus der Wüsten-Isolation, Print S. 14 + 15 und online
- 16Oct2021: Kleine Zeitung, Mission AMADEE-20 Wie das Überleben auf dem Mars geübt wird, online + Print
- ORF Steiermark, Heute, Mars Mission mit Steirer Technik, TV Beitrag, 2:06 Min.
- 15Oct2021: ORF OÖ, Marssimulatio mit Österreichischer Beteiligung, TV Beitrag 2:50 Min. (Mediathek)
- 14Oct2021: Ö1 Kinderjournal, Nachrichten für Kinder: Ein Marshund in der Sandkiste, Radio
- 11Oct2021: Krone.at, Physiker aus Österreich wohnt 3 Wochen am „Mars", online
- servustv.com, Mars-Simulation in israelischer Wüste gestartet, TV Beitrag + online
- DerStandard.at, Mars-Simulation unter österreichischer Leitung, online
- ORF, ZIB 1 19.30, Mars-Simulation in israelischer Wüste, TV Beitrag
  oe1.orf.at, Israel: Mars-Simulation, Radiobeitrag, online
- Tiroler Tageszeitung, "Abläufe gleich wie bei der NASA": Mars-Simulation mit Technik aus Tirol, online + Print S. 6
- 07Oct2021: DerStandard.at, Start von Simulation einer Marsmission mit Helikopter-Tests, online
- 01Oct2021: science.apa.at, Mars-Simulation: Analog-Mission "AMADEE-20" startet am Montag, online
- Salzburger Nachrichten, Mars-Simulation: Analog-Mission "AMADEE-20" startet, online
- science.orf.at, Nächste Marssimulation startet, online

International Media

- israelmagazin.de, Präsident Herzog trifft Astronauten der AMADEE-20-Marssimulation, online
- NPO2 (Netherlands), Atlas – Science Show: interview with Thomas Wijnen on AMADEE-20, TV feature
- Japanese TV, news feature, 1.42 min.
- Stern.de, Bilder des Tages: 11. Oktober: Marsmission, online
- TV5Monde: Espace : des astronautes simulent la vie sur Mars dans le désert israélien, online
- news.abs-cbn.com, Astronauts conduct Mars simulation in Negev desert, online
- New York Post, In a rocky Israeli crater, scientists simulate life on Mars, online
- FAZ.net, Marsmenschen in Israel, online
- DailyMail.co.uk, Life on Mars? Six astronauts are spending four weeks on a fake 'Red Planet' in Israel's Negev Desert to prepare for future missions, online
- Spiegel.de, Mars-Experiment in der Wüste: »Wir wollen ganz schnell scheitern«, online
- BBCNews, The #Mars mission taking place in the Israeli desert. #AMADEE20, TV feature kompass.com
- zhukvesti.info, Миссия Amade-20: Analog Mars завершается в Израиле через 3 недели, online
- cronica.gt, AMADEE-20: La misión analógica a Marte con sede en Israel finaliza después de 3 semanas, online
- telemundo40.com, Misión a Marte: así se preparan los astronautas en la Tierra para viajar al "Planeta Rojo", online
- The Jerusalem Post, AMADEE-20: Israel-based Mars analog mission finishes after 3 weeks, online
- technews.tw, 火星計畫未雨綢繆， 先在以色列拉蒙坑練習, online
- 3sat NANO, Marsmission in der Negev-Wüste, TV Beitrag 5.05 Min.
- publico.pt, Experiência portuguesa simula comando de robô marciano… no deserto do Negev, online
- De Telegraf (NL), STAR TREK in de woestjin, Print S. 19
- bbc.co.uk, Mars mission in Israeli desert will help prepare for life on Red Planet, online
- Jamaica Observer, Life on Mars: simulating Red Planet base in Israeli desert, online
- BBC.co.uk, Mars mission in Israeli desert will help prepare for life on Red Planet, online
- The Jakarta Post, Life on Mars: simulating Red Planet base in Israeli desert, online
- Borneo Bulletine, Life on Mars: simulating Red Planet base in a desert, online
- Bangkok Post, Life on Mars: simulating Red Planet base in Israeli desert, online
- Taipei Times, Scientists simulating life on Mars in Israeli crater, online

- indianlekhak.com, Life on Mars: A simulation of the Red Planet base in the Israeli desert for astronaut training, online
- The New Zealand Times, Life on Mars: simulation of the base of the red planet in Israel, online
- RTL.de, Test für bemannte Missionen auf dem Mars, online
- GEO France, Dans le désert israélien, des astronautes simulent la "vie sur Mars", online

17. AMADEE-20 Social Media

The aims of the social media campaign were…

- Tell the story of our **13th Mars analog mission in Israel** as a necessary step to pave the way for future human Mars missions.
- **Increase the profile** of OeWF as competent, international research partner and its world-class expertise in conducting high-fidelity Mars analog research complemented by a Mission Support Center
- **Space exploration made in Europe**: The OeWF is the only organization in Europe to develop spacesuit technology for human planetary missions.
- Inform & inspire the next generation of researchers through the Junior Research Program for future human Mars missions.

For AMADEE-20 there were 2 major taglines:

Exploring Tomorrow. Exploring Mars.

The primary tagline was to be used when communicating about Mars analog activities, activities in Israel, explaining the analog mission.

Space Exploration made in Europe

The secondary tagline was to be used when communicating OeWF expertise, Mission Support Center and international cooperation.

AMADEE-20 key messages were:

- During AMADEE-20 the Austrian Space Forum will apply its world-class expertise in conducting high-fidelity Mars analog research.
- AMADEE-20 moves us closer to understanding the scope of the biggest adventure of our generation: Humans exploring Mars!
- AMADEE-20 brings challenges for both technology and humans. We are paving the way for future human Mars missions.
- The Austrian Space Forum is the only organization in Europe, and one of only four worldwide, to develop spacesuit technology for human Mars missions.
- AMADEE-20 is the Austrian Space Forum’s 13th Mars analog mission. We benefit from the insight and experience gained from our previous Mars simulations.
- The highly trained AMADEE-20 analog astronauts and field crew, complemented by the OeWF’s Mission Support Center will make their expertise and findings available to international partners.

- AMADEE-20 is an international and interdisciplinary analog mission involving more than 20 nations.
- AMADEE-20 is augmented by innovative education and outreach activities to inform and inspire the next generation of researchers and the general public for future human missions to Mars.
- The Israeli Space Agency is an indispensable and highly supportive partner hosting the AMADEE-20 mission. D-Mars is providing essential logistics, especially the Mars analog habitat which has been specifically designed for this mission, based on the Austrian Space Forum's specifications. The Negev desert in Israel is a most ideal test area for emulating a mission to the extreme living conditions found on Mars.

AMADEE-20 Hashtags: #AMADEE20, #simulateMars #exploringTomorrow #exploringMars
Main OeWF social media channels: Facebook: spaceforum | Twitter: @oewf | Instagram: oewf_org | LinkedIn: www.linkedin.com/company/austrian-space-forum-oewf-/ | Website: oewf.org

Highlights of our Social Media campaign:

- TeamFriday Timeframe: Apr-July 2020, Apr-Sep 2021
- Picture of the Day, Timeframe: Oct 2021
- Feature on science experiments: Timeframe: Oct2021
- Weekly summary about the mission (blog): Oct-Nov 2021
- Instagram Takeovers by AMADEE-20 teams: July – Oct 2021
- ESERO cooperation with Portugal https://amadee-20.esero.pt/pt

Social Media Numbers

With AMADEE-20 Social Media posts we reached about 6 Mio people with over 10 Mio Impressions. The video greeting of ESA DG Josef Aschbacher was the posts which reached most people. The best engagement was with the post from the State of Israel on AMADEE-20 ("Mars is closer than we think"), followed by our 1st picture of the Day, the all-female EVA. Social network wise, Twitter is the best network for reaching many people, Instagram the best one for engagement with our followers (54.6% engagement rate).

Twitter:
To track the performance of our hashtags #simulateMars and #AMADEE20 we used Keyhole as provider
Timeframe:26Sep – 06Nov 2021

- **1,586 Tweets**
- **3,179,398 Reach** (the number of unique users(people) that could have seen the hashtag)
- **9,472,626 Impressions** (the potential numbers of times somebody could have seen the hashtag)

In addition, we tracked separately also for oewf:

- **1,320 Tweets**
- **5,807,736 Reach**
- **10,335,674 Impressions**

Only 539 of these posts included the hashtag #AMADEE20, in 166 posts the hashtag #simulateMars was included. This was an interesting observation and indicates AMADEE hashtag had a far higher reach than with the latter hashtag. This increased AMADEE hashtag use could be explained by frequent use by our own team members and partners. We were tagged by accounts such as @Israel and the Israel Embassy but they did not use the AMADEE hashtag. These accounts have high number of followers also outside the space community and therefore contributed to a higher reach within the "oewf" tracking, with an absolute number of **1,173,935** reaches (equal to potential reach)

The Keyhole hashtag tracking included Instagram, Facebook and news sites. The following screenshots included total social media numbers not just twitter. Unfortunately on Instagram and Facebook only business accounts can be tracked. Therefore, they do not contribute as much as Twitter to the total reach and impressions.

Tracker "AMADEE-20" (posts including #AMADEE20 or #simulateMars)

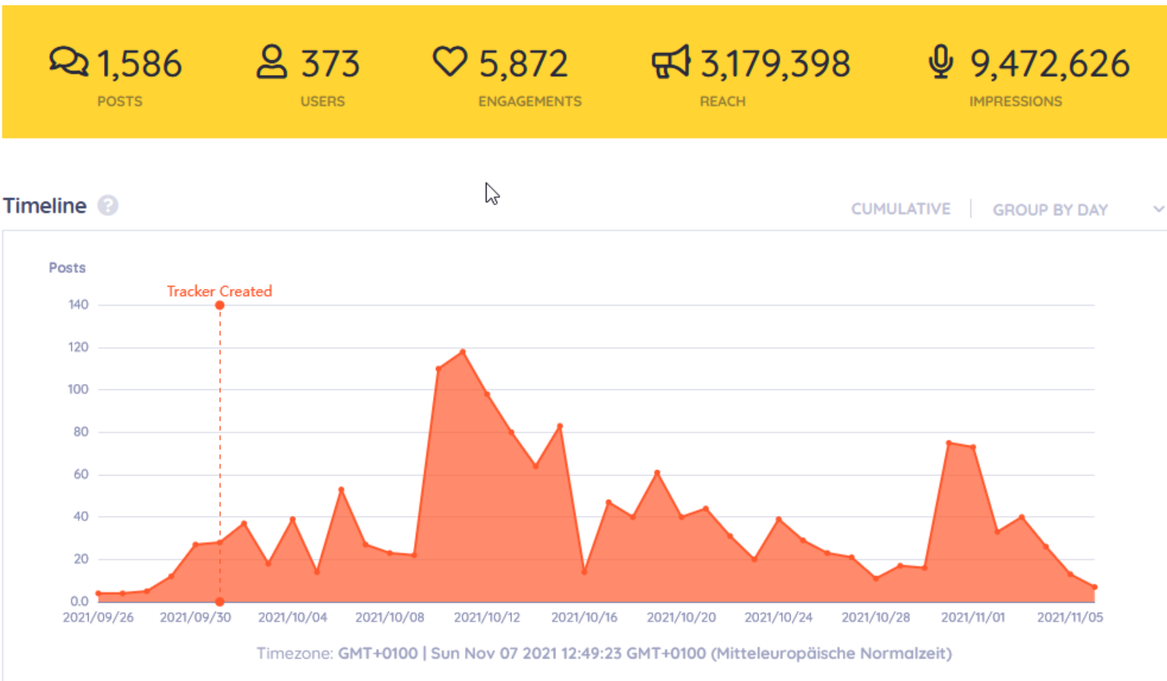


Figure 1: Keyhole Timeline 26Sep - 06Nov2021

Figure 2: Related Topics – many of the keywords used in the posts are related to Mars Mission analog and Israel

Influencers

Influencers are important catalysts, especially if you get influencers outside the traditional space community on social media. They can project their influence and reach far beyond our target audience and acquire new followers. For example, the BBC journalist Tanya Dendrinos tweeted a single time about our mission with a good engagment rate and therefore, this tweet led to a total exposure of 46,057 impressions. In addition to this, there were two tweets by the State of Israel twitter account which yielded a total exposure of 1,728,016 impressions. The OeWF twitter account has reach of about 2 million followers and we have posted around 265 tweets.

Tracker "oewf" (posts including oewf)

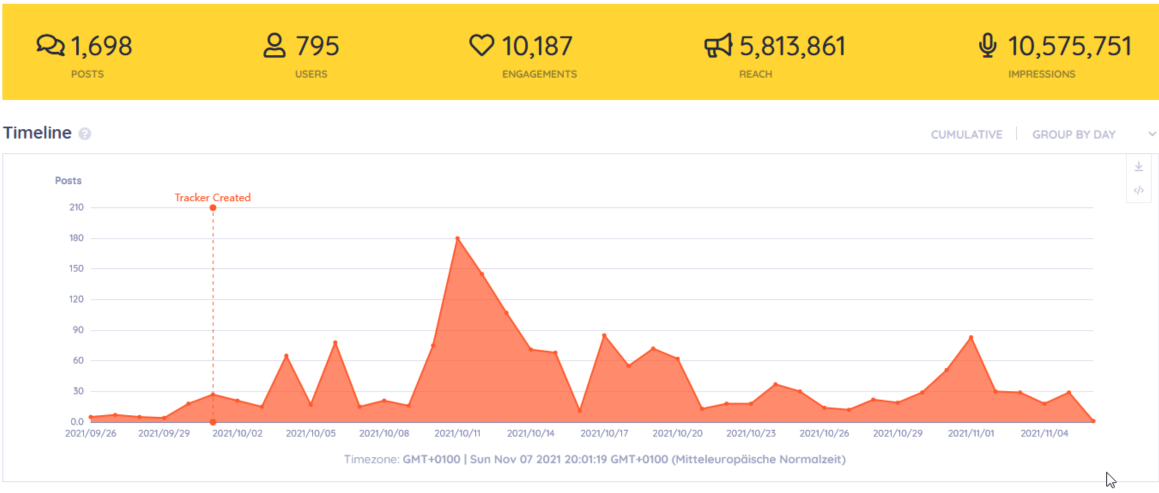
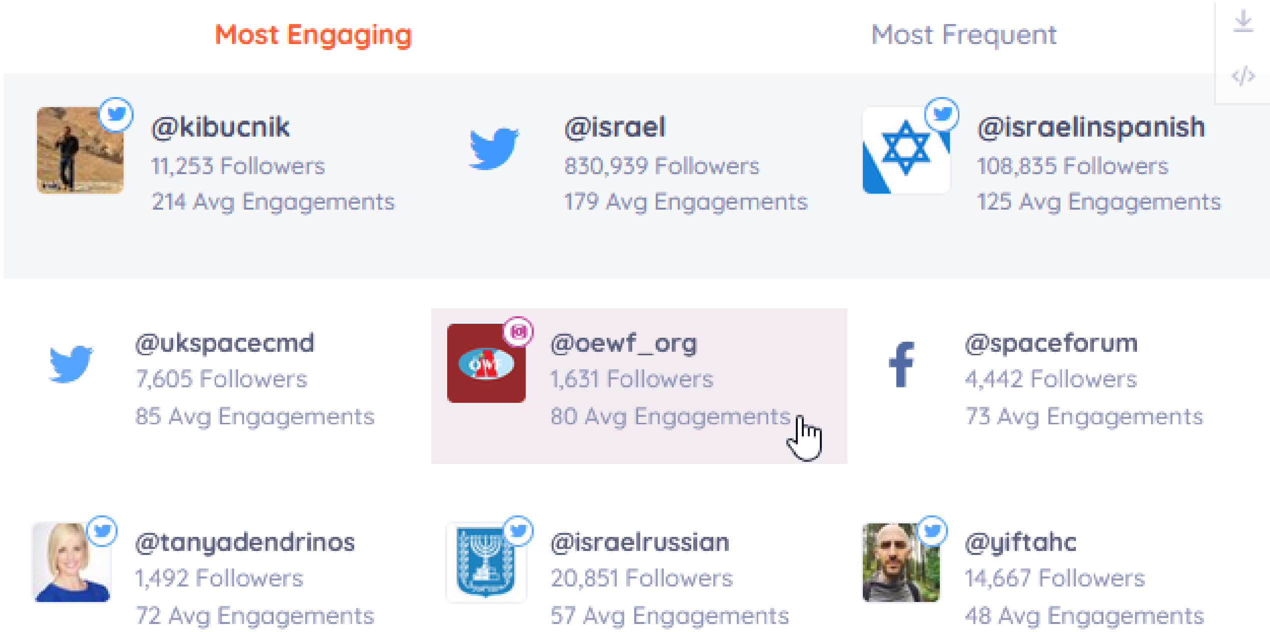


Figure 3: Keyhole Timeline 26Sep - 06Nov2021

The related topics are comparable to the AMADEE-20 tracker, the Influencers as well, therefore only a quick summary of the most engaging Influencers.



Top Posts during AMADEE-20 (Impressions/Reach)

Twitter

TWEET CAPTION	ENGAGEMENTS	IMPRESSIONS	ENGMT RATE	DATE
#AMADEE20 @esa DG Josef Aschbacher sent us following video message and congratulates us on the currently running AMADEE-20 mission. This was a big motivation for our teams on + . @ILSpaceAgency... Tag this post	126	9,335	<1%	Oct 18, 2021 10:20 AM
NEWS: Our first #AMADEE20 team successfully landed on #simulateMars in . @GWWorld look what they found there big thanks to @ILSpaceAgency & @DMarsAnalog for your hard work so far. #ExploringTomorrow Tag this post	281	6,623	<1%	Sep 30, 2021 11:51 AM
#Meettheflightcrew So the last one to conclude the #AMADEE20 flight crew is @ThomasWijnen . Thomas is also a "Tardigrade" (nickname of #classof2019) and AMADEE-20 will be his first #simulateMars mission. He holds a PhD i... UGC ×	172	6,349	<1%	Oct 6, 2021 7:50 PM
All the missions at and on Mars went to holidays due to Solar conjunction. As the Sun stands in the line of sight between Earth and Mars, communication is not possible during the next few weeks: https://t.co/Y0TjeVDF2O Tag this post	40	4,732	<1%	Oct 2, 2021 10:06 AM
#AMADEE20 Flightplan: @Astro_Wild & @ThomasWijnen are doing an EVA this morning. On the consoles are @Astro_Anika & @izarnauta . For the afternoon we plan VFReFast & another Merop run. : Today's helmet cams,... UGC ×	124	3,886	<1%	Oct 15, 2021 10:48 AM
#AMADEE20 Day-0 We are writing OeWF history with our all female EVA! Our analog astronauts @Astro_Anika and @astro_carmen entering the Negev desert in Israel. @voggeneder @ILSpaceAgency,... UGC ×	249	3,667	1%	Oct 10, 2021 3:00 PM

Facebook

POST CAPTION	ENGAGEMENTS	REACH	ENGMT RATE	DATE
#AMADEE20 Picture of the Day 05 A beautiful aerial view of our mission site in the Ramon crater in the Negev desert in Israel. You can see the AMADEE-20 habitat, the solar panels for power generation (provided by the... UGC ×	259	2,843	9%	Oct 15, 2021 12:01 PM
Safe travels to all our #AMADEE20 team members on their way to #simulateMars in or to the Mission Support Center in #ExploringTomorrow Tag this post	306	2,605	12%	Oct 2, 2021 5:30 PM
In #AMADEE20 many women in various positions are involved. Analog astronauts, scientists, flightplanners, human factors, media, on-site-support, medical doctors & many more ... No matter your gender, together we bring... UGC ×	164	2,601	6%	Oct 8, 2021 5:20 PM
#AMADEE20 Day 01 The isolation phase of the six-member field crew starts today. With their field research, the international science teams and the analog astronauts bring us a little closer to a future Mars mission. Our analog... UGC ×	80	2,572	3%	Oct 11, 2021 12:01 PM
#AMADEE20 Day-0 We are writing OeWF history with our all female EVA! Our analog astronauts Anika Mehlis and Dr. Carmen Koehler entering the Negev desert in Israel. More about our #simulateMars Mission #AMADEE20 →... UGC ×	154	2,376	6%	Oct 10, 2021 3:10 PM

Instagram

POST CAPTION	ENGAGEMENTS	REACH	ENGMT RATE	DATE
#AMADEE20 #Science Tumbleweed, the wind-driven, rolling rover by @team.tumbleweed is exploring the Negev desert. This experiment is a Junior Researchers Experiment. These fine young researchers already took part in... Tag this post	135	1,872	7%	Oct 20, 2021 5:31 PM
AMADEE20 Mission End Trailer Our 13th Mars analog simulation #AMADEE20 ended on 31 October 2021. More than 200 people from 25 countries... Tag this post	41	1,041	4%	Nov 2, 2021 5:31 PM
Did you follow our story today? If not check it out as our analog astronauts did takeover our account and gave unique insights during the isolation phase. #AMADEE20 #simulateMars #Mars #analogs #simulation #Israel... Tag this post	47	990	5%	Oct 19, 2021 6:58 PM
ESA Director General Josef Aschbacher sent us following video message and congratulates us on the currently running AMADEE-20 mission. . What a great motivation for our teams on + . #AMADEE20 #simulateMar... Tag this post	46	846	5%	Oct 18, 2021 11:10 AM
#Meettheflightcrew So the last one to conclude the #AMADEE20 flight crew is Dr. Thomas Wijnen . Thomas is also a "Tardigrade" (nickname of our #classof2019 analog astronauts) and the mission in the Negev desert will be his... UGC ×	79	797	10%	Oct 6, 2021 5:30 PM

On Instagram, reels were not tracked by Keyhole. These performed very well with 2 out of the 3 reels reaching more followers than Instagram post.

Recent content	Type	Reach	Likes and reactions	Comments	Shares
Expect this in... Sun Oct 10, 9:0...	Instagram	5.8K	120	1	0
That's how a... Fri Oct 29, 4:38...	Instagram	3.7K	93	0	0

Instagram has the best engagement rates with approximately about 1,600 followers. The stories performed very well and each story had on average 150 impressions (we posted in total about 300 stories)

Homepage: A total of 7 articles were published during the mission (counting only one language). These consisted of one press release (Mission start day), 5 blog posts (Weekly updates on Sunday) and one picture of the day articles (starting with 1 day before the mission start day, which was uploaded daily). If every picture of the day were counted as an individual article this would have been an additional 22 articles.
This is comparable to the AMADEE-18 mission with 9 articles and AMADEE-15 mission, were a total of seven articles were published (AMADEE-15 was shorter with only 14 day mission).
For AMADEE-20 there was a focus on longer texts on social media and not publishing blog posts. On the AMADEE-20 landing page a social media wall was included so that non-social media user can also access this information.

18. Industrial & marketing partners

Name of partner	Short description of partner	Contribution to A-20
AMADEE-20 experiment teams	We consider all external experiment teams as partners as well. However, those teams might have further partnerships with e.g. technology manufacturers on which the OeWF does not have any influence or relationship.	
B&C Privatstiftung	Industrial and educational trust fund (https://bcgruppe.at/en/private-foundation/)	Sponsorship and exchange of A-20 power projections
ESA	European Space Agency	Provision of the MELT 3D printer
Fair-rescue	Local distributor of medical equipment (https://www.fairrescue.at/news/index.php)	Provision of medical equipment
Fortis	Manufacturer of luxury watches www.fortis-swiss.com/amadee-20	"Official timekeeper" supporting with creation of the A-20 watch
FPT industrial	Provider for power solutions and manufacturer of generators (https://www.fptindustrial.com)	Sponsorship
Gebrueder Weiss (GW)	Globally working transport and logistic company from Austria (https://www.gw-world.com/)	"Shipment and logistic partner" providing the hardware transport to and from Israel
Goetzloff Inc.	Providing protective clothing for biohazards	Providing hygiene material for visitor entering the habitat
Governments Tyrol & Upper Austria	Dep. of Health and Sciencen (Tyrol) + the Dep. of Social & Health (Upper Austria)	Financial support for Outreach activities in schools & MSC
Henschl	German tech company in autonomous navigation	Rovo 2 follow-me technology
IKB	Regional high bandwidth provider (www.ikb.at)	Connectivity for the MSC during the DR I-III
LANCOM	Provider for IT solutions and manufacturer of W-LAN hardware (https://www.lancom-systems.com)	Provision of W-LAN equipment, Polo shirts and a training
Landgarten	High quality organic food producer www.landgarten.at	Provision of goodie bags for the Innovation day
Lumina Sparks	German provider of human factors training (https://luminalearning.com)	Resilience and reflection training for team members
Magenta Austria	National high bandwidth provider (www.magenta.at)	Connectivity for the MSC during the DR IV-V & Mission
Manastech, Argentina	Software engineering for unconventional prototypes, https://manas.tech/	Software support for the Aouda Head-Up Display
Mattro	Austrian electric mobility plattform provider (https://mattro.com)	Rovo 2 robotic mobility platform
PBS Swiss Tools	Manufacturer of mechanical precision tools (https://pbs.swisstools.com)	Provision of mechanical tools like screwdrivers
Peak Technologies	Lightweigth aerospace structures manufacturer www.peaktechnology.at	Sponsorship of the Innovation Day luncheon
Roboauto	Rovo 2 teleoperations, https://roboauto.tech	Provision of teleoperation capability for Rovo 2
TesPack	Manufacturer of portable solar panels and power banks (https://www.tespack.com/)	Marketing cooperation
x-bionic	Manufacturer of high-performance sports garment (https://www.x-bionic.com/en)	Provision of high-function undergarment for AAs

A-20 Innovation Day / 31Oct2021

This industrial networking activity was combined with the walk-out of the analog astronauts after the conclusion of the mission. There were no major science assets operational on that day, e.g. no donning of spacesuits

Innovation Day schedule

- 11:00 Arrival at the Pangea Restaurant (next to the A-20 field office): Welcome and safety briefing for the habitat visit
- 11:30 Introduction of the Israeli space startup ecosystem, highlighting Israeli space capacities and industrial needs
- 12:30 Lunch break, Networking meetings & bilateral round tables
- 13:00 Transfer to crater & welcome-back ceremony/ A-20 flight crew
- 17:30 Busses returned to Tel Aviv

Participating partners at the Innovation Day

GreenOnyx Space Vision: Duckweeds For Feed & Life Support

19. Science Strategy Overview

Exploration Cascade

The AMADEE-20 expedition focused on the interplay of the respective instruments and experiments relevant for human-robotic Mars missions. Based upon the research question of how to identify biomarkers, which traditionally categorizes the (paleo-)geoscientific environment, leading to the experiments being selected to reflect a realistic sequence of activities.

This strategy was based upon the "exploration cascade", an algorithm defining an efficient deployment sequence, providing the framework for the following question: "*which instrument would need to be active where and when, leading to what kind of data sets, leading to what kind of knowledge, leading to which type of input for the tactical flight planning*"

As suggested by Neveu et al. (2018) life-detection measurements must be sensitive, contamination-free (absence of interfering signals), and reproducible. One or more features must be detectable, preserved, reliable, and compatible with life on Earth. Experiments will be scheduled according to a flight plan defining the resources, location and timing. Additionally, considering the processing pipeline between data acquisition in the field, data transfer and integrity checks and the subsequent near-real time interpretation to formulate a hypothesis. This then translates into a scientific input into the tactical flight planning for the field crew.

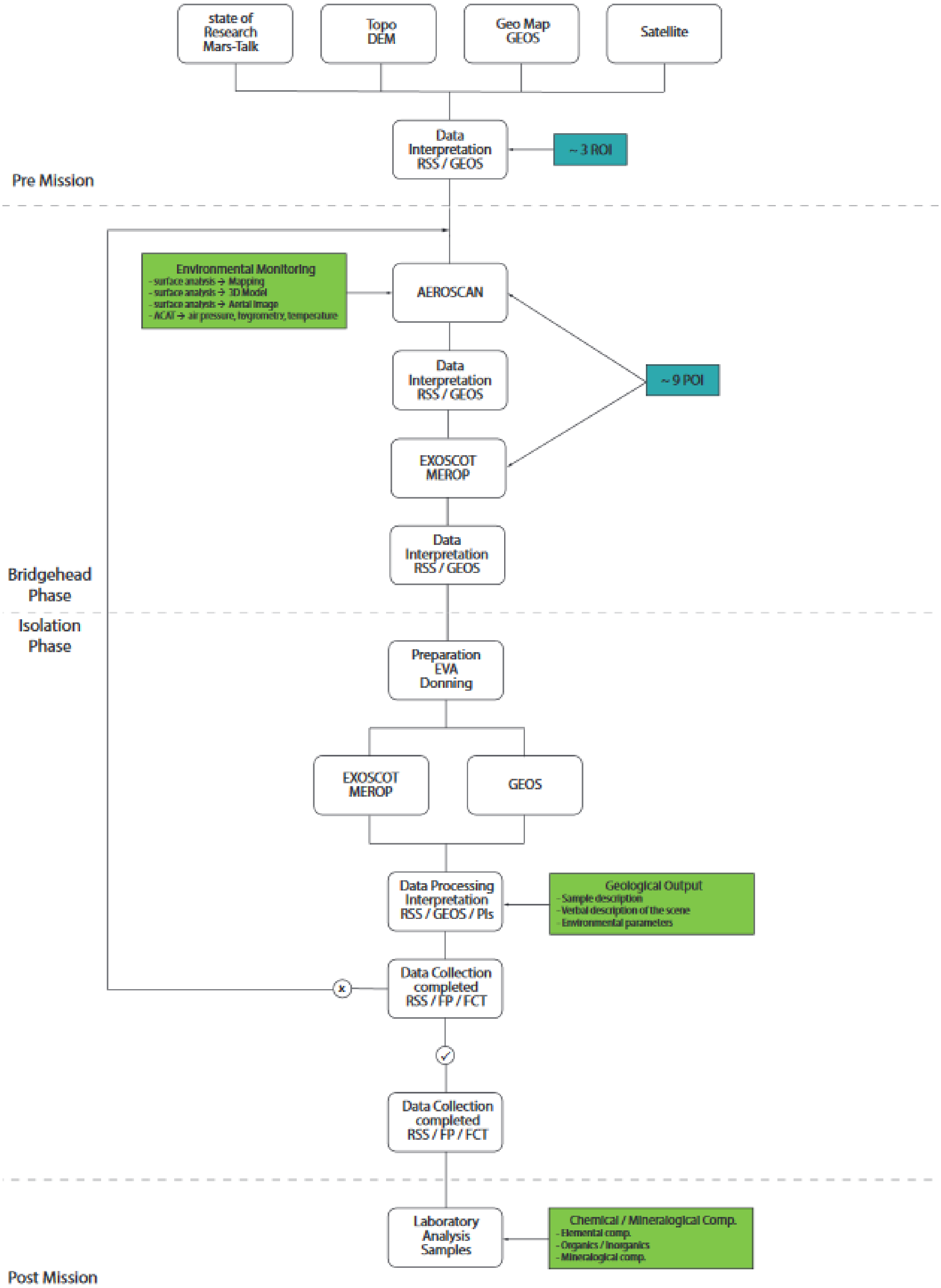
For details we refer to the BSc work of Stefanie Garnitschnig from 2018 on the Exploration Cascade (available via www.oewf.org → Research → Academic theses).

Besides the search for life and the preceding characterization of the (sub)surface and aeolian environment, robotic elements such as copters, rovers or human-operated tools are considered as an enabler to perform the science. Therefore, robotic experiments were selected according to their enabling potential (such as mapping, carrying an instrument or rock sample), and not on their engineering maturity or engineering demonstration alone.

ROI = Region of Interest

Exploration Cascade Workflow

The Exploration Cascade constituted an algorithm defining an efficient deployment sequence, providing the framework for the following question: “which instrument needs to be active where and when, leading to what kind of data sets, leading to what kind of knowledge, leading to which type of input for the tactical flight planning”



20. Experiments included into the EC

AEROSCAN:
The AEROSCAN project™´s aim was to test an autonomous, solar-powered VTOL (vertical take-off and landing) drone for surface analysis and photogrammetry. The X-5 drone was an experimental concept for an autonomous aerial platform designed to complement human crews on Mars.

Provided data: Imaging, terrain photogrammetry; thermal analyses; mapping of the surroundings leading to a 3D-model which could be used by the AAs/RSS/FP; photos of the terrain and 3D maps could support the performance of MEROP.

EC Output: data provided by AEROSCAN helped to define the A20-POI (~9 POI)

MEROP & ExoScot:
MEROP: Providing haptic feedback of traction and space orientation, to analog astronauts while teleoperating a ground robot, for exploration or mission support, in order to make teleoperation more efficient and less taxing to the analog astronauts.ExoScot: The rover will either explore a given area and provide a detailed digital elevation map or provide a detailed 3D map of a given limited area or provide detailed close up measurements of an interesting location, e.g. rock.

Provided Data: ExoScot provided detailed 3D maps of ROI including slopes and color information, stereo reconstruction, geological interpretation of a 3D reconstruction; Close up images of ROI; piggyback measurements

EC Output: data provided by MEROP&ExoScot will help to define the A20-POI (~9 POI); MEROP&ExoScot supported the AAs during the EVA.

GEOS:
GEOS included 3 EC relevant sub experiments:
(1) Geomapping: establishing the geological map of the working area and also points out dangerous/inaccessible regions of the site; compounds (organic/inorganic/mineralogical) and finally leads us to understand the geological- and biological history of the test site.
(2) Geosampling: collecting sand- and rock samples from the predefined POI
(3) Micrometeorites: searching for micrometeorites within the collected sand samples in the field

Provided Data: geological maps (topography) and geological profiles; sand- and rock samples for post mission analysis.

EC Output: during pre-mission phase GEOS provided a detailed geological map and based on that GEOS, together with the RSS/FP defined 3+ ROI for the mission. During the Mission GEOS supported the RSS/FP decision processes – defining POI – based on the data output provided by AEROSCAN and MEROP/ExoScot. Conclusively GEOS provided sand- and rock samples for post mission laboratory analysis.

Layout of the Exploration Cascade:

Pre-Mission activities provided information needed to formulate the missions first hypotheses – to narrow down the area of interest and to finally define the mission`s ROI. These activities were manly carried out by the GEOS/RSS team. Based on information provided through (1) state of research, (2) Topo DEM, (3) Geo Maps and (4) Satellite the GEOS/RSS team produced a geological map (topography and geological profile) of the test site and defined the ROI.

Bridgehead Phase activities focussed on (1) the definition of ~9 POI and further on EVAs.

During the bridgehead phase, AEROSCAN already started with its investigation flight at ROI. After processing their data and interpretation through the GEOS/RSS team ExoScot/MEROP was sent out to explore areas of interest within the ROI. With the EC output provided by ExoScot/MEROP GEOS/RSS will define approximately 3 POIs.

During isolation phase, the AAs, supported by MEROP/ExoScot, executed the first EVAs on the previously defined POIs. MEROP/ExoScot supported the AAs by carrying the tools and samples.

Parallel to the first EVAs AEROSCAN started with its investigation flights at ROI (2/3). In line with this, MEROP/ExoScot generated data output which further helped to define ~6 more POIs in total. Stepwise, the following EVAs were conducted (as described previously) by the AAs, supported by MEROP/ExoScot.

These steps were repeated until the GEOS/RSS compiled a complete data set resp. the AAs collected enough samples to carry out post mission laboratory analysis.

Post Mission activities focused on the laboratory analysis of the sand- and rock samples. Different instruments (e.g. Raman spectroscopy) will be used, as well as petrographic and geochemical analysis.

Photo: Geologist Dominik Jaeger taking a ground truth rock sample

LunAres pre-mission experiments 05-24May2021

Prior to the AMADEE-20 field test, a preceding mission was conducted to perform calibration, validation and comparison studies during a 2-week campaign at the Polish LunAres station.
OeWF Analog Astronaut Simone Paternostro was assigned as a crew commander (Backup: AA Adam Crellin). The Austrian Space Forum offered the opportunity to deploy hardware assets and selected experiments for validation studies.

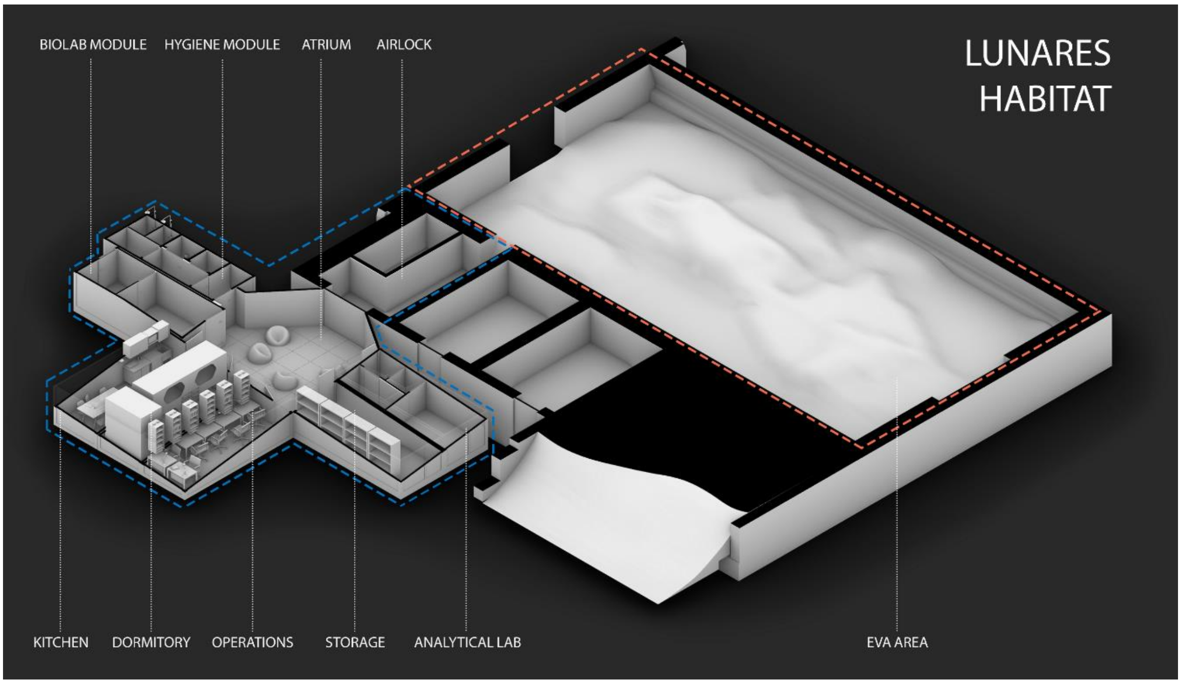
LunAres Mission aims were:

- Conducting experiments by simulating their usage on Mars, to analyse and research their behaviour
- Gather Know-How for the managing and planning of the human Mars missions
- Identify strengths and weaknesses in the workflows and infrastructure of the LunAres facility
- Explore the potential for future cooperation with LunAres and their partners
- Improve the leadership skills of the analogue astronaut

As a former cold war bunker hangar, the facility is specialised in simulating lunar or Mars surface missions. On an area of 300m² an infrastructure it facilitates research in the field of grey water usage, plant cultivation and human factors as well as experimental investigation of modern technologies.

250 m² offered an activity terrain that simulates a lunar surface environment with Regolith-simulant for the EVAs. The other 50 m² provide, as the research station, nine different modules, each with different features to represent basic functions of the habitat like kitchen, hygiene, gym, dormitory, etc.

PERIOD	STAGE	TASKS
Nov. – Dec. 2020	Mission Proposal	• Identify another Organisation • Request
Jan. – Mar. 2021	Mission Preparation	• Telecon • Data & Information exchange • Research Proposal and Experiments review • Crew Call Announcement and first Selection
Apr. 2021	On-Site Preparation	• OnSite Visit • Final crew selection • Last Experiment Request • First Crew Meeting • Hardware Shipment • Workshop for AA • Dress Rehearsal • Preparing Experiments
04-25 May	**LunAres May Mission**	• **Pre-Flight** • **Isolation** • **Post Flight**
Jun. 2021	After Mission	• Secure Data • Recover Equipment • Send Hardware back • Lessons Learned and Debriefing



(Image credits: LunAres facility, operated by Space is More Sp. z o.o.)

21. Experiment Descriptions & Contacts

Principal investigators meeting during the AMADEE-20 Science Definition Workshop in May2019, Innsbruck/Austria.

This is a listing of the experiments scheduled for AMADEE-20. However, in addition, there are several science experiments planned which are not affecting the field operations as they are purely passive or based upon science data archive analysis or are solely engineering tests.

The timeline for the experiment selection process is as follows:

Jan2019	Original Announcement of Opportunity released
May2019	AMADEE-20 Science Definition Workshop
Nov2019	Experiment interactions defined & preliminary mission definition
Aug2020	Decision to postpone the AMADEE-20 expedition by 12 months
20Oct2020	Stage 1 deadline for A-20 experiment submissions, adding on the existing experiments
30Nov2020	Stage 2 deadline for additional experiments
15Dec2020	Final experiment decision communicated
03May2021	Experiment readiness review
04-06Jun2021	A-20 Dress Rehearsal IV (in Innsbruck, Austria)
13-15Aug2021	A-20 Dress Rehearsal V (in Innsbruck, Austria)
Aug-Sep2021	Hardware shipment to Israel
04Oct-31Oct2021	**Field Mission**
Nov-Dec2021	Return of hardware to Innsbruck, shipping back to home institutions
Apr2022 (tbd)	AMADEE-20 Science & Technology Workshop (location tbd)

Fully Peer-Reviewed Experiments

Name	Description	Institution
MICROBIOME	Investigating the development of astronauts' microbiome during and after an isolation mission	Research Unit Comparative Microbiome, Helmholtz Center Munich, Germany Technical University of Munich, Germany
MSG	Data collection on social density and spatial density in the Mars base habitat	Eco-encounter therapy program in Eco-encounter Study Institute Israel and Weizmann Institute of Science, Israel
ACT	Utilizing Acceptance and Commitment Therapy (ACT) to improve participants' psychological flexibility, stress & well-being, performance & error measures	Goldsmiths University of London, UK
AEROSCAN	Test an autonomous solar-powered Vertical take-off and Landing (VTOL) drone for the Martian surface analysis and photogrammetry	University of Houston, USA Airvision srl, Italy
AMAZE	Visual-inertial Navigation for aerial Planetary Exploration for the NASA MARS2020 mission	Univ. of Klagenfurt, Austria
SHARE	Situational awareness testing of analog astronauts during extra-vehicular activities	Ecole Nationale Supérieure de Cognitique, Bordeaux INP, France
MICRO-POTENTIAL	Evaluation of Microbial Potential Contamination by A Human Exploration Mission in an Isolated Environment, DNA analysis of contamination vectors	Dead Sea and Arava Science Center Tel Aviv University Weizmann Institute of Science, Center for Planetary Science, Israel
GEOS	Geoprocesses of the area with a series of geological techniques & AA geo-training applications on the field and to create a potential AA training model.	Austrian Space Forum & Polish Academy of Sciences
HUMAIN	Human- Machine Interface Research for Space Suit Head-Up Displays	Austrian Space Forum, Austria Delft Univ. of Tech, The Netherlands
MEROP	Remote operation of planetary ground robots using advanced human-machine interfaces	University of Lisbon, Portugal
MOVE	Effect of Environmental Stressors on Frequency and Consistency of Bowel Movements among the crew	Norwegian University of Science and Technology, Norway
PSYCHSCALE	Human Performance & Analog Mission Evaluation of Environmental Stressors via Anonymous Standardized Psychological Assessment Scale	International Space Univ., France University of Cadiz, Spain NTNU, Norway

VFR-eFAST	Feasibility of having analog astronauts perform a focused ultrasonography of the abdomen and thorax (eFAST; extended Focused Assessment with Sonography in Trauma).	Örebro University Hospital, Sweden University Hospital of Cologne, Germany European Society of Aerospace Medicine, Germany
EXOSCOT	Autonomous robot for supporting the early stages of the exploration cascade by providing scouting, mapping, and close-range investigation capabilities	Technical University of Graz, Austria
RETINA	Eye diagnostics for spaceflight applications for detecting numerous vision pathologies	German Aerospace Agency DLR, Germany
OGH	Measurement of basic habitat telemetry and assessing crew consumables in a representative setting	D-Mars, Israel
MARSLOCK	Acquiring basic data sets for a future suitport for habitation modules	Univ. of Bremen, Germany
INTERTEAM	Study of teamwork processes, such as how stress evolves in the crew, MSC and OSS teams, how communication is affected by the perceived task load, the dependence of team performance and work satisfaction	Univ. of Bremen, Germany
POLLY	Evaluate the potential use of a conversational user interface (CUI) for astronaut scientists	Univ. of Bremen, Germany
TUMBLEWEED-JRP	Student experiment on a wind-driven sphere with environmental sensors	Austrian Science and Engineering Students

ACT

Principal Investigator	
Name	Karoly Schlosser
Affiliation	Institute of Management Studies, Goldsmiths University of London
E-mail	k.schlosser@gold.ac.uk
Co-Investigators	
n/a	
MSC Connections	
Lionel Métrailler (FP-Coordinator), lionel.metrailler@oewf.org Christine Czakler (Main RSS-Coordinator), christine.czakler@oewf.org Istem Ozen Ruber (Deputy RSS-Coordinator), istem.ozen@oewf.org	

Description

Astronauts are at all times required to perform to the highest standards. They are to remain resilient and to maintain their psychological well-being in order to successfully accomplish their mission in extreme and isolated environments. Future Martian explorers therefore have to be selected and trained to be able to deal with such environments and to be able to maintain an adaptive and resilient mind-set, communicate with others efficiently and proactively, process and accept worries and sadness, and to stay persistent with respect to the goals of the mission.

In the course of the experiment, all six analog astronauts were trained in Acceptance and Commitment Therapy (ACT). In a wide range of studies, ACT had proven to increase people's psychological flexibility; this is, their ability to pursue their important goals, even when they experience thoughts, feelings, fears, and emotions that may get in the way of their moving towards those goals.

The ACT training focussed on providing key, practical skills that the participants could use in carrying out their daily activities, as well as in interacting with their colleagues. This study aimed to assesses the ability of ACT to improve participants' psychological flexibility, stress and well-being, performance and error measures, narrative contents and communication patterns, cognitive and physiological outcomes.

The study used a pre - post-test design. The pre-test was completed by the participants before the ACT training, a post-test after completing the training. Further, a follow-up measure will be taken from participants at the end of their mission. Additional qualitative data were collected from the analog astronauts in form of a diary.

AEROSCAN

Principal Investigator	
Name	Vittorio Netti
Affiliation	University of Houston DOME Drone Operations for Martian Environment
E-mail	vittorio@coompany.io
Co-Investigators	
Andrea Beggio, Airvision srl, andrea.beggio@neutech.it Paolo Guardabasso, Valispace GmBH, paolo.guardabasso@gmail.com Francesco Guerra, IUAV, rsrd.guerra@gmail.com	
MSC Connections	
Cillian Murphy (FP-Coordinator), cillian.murphy@oewf.org Seda Özdemir-Fritz (Main RSS-Coordinator), seda.ozdemirfritz@oewf.org	

Description

For future (human) Mars missions, aerial drones can be an essential asset. They can assist in logistics, search and rescue, multispectral analysis and similar tasks. Especially in the field of surface photogrammetry aerial drones can help to close a gap: rovers can obtain high-precision data, but only cover a comparatively small area in a given time and orbiters can cover an extensive area of survey, but without the needed precision.

The AEROSCAN project's aim was to design, assemble and test an autonomous, solar-powered VTOL (vertical take-off and landing) drone for surface analysis and photogrammetry. The X-5 drone was an experimental concept for an autonomous aerial platform designed to complement human crews on the Martian surface. Thanks to its VTOL and automatic flying capabilities, the drone could autonomously take off and reach the mission objectives without the need of direct control from the crew. The main objective of this project was to demonstrate the reliability and the capability of an autonomous solar aerial drone platform for surface surveys. The secondary objective was to demonstrate the capability for an on-site human mission to operate the drones and to be able to collect useful data about the surface.

Using the photogrammetry technique known as structure from motion (SfM), where 2-D images are transformed into 3-D topographic surfaces, high-resolution topographic imagery was obtained.

The main payload was a global shutter camera for photogrammetry survey. Additionally, the drone carried an array of sensor for pressure, a hygrometry and temperature.

Aeroscan Experiment report

DOME provided OeWF with two complete X5 Drones for the AMADEE20 mission. Both drones have been delivered to the site but one of them showed hardware problems at the Air unit. Both drones have shown problems with the sensor arrays. Those unforeseen problems have caused not nominal operations on different occasions, ultimately leading to uncontrolled crashes on the ground.

Aeroscan preliminary insights

From the first analysis of the recovered data, sent to our team during mission time, the problems can be allocated to environmental causes. In fact, regardless of the numerous flight tests conducted at Vector Robotics before the mission, the numerous errors encountered has been a constant since the first flights on the field. Possibly, the high temperatures and the presence of ferrous sand on the ground will be indicated as the main causes of those failures.

Aeroscan Data Processing

Deep failure analysis will be possible just after the return of the hardware to the Vector Robotics Srl site. The drone remains will be analyzed and the full logs of all the flights performed downloaded. The Interpolation of the data readings from the onboard sensors is fundamental to identifying hardware failure patterns that can validate the first assumptions.

Involved personnel

The AEROSCAN experiment has seen more than 15 people involved, between the Vector Robotics technicians, the whole DOME research Team, and the photogrammetry department specialists from IUAV University in Venice.

DOME Research group and Vector Robotics Srl would like to thank the whole OeWF Team for the continuous support and tireless effort.

AMAZE

Principal Investigator	
Name	Stephan Weiss
Affiliation	Institute of Smart System Technologies, University of Klagenfurt
E-mail	Stephan.Weiss@aau.at
Co-Investigators	
Christian Brommer, Institute of Smart System Technologies Christian.Brommer@aau.at Martin Scheiber, Institute of Smart System Technologies mascheiber@edu.aau.at	
MSC Connections	
Karin Brünnemann (FP-Coordinator), karin.bruennemann@oewf.org Christine Czakler (Main RSS-Coordinator), christine.czakler@oewf.org Francesca Baisi (Deputy RSS-Coordinator), francesca.baisi@oewf.org	

Description

AMAZE was the second aerial drone experiment participating in AMADEE-20 (in addition to AEROSCAN). It was originally designed as a technology demonstrator in preparation of NASA's Mars Helicopter Scout INGENUITY launched in 2020 together with the Perseverance rover mission to Mars. The experiment's objectives center around testing algorithms for GNSS independent visual-inertial based localization. It was a follow-up to the AVI-NAV experiment participating in AMADEE-18. In AMADEE-18 the experiment team demonstrated that such localization is feasible on Mars-like surfaces given a favorable selection of daytime and surface structure. The objectives to be tested by the AMAZE experiment were:

- Autonomous take-off under different environmental and surface conditions
- Autonomous waypoint following and mission plan execution, i.e. evaluate the robustness of surface relative navigation for a defined trajectory
- Autonomous landing on safe landing sites

During the bridge-head phase where members of the experiment team would conduct on-site tests with the potential next-generation Mars Helicopter Scout algorithms and Mars Helicopter Scout mission-relevant scenarios were to be flown autonomously. For the isolation phase, a modified version of the code, depending on the classification of the code developed jointly with JPL, was used.

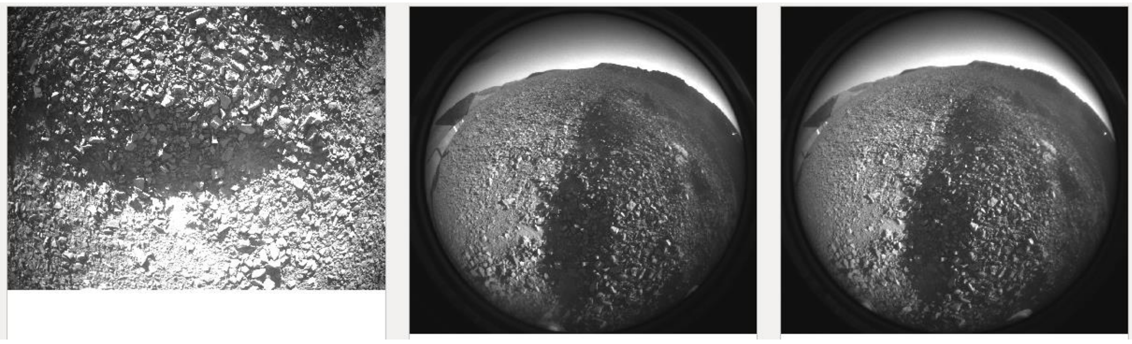
Experiment Summary - AMAZE

Thanks to the outstanding opportunity provided by AMADEE20, the data acquisition performed by the AMAZE field crew exceeded the predetermined data recording plan. During the bridgehead phase, the team recorded vision data over various ground conditions and terrain structures. Among uneven terrain, the AMAZE team was also able to record aerial data of cliff flight-overs with consecutive science close-ups along different crater walls. This data does provide all information to perform a 3D reconstruction of the crater wall structure utilizing the forward-facing stereo camera. The data also provides all means to test and improve visual-inertial odometry algorithms in the future with outstanding ground-truth quality. In total, the field crew recorded 50 datasets, including 12 datasets with possible sensor degradation and outages, which are of importance for further improvements of the autonomy engine, safety, and mid-flight system recovery. The total recorded data amounts to more than 600Gb.

The AMAZE platform makes use of two RTK GPS antennas to record accurate ground-truth for vehicle position and orientation. This system is sensitive to external and local self-introduced RF interferences. The development team paid special attention to this issue and prepared and tested the vehicle in semi-urban environments. The final system made use of additional EMI antenna shielding and special filters for high-frequency data lines. The first system evaluation at the final test location showed that due to less environmental RF interferences, the noise floor of the environment was lower than expected, and the results of the ground-truth system were exceptional in quality and signal reliability. This resulted in a ground-truth position accuracy of below 1cm and orientational accuracy of below 1 degree.

The team also anticipated temperature issues for the embedded computing units during the experiment phase. This issue was mitigated in the development phase as far as the limited size of the vehicle allowed. However, the in-field stress-tests in high environmental temperature showed that the preventive measures cooled the computation units more than sufficiently, which ensured the full availability of computational resources.

After the AMADEE-18 mission, it was apparent that the previous vehicle was not fully able to withstand high wind speeds. The current AMAZE platform was improved therein, and the team was able to perform flights and steady position hold scenarios at wind gust speeds of up to 11m/s. Another lesson learned from the AMADEE-18 mission was that dust shielding is crucial for a consecutive vehicle design. Thus the AMAZE copter had dedicated dust shielding for engines and sensitive electronics where no thermal constraints were posed by the module. It was confirmed that the dust shielding elements performed excellently throughout the bridgehead phase.



The AMAZE project experienced a number of difficulties and issues throughout the mission phase. The first version of communicated field logs confirmed that initial issues were related to incorrect communication between the vision sensor and the processing platform, possibly due to non-fully connected connectors. A second issue was related to the initialization of the VIO component. Both issues were addressed remotely by the AMAZE team and required communication through MSC towards OSS and the AA's. In total, the AMAZE experiment successfully performed 7 in-field updates to investigate and resolve these issues. The manual initialization method posed the biggest issue, and the AMAZE team wants to thank OSS and the AA's for their self-initiative and extra time spent on training this procedure inside the habitat on their day off.

The AMAZE project was developed/performed by 12 people including 2 technicians and 1 student, throughout the project. The data will be post-processed and shared with the robotics community providing great opportunities for numerous system improvements. The expected submission of a dedicated dataset paper is planned for mid of January, and a systems paper which addresses the full autonomy and system structure, including lessons learned, is expected to be submitted by the end of February

Exoscot (Mercator Rover)

Principal Investigator	
Name	Gerald Steinbauer
Affiliation	Institute for Software Technology, Technical University of Graz
E-mail	steinbauer@ist.tugraz.at
Co-Investigators	
Willibald Stumptner, Austrian Space Forum willibald.stumptner@oewf.org Keerthi Datta Konanur, Institute for Software Technology, Technical University of Graz	
MSC Connections	
Michael Müller (FP-Coordinator), michael.mueller@oewf.org Dominik Jäger (Main RSS-Coordinator), dominik.jaeger@oewf.org Markus Eder (deputy RSS-Coordinator), markus.eder@oewf.org	

Description

The aim was to develop an autonomous robot that supports the early stages of the exploration cascade. Tasks of the robot included the autonomous/ semiautonomous exploration and mapping of scientifically interesting locations.

The idea was to allow scientist and flight planners to increase their situational awareness about remote locations. The activity fitted between first reconnaissance activities in the exploration cascade with satellites, UAVs, or other means and a first scientific analysis of the location and a more detailed planning of scientific activities.

Within the experiment we demonstrated that an autonomous robot is able to explore and map an unstructured environment automatically. Another interesting aspect was the design of interfaces for the scientists and the planners to guide the rover to interesting locations. In contrast to earlier participations on field trials we were focused this time on vision-based navigation techniques that are much more relevant for space missions.

Exoscot experiment report

The goals of the ExoScot experiment were twofold. One goal was to show the envisioned A-20 exploration cascade where cooperating instruments refine the situation awareness around a scientifically interesting site. The second goal was the cooperation with the Merop experiment to test innovative teleoperation concepts. Both goals were achieved.

For the exploration cascade we demonstrated a pipeline where the initial planning of an exploration run (e.g., site selection, activity planning, route planning) is based on satellite images. For the navigation of the rover these satellite images are converted into a cost map (macro scale – larger geological structures like riverbeds or rims, micro scale – larger rocks and terrain classification) using Machine Learning. Using this cost map, the rover is able to travers up to 2km autonomously (velocity limited to 1m/s). During mission these cost maps will be refined using ortho-images collected by UAVs. Using the same processing pipeline very much fine-grained cost maps (cm resolution) can be obtained. During the autonomous travel to a given interesting location the rover collected images and 3D laser scans that can be further used for a better situation awareness. Two runs of the exploration cascade based on one airborne mapping campaign were conducted during the bridgehead phase and showed the intended exploration cascade works. If the exploration was used during isolation is under investigation.

For the cooperation with the MEROP experiment we provided software interfaces to the Mercator rover. These interfaces were already tested in the Dress Rehearsals and worked almost out of the box in the field. Several runs during the bridgehead and isolation phase were conducted where the rover was tele-operated from the habitat.

The data collected data from the exploration runs had been transferred to RSS for processing. Currently it is investigated by the experiment team how this data can be converted in a 3D visual representation. Moreover, detailed telemetry data on the robot had been recorded. This data is currently analyzed to understand the actual navigation behavior of the rover and to develop more reliable navigation approaches for future missions.

Although the Amadee-20 mission was a huge success for the ExoScot team as an integrated exploration cascade was demonstrated, there had been already potential improvements for future missions identified. The entire exploration framework including different groups and tools needs to be more integrated and automated. Better visualization tools for the actual situation (environment) and the state of the rover (telemetry) are needed. Data products need to visualized using more professional tools. Also, the planning and decision making on the robot needs to be more transparent. Moreover, the actual navigation behavior of the over needs to be improved by better utilizing the sensors on the rover. Finally, the dependence on GNSS systems needs to be removed.

In the development of the Mercator rover and the control software were 6 master students, 2 PhD students and 2 faculty involved.

Field Robotics
TU
E-NETIC
DCNA
FFG
KIRAS

GEOS

Principal Investigator	
Name	Seda Oezdemir
Affiliation	Austrian Space Forum
E-mail	seda.ozdemirfritz@gmail.com
Co-Investigators	
Anna Losiak, OeWF / Polish Academy of Sciences, Anna.losiak@oewf.org	
MSC Connections	
RSS: Seda Oezdemir (as part of the RSS-internal experiment team) Eleni Ravanis (FP coordinator), eleni.ravanis@oewf.org	

Description

The team identified the geological processes of the area with a series of geological techniques. Besides defining these processes, they focused on Analog Astronauts geo-training applications in the field and to create a potential AA training model. The GEOS was comprised of four experiments:

(1) Geomapping: establishing the geological map of the working area, the area before the mission to determine the geological and topographical features. These pre-identified features guided the fieldwork; e.g., the optimized path that the AAs followed and the best sample locations. During the mission, the map improved by using the drone and rover outputs as well as AAs observations. After the mission pre- and post-mission maps were compared to optimize and improve the mission preparation phase.

(2) Geosampling: is the process of collecting data (e.g., rock and sand samples) from the sites in order to obtain an understanding of the geology of the field.

The first two geoexperiments (geomapping and geosampling) were classic geological methods to understand the natural environment by using compositions and the age of the rocks to determine the sequence of events.

(3) Geocompare: compare spatial information acquisition strategies between people with varying levels of experience during the field work to determine how different people analyze spatial data (thematical/geological maps and the natural environment), and how to more efficiently teach this skill to both astronauts (-analog and -space) as well as field workers (e.g., geologists, civil engineers, biologists, etc.)

(4) Micrometeorite: searched for micrometeorites within the collected sand samples in the field, aiming to find these highest flux extraterrestrial materials on the earth's surface.

GEOS field work – short report
Planned: optimal 4 runs-Suited, 30 rock samples +sand sample (1kg) / 5 runs 50 samples + sand sample (2 kg)

STATISTICS/HARD FACTS
The GEOS experiment was conducted over two runs with suit, making detailed descriptions of outcrops around the habitat as well as region of interest “North”. About 10 kg of geological samples (hard rock and sediment) were collected and returned for further analysis.
While detailed data analysis is still pending, we are able to identify a number of operational issues and insights:

1) Suited geological field work: we were once again reminded of the technical and physical limitations put on the analog astronauts by the suit. Technical issues e.g. telemetry data (Ax), limited Wi-Fi coverage, caused major change of plans on GEOS ‘s field work. To minimize physical limitations, we provided slightly modified equipment (e.g., sampling tools and field tablet), but to maximize efficiency, further improvements still need to be made. We also will have to re-evaluate the way and aims of suited geological field work.
2) Definition of regions of interest (RoI): we selected general regions of interests (RoI) predominantly based on satellite- and aerial images, and digital elevation models (DEM). This yielded, form a geo-scientific point of view, reasonable results, although future missions should make use of more sophisticated remote sensing data (notably, images taken in the infrared spectrum). Further, poor DEM data quality proved to be a problem. Generally, RoI were too large to be properly investigated within the scope of the mission. Some regions could not be accessed due to unexpected terrain/road conditions.
3) Definition of points of interest (PoI): we selected possible points of interest (PoI) based on detailed study of (orthoscopic) satellite-/aerial images and DEMs. Our original strategy was to then use aerial drone and rover-based remote sensing data to select specific outcrops for geological field work (outcrop description and sampling). However, technical difficulties prevented these data from being provided and we eventually had to revert to choosing outcrops based on orthoscopic images.

These emerging findings will help implement crucial improvements for both the planning- and field phase of future missions, by adapting the analog astronauts’ geological training and equipment, as well as refining our strategy for planning conducting geological field work within the framework of an analog mission.

GEOS-Work Schedule
GEOS by AAs

18.10.2021 EVA-Near habitat GEOS expedition (morning 2 hrs) -suited
19.10.2021 EVA-Near habitat GEOS expedition (morning 2 hrs)-suited
19.10.2021 @HABITAT all Geos samples collected so far recorded to MS (morning+afternoon)
29.10.2021 EVA-North GEOS expedition (morning 3 hrs)-suited
30.10.2021 EVA-South GEOS expedition-<u>unsuited AA</u> (whole day)

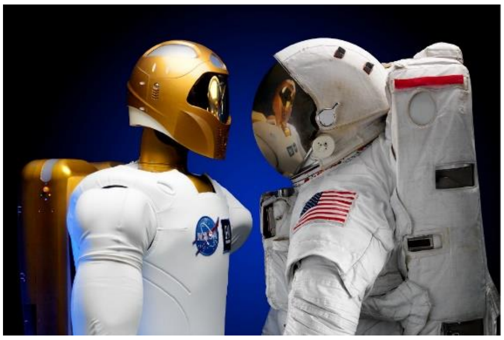
GEOS COMPARE by OSS-Dominik Jaeger

21.10.2021 FIELD-whole day ROI investigation
22.10.2021 OFFICE-half day sample inventory
24.10.2021 FIELD-whole day ROI investigation
27.10.2021 OFFICE-half day sample inventory

HUMAIN

Principal Investigator	
Name	Kartik Kumar
Affiliation	Austrian Space Forum (OeWF) / Satsearch
E-mail	kartik.kumar@oewf.org
Co-Investigators	
Joao Lousada, Austrian Space Forum (OeWF) joao.lousada@oewf.org Sebastian Sams, Austrian Space Forum (OeWF) sebastian.sams@oewf.org	
MSC Connections	
Maxime Vanherle (FP-Coordinator), maxime.vanherle@oewf.org Istem Ozen Ruber (Main RSS-Coordinator), istem.ozen@oewf.org Sébastien Ruhlmann (Deputy RSS-Coordinator), sebastien.ruhlmann@oewf.org	

Description



The HUMAIN experiment studied the interaction between humans and machines, specifically between the analog astronauts and the Aouda spacesuit simulator.

The field of HMI (human-machine interface) not only includes control devices such as switches, keyboard or touchscreens; but also, the displaying of information, such as sound or graphical displays. In particular, the ability to correctly and effectively display information plays a major role in high workload, time-critical, hazardous environments such as aircraft piloting or performing EVAs. It is crucial in providing good situational awareness and allowing proper risk assessment and management.

The Aouda space suit simulator includes a head-up display (HUD) that allows the visualization of information such as sensor data, procedures, videos or maps. The experiment focused on the use of the Aouda HUD to increase situational awareness within the space suit, for risk assessment and risk management during EVAs.

The basic hypothesis was whether making trend data available from sensors, specifically the sensors for carbon dioxide (CO_2) and temperature within the suit, would improve the AA's perception of risk. This boils down to the research question, "do the CO_2 and temperature readings acquired during an EVA statistically differ if the AA is shown only current CO_2 and temperature readings, vs. trend data for the last few minutes?"

HUMAIN Experiment feedback

Due to the limitations imposed on Aouda.X EVAs, the HUMAIN experiment was heavily impacted. Representative EVAs as defined in the SEIF became increasingly rare and the minimum data points as defined in the SEIF was not collected. The PI is still assessing if the collected EVA data can be used.

A detailed data analysis still needs to be performed, but a preliminary look at the subjective feedback received (questionnaires) shows an overwhelming preference for trend data being displayed.

Telemetry from the suit needs to be analysed for the EVAs that could render some meaningful data. The factors of shorter duration of EVAs, separation of suits, different activities performed by the AAs, need to be considered and their impact on the data collected needs to be better understood and eventually mitigated, if possible. Subjective data (questionnaires) also needs to be analysis and a consolidated report of its finds needs to be collected. Pending positive feedback of the new HUMAIN HUD updates that were tested, these shall become fully integrated as part of the upgraded HUD software.

Four volunteers have been working on that project.

INTERTEAM

Principal Investigator	
Name	Prof. Dr. Vera Hagemann
Affiliation	University of Bremen, Faculty of Business Studies and Economics, Business Psychology and Human Resource Management
E-mail	vhagemann@uni-bremen.de
Co-Investigators	
Dr.-Ing. Christiane Heinicke University of Bremen, ZARM - Center of Applied Space Technology and Microgravity email: christiane.heinicke@zarm.uni-bremen.de	
MSC Connections	
Karin Brünnemann (FP-Coordinator), karin.bruennemann@oewf.org RSS-Coordinator: tbd	

Description

Crew members significantly depend on each other for the correct and timely completion of their tasks, but at the same time, crew members can be the greatest stressor to each other in the isolation and confinement of their habitat. Only teams whose members have a reasonably good and solid professional relationship with each other can function effectively over a long period of time. Examples for stressors experienced by the crew while working highly interdependently in a complex situation are as follows: adapting to new circumstances, collecting information from various sources and making decisions - ofter under time pressure. These stressors enhance the mental workload.In order to face these challenges effective team processes are significant for successful teamwork and high team performance.

The experiment studied teamwork processes. This included questions regarding how stress evolved in the crew, MSC and OSS teams, how communication was affected by the perceived task load, the dependence of team performance and work satisfaction on various factors and temporal changes in collective orientation.

In order to answer these research questions, the three teams (field crew, MSC, OSS) did short experiments, aiming to examine evolving task load and stress. The data were collected via questionnaires. The experiment was comprised of two parts: one studied processes within individual teams, the other processes within conjoint teams (i.e. between MSC, OSS and crew). Participants had to accomplish tasks that require highly interdependent work, i.e. could only be solved in a joint team effort. In part one this was accomplished within the respective team, part two involved communication between teams – thus the task accounted for the time delay.

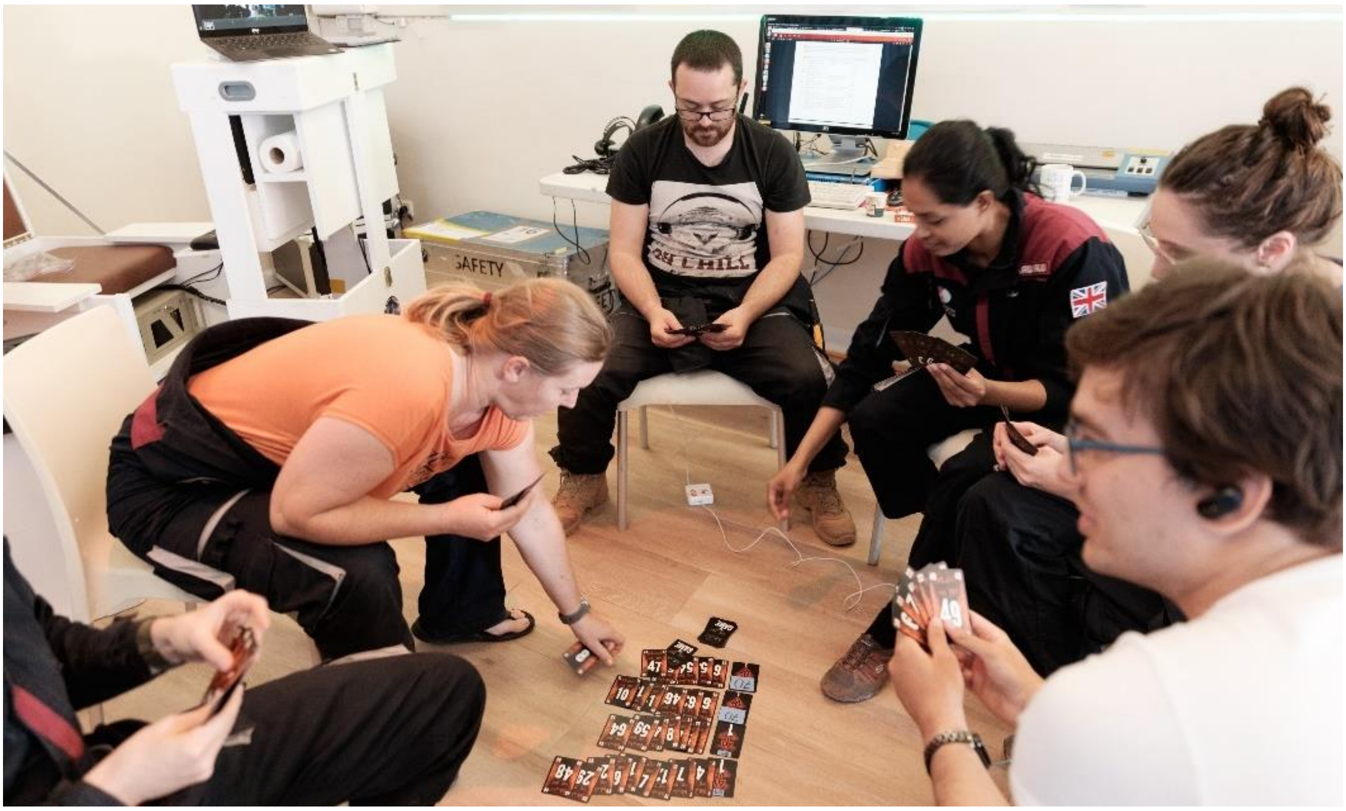
Interteam Experiment summary

For Experiment Part 1, in total seven runs were planned for all three teams (Analogue Astronauts, Mission-Support-Centre and On-Site-Support). The analogue astronauts and the OSS team did six of the seven runs. As the last run was not necessarily mandatory, the data collected during the six successful runs is enough. Because only few people were present and had time to participate in this experiment, the MSC crew only finished five of the seven runs. Thus, two runs are missing for the Mission-Support-Centre. For Experiment Part 2 (analyses within conjoint teams), the video recordings of the analogue astronauts for Experiment Part 2

Run 1 was missing as they stated that they did not have the information to record the run (even though this was written down in the procedures). On-Site-Support had recorded Experiment Part 2 Run 3 but unfortunately, they lost the recording. For Experiment Part 1, the video recording of the OSS team for Experiment Part 1 Run 1 was also missing. The questionnaires were almost always filled in completely. Only in some cases a missing value occurred.

Preliminary insights

Currently we are in the process of processing data (from the videos and from the questionnaires) and are already able to carry out isolated analysesSo far, we were able to analyse the Collective Orientation and the development of stress (assessed with questionnaires) over the runs of all teams. In Figure 1 the development of the teamwork relevant attitude Collective Orientation over all runs and of all teams of Experiment Part 1 is visible. Collective Orientation was measured at the beginning of each run in questionnaire 1 (before starting the task) and at the end of each run in questionnaire 4 (after finishing the task). The dark blue line resembles the means of questionnaire 1 per run (before task) of the analogue astronauts (AAs) while the light blue line resembles the means of questionnaire 4 (after task) per run of the analogue astronauts. The means of questionnaire 1 (before task) per run of the Mission-Support-Centre (MSC) is shown in the orange line and the means of questionnaire 4 (after task) per run of the Mission-Support-Experiment concluded report Centre is shown in the yellow line. For the On-Site-Support (OSS), the means of questionnaire 1 (before task) are displayed in the dark green line while the means of questionnaire 4 (after task) are displayed in the light green line. It is already visible in Figure 1 that, as expected, the Collective Orientation of the analogue astronauts was almost constantly higher than the Collective Orientation of the two other teams. Next to this, it is also visible that for the analogue astronauts the Collective Orientation was almost always higher in questionnaire 4 (after finishing the task, light blue line) compared to questionnaire 1 (before starting the task, dark blue line) in all runs. For Mission-Support-Centre and On-Site-Support this is also the case in some runs, but there are also runs in both teams where the Collective Orientation was higher in questionnaire 1 compared to questionnaire 4, meaning that the Collective Orientation decreased in the teams during task accomplishment.



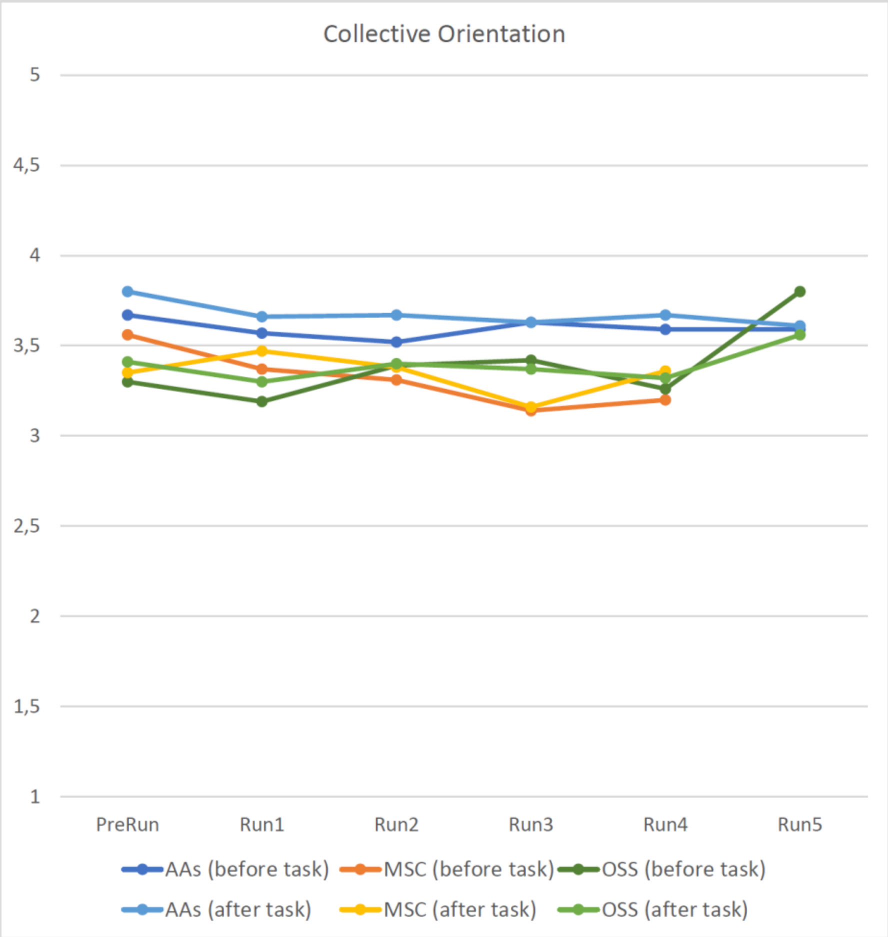


Figure 1: Collective Orientation of all teams over all runs of Experiment Part 1

Next to the Collective Orientation, the perceived stress was analysed over all runs of Experiment Part 1 and of all teams. The perceived stress was assessed three times during each run. In Figure 2, the blue line resembles the means of stress of the analogue astronauts (AAs) during all measurement points (questionnaire 2 (after 5 minutes), questionnaire 3 (after 10 minutes) and questionnaire 4 (at the end, after 15 minutes)), the orange line shows the means of stress of the On-Site-Support team (OSS) during all measurement points (Questionnaire 2, questionnaire 3 an questionnaire 4), and the grey line displays the means of the Mission-Support-Centre (MSC) during all measurement points (questionnaire 2, questionnaire 3 and questionnaire 4). Except of Run 4, it is visible that the analogue astronauts experienced less stress in all of the three measurement points compared to the Mission-Support-Centre and the On-Site-Support-Team. Two possible explanations for these findings in Run 4 relate to the fact that, according to the flight plan, the analogue astronauts had scheduled the ACT before the INTERTEAM run and that the analogue astronauts were the only team where all participants already knew the task for Run 4 from the pre-run. Since the ACT addresses mindfulness, it could be that the analogue astronauts answered INTERTEAM's subsequent questions in a more nuanced way. In addition, it could also be that the analogue astronauts had the ambition to be more successful in the task compared to the pre-run and thus showed minimally more stress than the other two teams. No differences are visible in Figure 2 comparing the means of stress in Run 1 and the means of stress in Run 5.

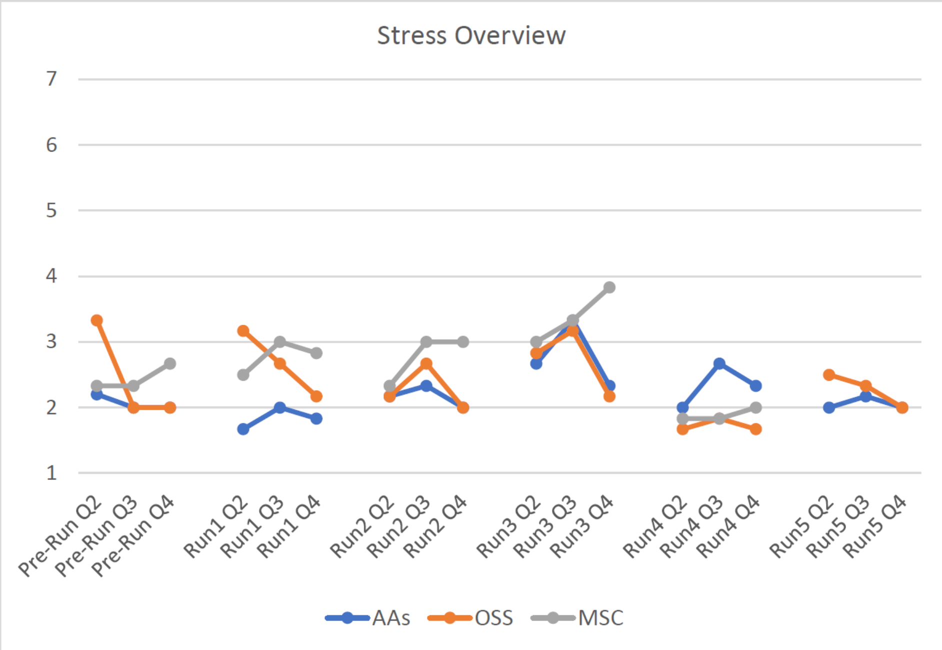


Figure 2: Stress of all teams over all runs of Experiment Part 1

Regarding the workflow, we noticed that information was lost or misunderstood in some places. This is probably due to the change within the Mission-Support-Centre and fortunately we noticed it early enough. This is certainly an area for development, especially since the documents (SEIF, procedures) contain the necessary experiment information. It may also be due to the fact that our experiment as a psychological experiment does not fit the SEIF in some places, or that it was difficult for us to answer some points in the SEIF. If more psychological experiments are included in AMADEE in the future, it is advisable to revise points of these documents, so that they also correctly represent the psychological aspects of the experiments.

Experiment processing

On the 2nd of November Vera Hagemann and Lara Watermann took part in the research seminar at the Centre of Transformative Work Design (Curtin University, Perth, Australia, Prof. Dr. Sharon Parker) and presented our project. Next, we will publish a short article about INTERTEAM in the Business Psychology Newsletter of the Ruhr University Bochum (Germany) and we plan to develop two articles in peer-reviewed journals from the data that we received. In the future, we would be interested to see how the team processes develop in the teams over a longer period of time. Furthermore, it would be interesting to see how team processes develop in more mission-representative tasks.

People working on the INTERTEAM experiment

Prof. Dr. Vera Hagemann (Chair of Business Psychology and Human Resource Management, University of Bremen, Germany) and Dr.-Ing. Christiane Heinicke (ZARM, University of Bremen, Germany) are the principal investigators of INTERTEAM. Lara Watermann supported the INTERTEAM-project as a student assistant. For the analysis of the videos, we use the Communication-Analysis-Tool (CAT). In order to set up the measure for our analysis and to use the CAT correctly, Dr. Florian Klonek and Bram Chai (both: Centre of Transformative Work Design, Curtin University, Perth, Australia) also supported the INTERTEAM project.

MarsLock

Principal Investigator	
Name	Dr.-Ing. Christiane Heinicke
Affiliation	University of Bremen, ZARM - Center of Applied Space Technology and Microgravity
E-mail	christiane.heinicke@zarm.uni-bremen.de
Co-Investigators	
Prof. Dr. Johannes Schöning University of Bremen, Human-Computer Interaction johannes.schoening@uni-bremen.de	
MSC Connections	
FP-Coordinator: Sandra.Zellinger@oewf.org RSS-Coordinator: tbd	

Description

Airlocks are arguably the most critical component of a Mars habitat: They allow the crew to enter and leave their habitat and venture into the Martian environment. Practically all simulation habitats in operational environments therefore feature a room that serves as a simulated airlock.

Photo: A-20 Habitat airlock

In these, the airlock is under ambient pressure and “locking” is simulated simply by having the crew wait for a specified amount of time. Decontamination of suits that would be needed on Mars both during inbound and outbound passage crew is ignored more often than not. Hence, most information available on simulation EVAs is thwarted by the unrealistic setup of and operations inside the airlock. Given the set-up of the D-MARS station, with the slight over-pressurization of the habitat and inherently necessary dust mitigation, the station’s airlock is more realistic than average; therefore, this study investigated if the airlock or its sub-components could serve as a prototype of an airlock for Mars. During A-20, information on the usability of an existing, (somewhat) realistic airlock, and lessons for the design of future airlocks for extraterrestrial (and simulated) environments were obtained.

Crew feedback was collected via questionnaires to be answered by the crew after each EVA and post-mission. Airlock usage and adherence to airlock protocols was monitored by cameras in- and outside the airlock. The experiment also evaluated the effectiveness of simple dust mitigation activities and aimed to understand how routine affects the adherence to dust mitigation protocols. Effectiveness of dust mitigation was quantified by mass measurements of imported dust/sand (after routine sweeping).

Marslock experiment conclusion report

The study comprises the following components:

- questionnaires to be answered by the crew (A-questionnaires on Mission Days 9, 15 21; more
- extensive B-questionnaire after the EVA on Mission Day 27)
- cameras recordings of the area in front of the airlock, where the crew suits up
- B-Check-reports and Post-Mission Tear&Wear Check report

The cameras were successfully put to operation on October 5th. No recording issues were reported by OSS except for an interruption on October 11th. The recordings are stored locally on microSD-cards inside the cameras and will be shipped to the PIs in the coming weeks.
No issues were reported for the questionnaires, although so far only the first questionnaire (A questionnaire filled in on Mission Day 8) has been received via the OeWF Hive.

MarsLock preliminary insights

Since the data is not yet with the PIs, no preliminary analysis of the data was done so far.
Lessons learned from conducting the experiments:

- Surveillance-style cameras are more difficult to set up; stand-alone cameras would be better.
- The procedure required the crew to save data to the MarsLock-folder of the day (a text file almost every day; the questionnaires on specific mission days). This seems to have been not clear enough, as it was only performed once. More effective measures for confirming the experiments are running nominally should be found.
- Generally, remote support was found to be difficult, as the information flow via email alone was not optimal and many (seemingly?) small issues were rather not addressed. Also, it remained unclear how and when contact by OSS, RSS, and the PI would be/should be made.

Experiment processing

As soon as the data is complete, we will start data processing. The results are eagerly awaited as input to other projects. At the moment, we hope that we can participate in the next AMADEE mission with a more advanced project and more specific questions.

MarsLock Involved people

In total, there are 4 people involved with MarsLock:

- Christiane Heinicke, PI and organizer; will perform data analysis in collaboration with co-PI
- Johannes Schöning, co-PI
- Philipp Harms, technical assistance
- Tom Tietz, initially involved with preparation of the experiment; dropped out for health reasons

MEROP

Principal Investigator	
Name	Rodrigo Ventura
Affiliation	Institute for Systems and Robotics, Instituto Superior Técnico, Univ. of Lisbon
E-mail	rodrigo.ventura@isr.tecnico.ulisboa.pt
Co-Investigators	
José Luís Silva, Instituto Universitário de Lisboa (ISCTE-IUL), ISTAR-IUL, and Madeira-ITI jose.l.silva@m-iti.org José Corujeira, Inst. for Systems and Robotics, Instituto Superior Técnico, Univ. of Lisbon and Madeira-ITI; jose.corujeira@tecnico.ulisboa.pt Rute Luz, Inst. for Systems and Robotics, Instituto Superior Técnico, Univ. of Lisbon and Madeira-ITI; rute.luz@tecnico.ulisboa.pt	
MSC Connections	
Michael Müller (FP-Coordinator), michael.mueller@oewf.org Sébastien Ruhlmann (RSS-Coordinator), sebastien.ruhlmann@oewf.org Francesca Baisi (Deputy RSS-Coordinator), francesca.baisi@oewf.org	

Description

For human exploration of extra-terrestrial bodies, remotely teleoperated robotic platforms will be important. Teleoperation implies a cognitive disconnect between the operator and the robot, since they are not physically collocated. This often leads to an impairment in situational awareness. For instance, events such as the robot not moving as expected, e.g. due to loss of traction, often leads to operator confusion. In common teleoperation interfaces, this problem is exacerbated by the overload of information on the visualization screen.

In the MEROP experiment evaluated the deployment of a novel multimodal teleoperation interface. This interface aimed at offloading of the visual channel using a haptic interface to convey both the traction state of the robot and its attitude. For analysis of the interface's performance, the situational awareness and mental workload of the analog astronauts, the time to complete the task, the number of collisions, etc., were recorded.

The experiment team was interested in collaborating with other teams, by providing expertise in Human-Robot Interaction. They intend to adapt their teleoperation interface to another team's mobile robot and perform their research within the constraints of that mobile robot.

The robotic platform for MEROP was provided through the EXOSCOT experiment.

Experiment Conclude report

The initial flight plan (before mission start) planned for 12 experimental runs, however due to flight plan adjustments during the mission it was possible to obtain 21 complete runs (12 for Inspection, 9 for exploration). We are currently waiting the return of the equipment to verify if all the data was recorded successfully and start data processing and analysis. Concerning the inspection runs, all 6 astronauts performed the 2 experimental conditions (with and without haptic feedback), that will allow to compare task performance with the use of haptic feedback during teleoperation. For the exploration runs, 4 astronauts performed both experimental conditions, and one performed just the haptic feedback condition.

Before the mission, the Dress Rehearsals and Scientific workshops were crucial to prepare, test, and iterate the hardware (teleoperation control unit) and Procedures used by the AAs during the mission.

During the mission, the workflow of the MEROP experiment was compromised by two main issues:

- Issues with the telecommunication infrastructure (Wi-Fi) present in the field (affecting the communication between the habitat and the Mercator rover). This was a critical issue because communication losses meant that the rover was no longer controllable from within the habitat and either the run was cancelled, or the OSS had to intervein and manually position the rover within a wi-fi covered area.
- Restrictions of the areas the rover was allowed to explore within the Negev Desert national park, imposed by the local authorities. These restrictions were an issue mainly because the MEROP experimental runs required to be performed in terrain with significant changes of inclination and terrains where the rover was more likely to lose traction (e.g. sandy or rocky areas).

In the first few runs there was also a lack of timely and clear communication between the support team and the operational team (flight crew). Leading to flight crew not knowing when they could begin the run, and OSS team not being aware they needed to perform a system restart. Which impacted the synchronization of their respective tasks during the experimental runs.
The presence of one of the MEROP PIs in the MSC was crucial for troubleshooting issues related to the MEROP equipment, for coordination and clarification of what was to be planned for the following runs. Allowing us to quickly understand the issue and provide fixes or workarounds.
An interesting insight and adaptation to the circumstances from the operational team (flight crew), is that after several runs, they noticed a suboptimal depth perception (proximity to obstacles), so they adopted a buddy system, when performing inspection. That is, a second AA would lookout through the habitat windows to check if the Mercator rover was moving to close to the walls or equipment and inform the AA operating to stop or reverse.

Due to the telecommunication issues, such as communication delays and temporary losses, the AA's changed their modus operandi to use a "move and wait" approach instead of a continuous approach used during the Dress Rehearsals.
Our next steps will be to analyse the data from the experiment runs and publish the results of this analysis.

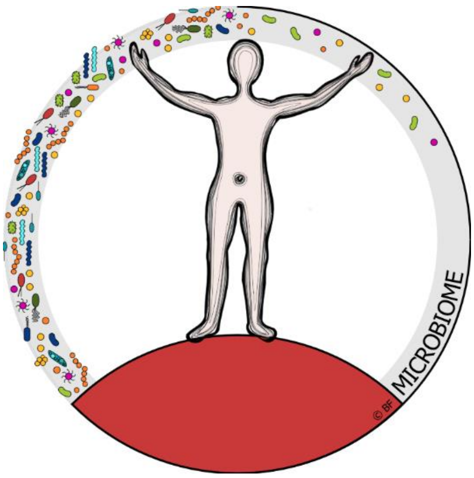
Four people (2 PhD students and 2 Professors) have been working in the MEROP experiment since the beginning, with an additional person joining in for media coverage in the stages nearing and during the AMADEE-20 mission.
We would like to thank flight crew and OSS team for the significant effort done to ensure the MEROP experiment was successfully executed, despite the several issues that appeared along the mission. We would also like to thank the MSC team for their coordination and planning efforts.

Photo: AA Joao Lousada during MEROP training at the 3rd Dress Rehearsal.

Microbiome

Principal Investigator	
Name	Dr. Bärbel Fösel
Affiliation	Helmholtz Center Munich - Research Unit Comparative Microbiome Analysis
E-mail	baerbel.foesel@helmholtz-muenchen.de
Co-Investigators	
B. Sc. Susanne Kublik, Helmholtz Center Munich - Research Unit Comparative Microbiome Analysis, susanne.kublik@helmholtz-muenchen.de Prof. Dr. Michael Schloter, Helmholtz Center Munich - Research Unit Comparative Microbiome Analysis schloter@helmholtz-muenchen.de	
MSC Connections	
Oscar Lafuente (FP-Coordinator), oscar.lafuente@oewf.org Karoline Kadletz (Main RSS-Coordinator), karoline.kadletz@oewf.org Armin Hochrainer (Deputy RSS-Coordinator), armin.hochrainer@oewf.org	

Description



The Microbiome experiment focussed on the (analog) astronauts' microbiome as a health factor. To date studies on the effects of spaceflight on astronauts' microbiomes are rare. In the experiment, the impact of short-term missions on the microbiome was assessed by characterizing the analog astronauts' skin and gut microbiome before, during and after the mission. The collected data was correlated with metadata on the analog astronauts' health and hygiene as well as environmental factors.

The research questions investigated were:

(i) Is there already an observable short term effect and - if so - is it rather on structural or functional level?
(ii) How resilient is the microbiome towards short-term stress? - How fast and to which extent does it react and how fast and to which extent does it turn back to the initial state?
(iii) Are there key stone species that can be used as markers for specific states or that even function as triggers?

Samples of the microbiome were taken every couple of days during the mission, as well as before and after mission for reference. The skin microbiome was sampled with swabs of the elbow crease and fecal samples were taken as proxies for the gut microbiome. For correlation of microbiome data with information on the astronauts' habits and health status metadata were collected by means of a questionnaire.

MICROBIOME Experiment feedback

Although hampered by the pandemic situation, pre-mission preparation processes and procedures went very well from our perspective. – Problems arising e.g. due to travel restrictions were overcome in a very professional and also personally appreciative manner. All additional questions regarding sampling and/or sample storage still arising during the mission could be clarified in an efficient manner, too.

Originally planned was to have skin, nose and stool samples from the 6 analog astronauts and from 6 ground crew members as the control group pre- (1 time point), during- (5 time points) and post-mission (3 time points). Additional urine samples (daily basis) should be taken during mission. Questionnaires on living circumstances, health status, hygiene routines and nutrition habits had to be filled once pre-mission.

Effectively, in the field the 6 analog astronauts and 4 control subjects have been sampled. Questionnaires have been filled and returned for the 6 analog astronauts, however are missing from the control group. Generally, expected samples could be obtained, although some shifts in timepoints occurred and/or some samples couldn’t be taken from specific individuals or timepoints. Pre- and during mission samples already arrived in good shape at our institute. In total, already about 60 skin and nose swaps, respectively, as well as further 60 stool samples have been collected and received for microbiome analysis. For metabolomics analysis the same amount of stool samples was taken in parallel to microbiome samples. 175 urine samples for metabolomics were recieved as well. Later post-mission samples are scheduled to be taken.

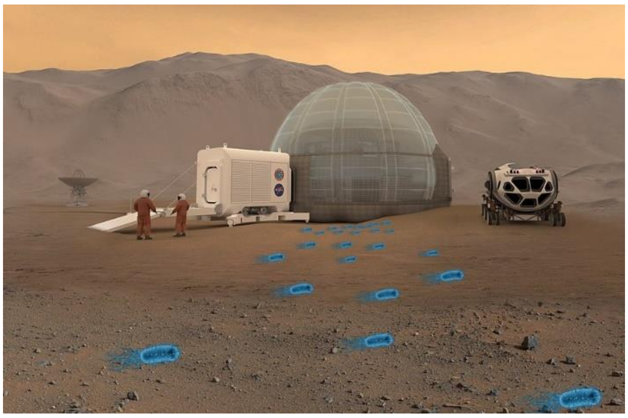
As next steps samples will be processed for microbiome and metabolome analysis, respectively. For microbiome analysis of skin and nose swaps as well as stool samples, a 16S rRNA meta-barcoding approach will be followed to investigate mission impact on analog astronauts’ skin and gut microbiome structure, respectively. For metabolome analysis, NMR-based analysis of urine and feces samples will be carried out to identify and semi-quantify abundant metabolites in these samples. Questionnaires will be evaluated, and data correlated with results from microbiome and metabolome analysis. This data set moreover is thought to be linked to results from further experiments as e.g. OHG, MOVE and MSG.

So far, mainly three persons (1 PI, 1 senior scientist, 1 student assistant) from Research Unit Comparative Microbiome Analysis (COMI) and two persons (1 senior scientist, 1 PhD student) from Research Unit Analytical BioGeoChemistry (BGC), both Helmholtz Center Munich, German Research Center for Environmental Health, as well as one person (1 senior scientist) from the Department of Dermatology and Allergology, Technical University of Munich, School of Medicine have been involved in designing and further developing the experiment, preparation of procedures and materials for the mission. For post mission sample preparation and analysis 2-3 further persons from COMI and BGC side will be involved. Moreover the experiment received great input and support from ÖWF side, the D-Mars team as well as the mission’s nutritional specialist.

MICRO-POTENTIAL

Principal Investigator	
Name	Reut Sorek Abramovich
Affiliation	Dead Sea and Arava Science Center Desert Mars Analog Ramon Station
E-mail	reut.sorek@gmail.com
Co-Investigators	
Yael Yair, Tel Aviv University yaelyairhelmann@gmail.com Oded Aharonson, Weizmann Institute of Science, Department of Earth and Planetary Sciences - Center for Planetary Science oded.aharonson@weizmann.ac.il	
MSC Connections	
Nina Sejkora (FP-Coordinator), nina.sejkora@oewf.org Stefanie Garnitschnig (Main RSS-Coordinator), stefanie.garnitschnig@oewf.org Karoline Kadletz (Deputy RSS-Coordinator), karoline.kadletz@oewf.org	

Description



© NASA/Clouds AO/SEArch (habitat rendering; modified)

For crewed missions to Mars investigating biomarkers, one must be aware of contamination issues and how they might interfere with the investigation. It is impossible to remove live organisms and organic material completely from an Earth based spacecraft prior to launch. Some bacteria, in spore formation, have been shown to survive under a thin layer of Martian soil after spacecraft sterilization techniques. Analog missions are relevant to test forward and backward contamination issues. Especially long-term analog missions, with several crew members providing a reliable, sustainable source of information for bacterial contamination analysis.

By using advanced sequencing techniques, the MICRO-POTENTIAL experiment aimed to study the effect of human missions on bacterial and eukaryotic dispersion in the vicinity of the habitat. The scientific hypotheses to be tested were:

1) Microbial population composition will correlate to the distance of samples from the habitat.
2) Few species (<10) will be present in all samples regardless of distance.
3) At a given geographical location, microbial population composition will vary with time

Background

PI team has published a paper looking into cross contamination challenges in a prior 2019 space simulation mission in Ramon crater, Israel. We aim to quantify and monitor the impact of a human crew on the search for life in a planetary mission on Mars. Our findings included not only quantitative data on forward contamination events, but also on backward contamination and potential cross contamination issues in a different mission architecture (D-MARS03) in the same locale. Several new microbial species never before reported from hyper arid areas and from the Ramon Crater were reported, including some species which might pose a health concern for a human crew in an isolated situation within a pristine environment. For full details and data, please see: "Temporal and spatial analysis of forward and backward microbial contamination in a Mars analog mission Y Yair, L Reshef, C Shopen-Gochev, G Yoffe, G Azulay… - Frontiers in Astronomy and Space Sciences, 2021.

AMADEE-20 has presented us with a different space simulation mission architecture, for which we had to adapt our protocols and aims. We designed an experiment only for forward contamination events, i.e. – did the analog astronauts and AMADEE-20 architecture promoted bacterial dispersion from the habitat and human activity to the hyper arid natural environment? Can this be monitored and quantified? How will it compare with our previous findings? In order to assess some effects of the environment on our results, AA were asked to deploy HOBO sensors for temperature and relative humidity measurements placed in top-soil next to three sampling points in total.

End of mission status

1. Out of the original 3 sampling points, only 2 were sampled eventually. The 3rd sampling point was not accessible to the ROV and AA, and it took ~7 days to come up with a 4th, new sampling point. This might affect our understanding of some of the underlying processes effecting the microbial and eukaryotic species in the area.

2. Out of 66 total planned soil samples, we got back 44 samples in total and this would affect statistical analysis to some extent, hopefully not too much to render our analysis weak.

3. The DNA extraction protocol was executed with ~80% precision, the success of which entirely goes to the passion and dedication of the AA who handled the experiment and had some experience in biological sciences prior to the mission. The minus 20% are due to some planning issues during the bridge phase, which could have been avoided (see recommendations at point 11).

4. Soil samples from 3 sampling points were taken and analysed during the mission. (see image below). 1 point was close to the habitat, 2 points were situated away and a bit isolated from the habitat and from one another.

5. All samples were transported back to the Weizmann Institute of Science by the PI, at the end of the mission, and are awaiting NGS sequencing in the coming months.

6. 2 of out 3 HOBO sensors worked beautifully and were retrieved by AA. (see data below)

7. Access to AA for debriefing post mission was limited, which is very unfortunate because memory tends to fade away quickly after such an intense experience. We are very thankful for the AA who were available to us during the week after the mission ended. We look forward to talking with the other AA in the coming weeks.

8. Our uniquely designed microbial soil sample rod worked beautifully with the limitations of the spacesuit.

9. No health or safety issues occurred during our experiment, as far as we know.

10. We are looking forward to collaborate with MSG PI – David Michaeli, and we really hope to compare our data with that of MICROBIOME PI. From our past knowledge, there is a good chance human associated microbiota might end up in one of our sampling points, due to human interruption and soil disruption operations. If we can match environmental microbial species with gut microbiota form the AA and thus, we will have a very strong evidentiary link between human activity during a space simulation and environmental impact.

11. Things we would have liked to see performed better:

1. Habitat equipment checklist execution– done by the PI, and checked by the AA during bridge phase. Any missing items should be brought immediately to PI attention. 1st week can be chaotic – Give the AA a breather, plan less items and more time for them. You can make up time in the following weeks, when AA are much more familiar with their workflow and new environment.

2. Camera – camera provided by this PI was not good enough for the operation. Please, either supply a list of recommended cameras that work well with the suits or supply an actual camera that we can use and get photos from. A camera is a crucial tool, if you have a new PI in one of your mission – kindly assist them in finding the right camera for them and you.

3. Soil sampler for AA – This PI has spent months and months for finding a solution, and at the end, I was not even sure it would work (uniquely designed microbial soil sample rod). This is too much uncertainty for anyone who is doing soil sciences with AA and the suits. AA can probably have their own tools or recommend an equipment/models for any scientist interested in soil sampling. Do not leave it in the hands of inexperienced PI who are not familiar with space simulation missions.

4. OSS was AMAZING. I think they should get credit everywhere for their hard work and perseverance, I felt they did not get enough credit.

12. I roughly estimate 2 students, 2 lab managers, 4 researchers, 4 staff, 1 operational manager involved in MICROPOTENTIAL (13 ppl in total, including myself).

Figure 4 Logger results for MP3

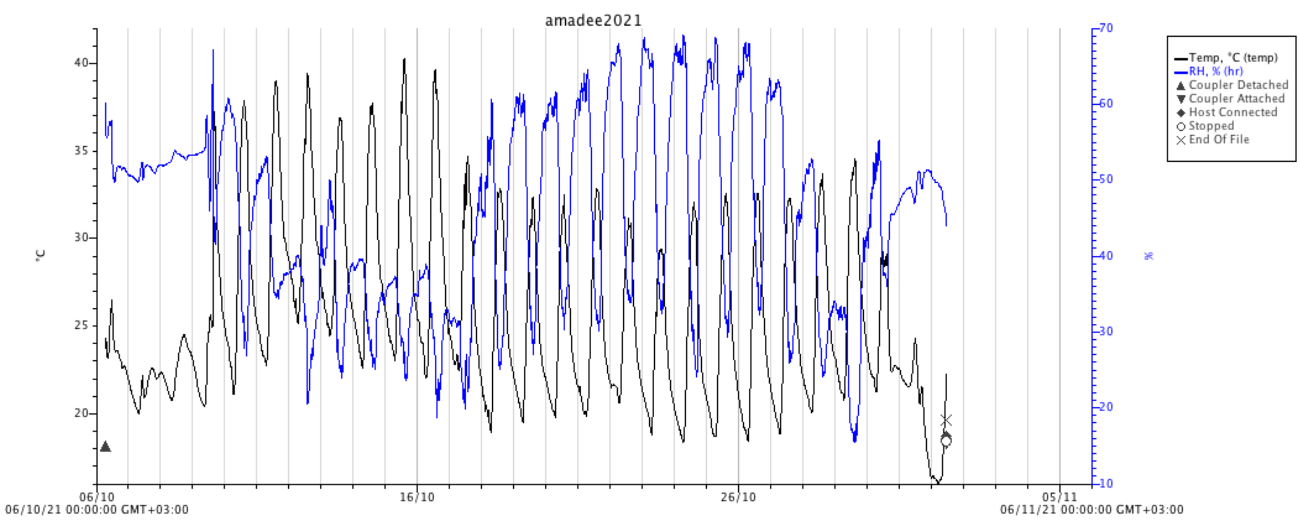
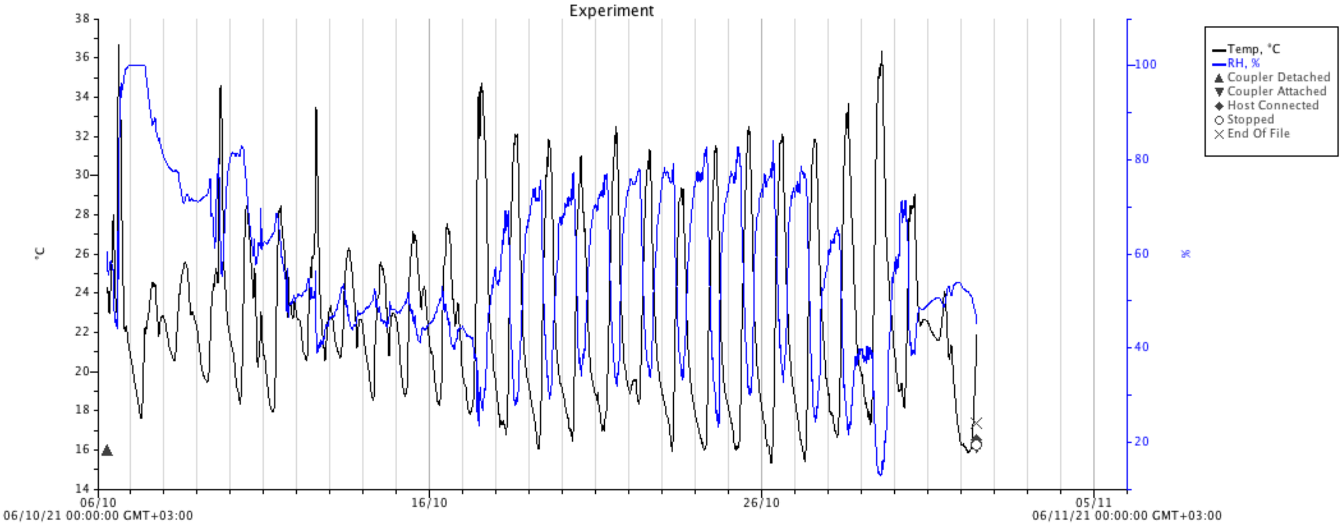


Figure 5 Logger results for MP2



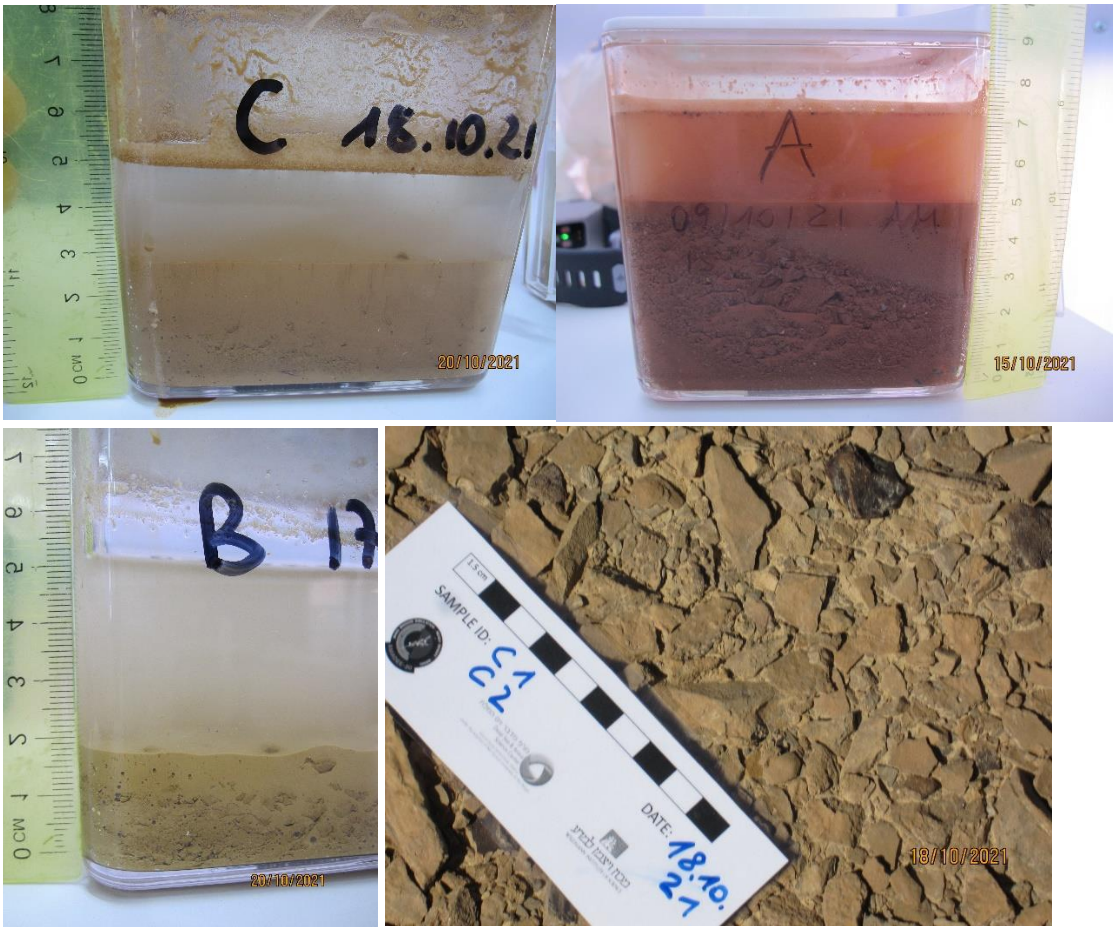


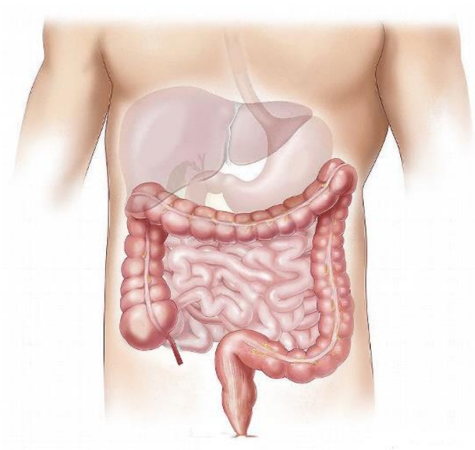
Photo: Soil texture and type analysis for points A,B,C.

MOVE

Principal Investigator	
Name	Tricia L. Larose
Affiliation	NTNU, Faculty of Medicine & Health Sciences, Dep. of Public Health & Nursing
E-mail	t.l.l.larose@flymed.uio.no
Co-Investigators	
n/a	
MSC Connections	
Peter Schüller (FP-Coordinator), peter.schueller@oewf.org Stefanie Garnitschnig (Main RSS-Coordinator), stefanie.garnitschnig@oewf.org Markus Eder (Deputy RSS-Coordinator), markus.eder@oewf.org	

Description

Normal bowel movements differ between individuals, and within the same individual over time. Factors such as diet, dehydration, increased stress, reduced physical exercise and exposure to extreme or abnormal environments, can have a negative impact. Short-term difficulties may be alleviated by addressing some of these factors, but longer-term issues or acute difficulties in the shorter-term may be symptomatic of more serious issues.B y tracking the bowel movements of the analog crew, we can intervene with possible medical care if necessary. In the future, results from this experiment may be used to develop prevention strategies for future planetary analog missions.



The MOVE experiment aimed to study the frequency and consistency of bowel movements among crew during the mission’s isolation phase. The data were monitored weekly to inform the medical team, and prevention strategies were established to ensure optimum health and well-being of crew members on future analog missions.

The experiment setup was rather simple: a laminated paper with four different images displaying images representing four possible types of excrement ranging from healthy to unhealthy were fixed to the habitat’s toilet door. Immediately after a bowel movement, the crew member logged the entry classifying it according to the information chart. A photograph of the log chart was taken weekly and sent to the support team.

MSG

Principal Investigator	
Name	David Michaeli
Affiliation	Eco-Encounter Study Institute
E-mail	madaf2@gmail.com
Co-Investigators	
Debi Sagi debisagi11@gmail.com Gal Yoffe gal@eco-encounter.com	
MSC Connections	
Karin Brünnemann (FP-Coordinator), karin.bruennemann@oewf.org Istem Ozen Ruber (Main RSS-Coordinator), istem.ozen@oewf.org	

Description

For a Mars exploration crew, the integrity and health of the group is of prime importance. This crew would be living in a confined space, which can make the group susceptible to negative environmental factors that can affect the group's integrity and the individual's behavior.

Ramonauts inside the D-MARS habitat during the D-MARS 01 mission, © D-MARS

The aim of the MSG study was to collect data on social and spatial density in the habitat in order to map positive and negative influences on the individuals in the AMADEE-20 field crew and the group as a whole.

The study aimed to examine the levels of activity during various time periods in different areas of the station, in order to assess the effect of overcrowding and closeness on the group's quality of life indices. The team intended to observe the activity in the station and determine the effects on the crew via questionnaires and interviews.

Experiment Summary Report

Data of group feeling and group movement in a confined area were collected for 21.5 days.

Obtained group feeling data:

Daily measurements: 57 complete samples + 9 partial samples were conducted out of 66 planned

Weekly measurements: 3 complete questionnaires were conducted as planned.

Pre-mission interview: 6 personal interviews, and 1 group interview were conducted as planned.

Post-mission interview: 5 personal interviews out of 6 were conducted. Group interview has not been conducted yet but is planned for.

Obtained group movement data:

Movement data of the 6 AAs were conducted 21.5 days (7/24), every 1 sec and in 30 sm resolution as planned. Due to a habitat communication system problem the data transmission was stopped 2 times: on the 13/10 19:53 to 14/10 15:45, and on the 26/10 23:25 to 27/10 09:20.

Preliminary insights:

Daily questionnaires measurements:

1. In the 3 weeks of the experiment, compliance was over 85% for all AAs.
2. All AAs showed inter-participant and intra-participant variability in responses over the time.
3. In the daily tool overall, the response “Good, Safe, Connected” was the most prevalent, consisting 31.1% of all responses.
4. Well-being, safety, and connectivity diminished over time, while concentration and difficulty remained relatively unchanged.
5. Throughout the period there is a decrease in the level of positivity (throughout the period the reports are positive however there is a decrease starting from the second week).
6. Significantly more positive at noon than in the morning (and in the middle of the evening).
7. Specific response patterns, and how they relate to the time of the mission, are still in progress, and their analysis is too preliminary yet to report.

Movement measurements:

8. GIS maps show frequencies of densities, locations, and trajectories. Specific response patterns, and how they relate to the time of the mission, are still in progress, and their analysis is too preliminary yet to report.

Workflows:

1. According to the personal interviews, using the questionnaire app was convenient, fast, and unnoticeable.
2. According to the personal interviews, filling out the daily questionnaire app contributed to raising the AA's awareness of their self-status and group status.
3. According to the research team impression, the daily and cumulative summary table of the daily application provided an initial diagnostic tool for possible difficulties of the participants.
4. Post-mission interviews were not conducted according to the work plan.
5. WhatsApp communication with the flight manager was an efficient and immediate alternative compared to regular email communication and in fact was the main communication channel especially due to changes in the flight plan.

Steps in the experiment processing: Analysis of the questionnaires, movement and interviews.

The MSG team has accumulated from the beginning of the work on the research 18 volunteers participants from various fields of eco-encounter therapy, disaster management, expedition management, group therapy, psychology, criminology, physics, IT, project management, hyperbaric medicine, diving, GIS, marine biology, communication, social work, education, architecture, art.

OGH

Principal Investigator	
Name	Hilel Rubinstein
Affiliation	The Desert Mars Analog Ramon Station (D-MARS)
E-mail	hilel.rubinstein@d-mars.org
Co-Investigators	
Alon Shikar The Desert Mars Analog Ramon Station (D-MARS), alon.shikar@d-mars.org Gal Yoffe gal.yoffe@d-mars.org	
MSC Connections	
Cillian Murphy (FP-Coordinator), cillina.murphy@oewf.org RSS coordinator: tbd	

Description

The advanced D-MARS habitat was composed of two main D-MARS habitats: prototype 1.0 serving as the residential unit, and 2.0 serving as the main operations and workspace unit. Power, communication, water recycling, as well as other subsystems were integrated to cover the basic needs of the analog astronauts and the various requirements of the analog mission.

D-MARS HAB 02 illustration (© A. Shikar et al. 2020, IAC-20,A1,7,9,x60722)

AMADEE-20 was an opportunity for in-depth study, analysis, and optimization of Mars outpost units and subsystems design. Particularly interesting was the analysis of habitat prototype 2.0, which included features like positive pressure and a clean room and is the first stage in the establishment of the future concept of D-MARS.
A wide range of data was collected, including Mars outpost sensors data, routine reports, and questionnaires. The experiment focused on three aspects: i) resources and consumables management and optimization; ii) time dependent physical characterization of habitat prototype 2.0; iii) habitat design effects on human factor aspects. The invaluable data collected during the mission will be used for real time preliminary analysis and post mission study and optimization of the design and operation of Mars outpost complex.

OGH summary report

OGH homemade sensors collected 28198 data points (divided into 8 sensors types), about 20000 of those are useful data. This amount of data is impressive and very valuable for D-MARS and the OGH team.

OGH questionnaires were not filled by the analog astronauts as far as we understand. This issue is discussed these days with OeWF RSS team.

Using the OGH data visualization interface we could see during AMADEE-20 that most of the time sensors data was in the expected range. In some cases there were anomalies, e.g. in the VOC values – a possible explanation was emission by quadbikes engines near the habitat.

Communication from the sensors was interrupted several times during the mission from several reasons; Sensor 1 (in the airlock unit) probably had a communication problem because of the metal structure of the airlock. Also, the D-MARS router sim cards internet package was fully utilized, what causes failure in communication 2 or 3 times during the mission. This is related probably to the fact that the D-MARS router was used not only for OGH but for other experiments (MSG?), and the amount of data was not estimated accurately.

Power consumption – the estimation for power consumption during the nights was wrong, more consumers were used than planned, what causes that the solar system batteries could not supply enough power and therefore the fuel generator had to work 24/7.

Water consumption was in the range of what we expected.

Other parameters of the OGH experiments are yet to be analyzed.

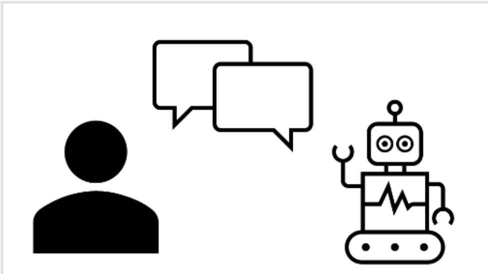
In the following months we will analyze the sensors data, to understand differences between the 4 sensors boxes, and time variations. We expect to understand more about the physical properties of the habitats, what could be very useful for the next phase of development and improvements for the habitats. We also expect to collect more data from other experiments – e.g. MSG, to learn about the relation between the habitat design and human factor aspects.

About 11 people were involved specifically in the OGH experiments, not including the D-MARS support team, and about 30 more people were involved in the design and establishment of the D-MARS habitats.

Polly

Principal Investigator	
Name	Dr.-Ing. Christiane Heinicke
Affiliation	University of Bremen, ZARM - Center of Applied Space Technology and Microgravity
E-mail	christiane.heinicke@zarm.uni-bremen.de
Co-Investigators	
Prof. Dr. Johannes Schöning University of Bremen, Human-Computer Interaction johannes.schoening@uni-bremen.de	
MSC Connections	
Karin Brünnemann (FP-Coordinator), karin.bruennemann@oewf.org RSS-Coordinator: tbd	

Description



The experiment evaluated the potential use of a conversational user interface (CUI) for astronaut scientists in an extraterrestrial habitat during the AMADEE-20 expedition. Even though guidelines for CUIs were developed decades ago, the interaction with these devices is still complex; therefore, general design guidelines for human-machine interaction need to be improved. While the studies on understanding ways people interact with CUIs in everyday scenarios are very recent, there is only a small amount of research on how CUIs can be used in other (more extreme) environments – such as extraterrestrial habitats. CUIs are supposed to assist astronauts on their challenging long-duration missions, in particular, to support them in research-related tasks during space flight or planetary exploration missions.

The study identified requirements of a CUI in an extraterrestrial habitat. Much information in that regard is believed to be contained already in the “normal” communication between the crew and mission support. Many requests that could be directed at a CUI will be directed to mission support instead; therefore, the team analyzed the mission communication post-hoc. The main question is what kind of information was requested by the crew: Specifically, in the areas of fact checking/information retrieval, logistics and timing, general conversation, technical issues and exchanges regarding requests to the on-site support team.

Such an analysis provided valuable information for improving our understanding of how a CUI could contribute to a Mars mission and what capabilities it would need to provide. At a more visionary level, we could ask to what extent a (human) mission support team could delegate work to a CUI, leaving more time for more complex trouble-shooting and saving human resources on Earth, ultimately making Mars missions more autonomous.

Polly experiment conclusion report

The study comprised the following components:

• written communication of the AMADEE-20 expedition in order to determine the potential use of a conversational user interface (CUI) for astronaut scientists during future expeditions.

No major issues are expected for the compilation of the data.

Polly preliminary insights

Since the data is not yet with the PIs, no preliminary analysis of the data was done so far. Data aggregation and analysis is expected for early 2022.

Experiment processing

Data processing is expected to commence in early 2022. We hope that we can participate in the next AMADEE mission with an early prototype based on the outcome of Polly and other experiments conducted at the ZARM – as was originally planned for Polly.

Involved people

In total, there are 4 people involved with Polly:
• Christiane Heinicke, PI and organizer; will perform data analysis in collaboration with co-PI
• Johannes Schöning, co-PI
• Tom Tietz, initially involved with preparation of the experiment and setup of the initally planned Polly prototype; dropped out for health reasons

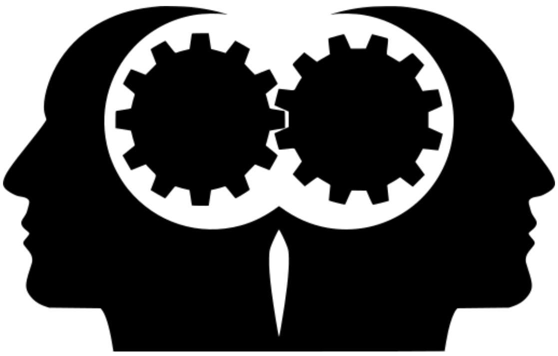
PSYCHSCALE

<table>
<tr><th colspan="2">Principal Investigator</th></tr>
<tr><td>Name</td><td>Tricia L. Larose</td></tr>
<tr><td>Affiliation</td><td>NTNU, Faculty of Medicine and Health Sciences, Department of Public Health and Nursing</td></tr>
<tr><td>E-mail</td><td>tricia.larose@ntnu.no</td></tr>
<tr><th colspan="2">Co-Investigators</th></tr>
<tr><td colspan="2">Ana Diaz-Artiles, Texas A&M University, Department of Aerospace Engineering
adartiles@tamu.edu

Gabriel G. De la Torre, University of Cadiz, College of Education, Department of Psychology
gabriel.delatorre@uca.es</td></tr>
<tr><th colspan="2">MSC Connections</th></tr>
<tr><td colspan="2">Lionel Métrailler (FP-Coordinator), Email: lionel.metrailler@oewf.org
Istem Ozen Ruber (Main RSS-Coordinator), Email: istem.ozen@oewf.org
Christine Czakler (Deputy RSS-Coordinator), Email: christine.czakler@oewf.org</td></tr>
</table>

Description

Mars analog astronauts undergo a rigorous selection and training process to ensure crew cohesion and mission success. However, even the healthiest, strongest individuals may face psychological challenges due to various stressors in extreme or abnormal environments. In our effort to further human space exploration in a safe and effective way, we must thoroughly understand and protect the psychological well-being of the crew, before, during, and after the analog mission.



The PsychScale experiment studied crew member anxiety and depression levels before, during and after the mission in order to better understand psychological well-being in response to known and unknown environmental stressors. It further aims to study the correlation between crew anxiety and depression levels and the possibility of a “third quarter phenomena” (TQP) whereby the first quarter of the mission may be characterized by crew excitement or anxiety, the second quarter by boredom and depression, and the third quarter by increased emotional outbursts.

This experiment used the Hospital Anxiety and Depression Scale (HADS) – an internationally recognized, validated questionnaire on anxiety and depression. Additionally, two open-ended qualitative questions that allow the participant to inform the scientific team of any issues related to individual or crew mental health were included.

RETINA

Principal Investigator	
Name	Dr. med. Claudia Stern
Affiliation	German Aerospace Center (DLR), Institute for Aerospace Medicine, Dept. of Clinical Aerospace Medicine
E-mail	claudia.stern@dlr.de
Co-Investigators	
Scott Ritter German Aerospace Center (DLR), Institute for Aerospace Medicine, Dept. of Clinical Aerospace Medicine, scott.ritter@dlr.de	
MSC Connections	
Anna Lanteri (FP-Coordinator), anna.lanteri@oewf.org RSS-Coordinator: tbd	

Description

The German Aerospace Center (DLR) has tested eye diagnostic devices for spaceflight applications as tools for detecting and mitigating against the numerous vision pathologies that astronauts experience in the space environment. These vision pathologies have been collectively termed Spaceflight Associated Neuro-ocular Syndrome (SANS). These devices are intended to replace older eye diagnostics devices, which are currently used in spaceflight, by offering multiple advantages in size, weight, and diagnostic capability. DLR's technology was the result of over 5 years of research and development to provide smaller, lighter, and better performing medical diagnostics technologies for use in space and on Earth. This technology is currently at Technology Readiness Level (TRL) 4. The goal of this experiment was to test this device in Mars analog conditions for potential use on future Mars missions. The objective was to show that small, lightweight, mobile, non-invasive, non-contact, light-based retinal imaging devices can feasibly capture fundus images from healthy test subjects in Mars analog conditions. During the mission, one analog astronaut used the device to capture retinal images of another crew member, repeated during the beginning, middle, and end of the mission.

Retinal imaging using the D-EYE Smartphone-Based Retinal Imaging System (© D-EYE Instructional Video)

Did you get all the data/samples you were hoping for?

TBD once hardware/data are returned.

What will be your first steps in the experiment processing?

Next steps include further hardware and software development for technology readiness level advancement.

Were there any further leads triggered by the AMADEE-20 experiment analysis?

Work was presented at the International Astronautical Congress (IAC) 2021 in Dubai.

Estimated number of people involved: 5 people

SHARE

Principal Investigator	
Name	Jean-Marc Salotti
Affiliation	1) IMS laboratory, Ecole Nationale Supérieure de Cognitique, Bordeaux INP 2) Association Planète Mars
E-mail	jean-marc.salotti@ensc.fr
Co-Investigators	
n/a	
MSC Connections	
Anna Lanteri (FP-Coordinator), anna.lanteri@oewf.org Dominik Jäger (Main RSS-Coordinator), dominik.jaeger@oewf.org Sébastien Ruhlmann (Deputy RSS-Coordinator), sebastien.ruhlmann@oewf.org	

Description

This experiment investigated how situational updates and directions can be shared between the Mission Support Center (MSC,) and a team on EVA. Imperfect situational awareness and imperfect sharing of instructions or descriptions among different participants collaborating towards the same goal are often the primary causes of accidents.

© OeWF (Voggeneder) – modified

The experiment quantified differences in geographical and situational awareness between the MSC and an analog astronaut on EVA. If the situational awareness of MSC personnel is correct, it should be able to estimate with minor errors the position of the analog astronaut in the field.

The basic concept of the SHARE experiment was as follows: First, a member of the MSC defined a walking path for the astronaut in order to send them to a precise location, based on map data available in the MSC. The MSC team member indicates where the analog astronaut is believed to be every 5 minutes. Then a message was sent to the field with instructions of how to get to the planned location. These instructions were only verbal, not via coordinates or a map. In the field the analog astronaut traveled the instructed path, as good as possible. Afterwards the actually taken path and durations were compared to the expectations from the MSC.

Such experiments may also be used to train and test the collaboration between astronauts and MSC.

Share experiment report

Five experiment runs occurred, involving each time 3 instructors and 1 analog astronaut wearing a space suit. The 3 instructors had to look first to a high resolution satellite image on which there were two marks, the first corresponding to the current position of the astronaut and the second to a destination located several hundred meters away. Then they had to write down a short list of instructions to be sent to the astronaut in a text message, explaining the path that has to be followed to reach the destination. The astronaut receives the message of the first instructor and tries to follow the path until the estimated final position. Then he comes back to the departure position and tries to follows the path of the second instructor, and finally he does the same with the final set of instructions from the third instructor. In total, this experiment has been run 5 times. For each astronaut trial, the final GPS coordinates have been collected, as well as the targeted GPS coordinates. Finally, instructors and analogue astronauts had to fill a questionnaire to better understand problems and possible solutions.

Interesting preliminary results have been obtained:

- **Distance is hard to estimate:** The astronauts felt the navigation instructions were relatively clear, but it was difficult for them to estimate the distance they traveled due to the lack of visual sizing cues and to the difficulties of the field (that may force detours or to follow curves, sometimes uphill, with rocky ground...). Moreover, they could not have any idea of their walking speed and of the length of their steps. This led to final positioning errors, sometimes of several tens of meters from the targeted position.
- **Landmarks are meaningful:** In one experiment, one in three instructors exploited a remarkable point in the environment to help spotting and this was highly appreciated by the concerned analogue astronaut, who found the instructions significantly clearer, with much less uncertainty. However, it has been noticed that it was generally difficult to find outstanding elemente in this type of environment.
- **More training would be useful:** Several instructors indicated that it would be useful to be trained in order to better interpret geological cues in satellite images, to standardize the procedure and to optimize the clarity and precision of the instructions. According to the astronauts, the use of cardinal points was clear but locally without a compass it was difficult to orientate with precision, and uncertainties accumulate as they move and change direction. Geological cues could help reducing uncertainties.

There is still a lot of work to be done for the processing of data collected during the experiment. We would like to focus on the words that have been used in the instructions, for example the number of times a geological term has been used, or the number of instructions steps. We also have to look at the distance between the arrival and the targeted position and analyze the different factors that may have led to that distance.

TUMBLEWEED-JRP

Principal Investigator	
Name	Julian Rothenbuchner
Affiliation	University of Technology, Vienna
E-mail	julian@teamtumbleweed.eu
Co-Investigators	
Moritz Stephan, Stanford University; moritz@teamtumbleweed.eu Dominik Schmidt, University of Technology Vienna; dominik@teamtumbleweed.eu Amelie Finan, University of Vienna; amelie@teamtumbleweed.eu Josef E. Pürmayr, Sir Karl Popper school; josef@teamtumbleweed.eu	
MSC Connections	
Karin Brünnemann (FP-Coordinator), karin.bruennemann@oewf.org Francesca Baisi (Main RSS-Coordinator), francesca.baisi@oewf.org Christine Czakler (Deputy RSS-Coordinator), christine.czakler@oewf.org	

Description

Tumbleweed is the concept of spherical rovers to be deployed on Mars. They are designed to be spheres of a diameter of 5 m driven by the Martian winds. One Tumbleweed consists of a sturdy aluminum/composite outer frame and sails arranged to provide optimal air resistance. Solar cells on the sails provide power. Sensors and electronics are attached to the outer frame.

The first Tumbleweed prototype had already participated in the AMADEE-18 mission. The research questions for the AMADEE-20 experiment were:

1) What is the performance of the solar cells performing under operational conditions? Specifically, what is the effect of the constantly changing illumination angle caused by the rover's movement and different times of day?
2) What is the distribution of abrasion on the Tumbleweed's structure? Surface abrasion is expected to be one of the main factors limiting the structural lifespan of a Tumbleweed Rover. The aim is to find out more about the rate and distribution of this abrasion. The test shall be conducted in sandy as well as increasingly rocky environment.
3) How does the Tumbleweed's speed and direction of movement vary under different wind conditions?

Tumbleweed Experiment Feedback/Report

From August to October 2021 over multiple experiment runs, meetings and back-and-forth discussions, the Team Tumbleweed V3 Prototype could overall successfully be tested.
Because this is an early Prototype with the aim to prove concepts like, structural integrity for the upscaled version, rolling behaviour, electrical systems and easy build up processes, all these points can be interpreted as successful for the AMADEE. Even after some critical failures in the early runs, it was possible to repair the tough structure and electrical components for further runs, which summed up to be about 6 runs in total.

Communication was rather difficult and hard to keep track of system has been tested, especially when having to deal with all that in a distant set-up. But as the data shows, everything worked out to be a great success.

For the future, we'll have to analyze the video footage as well as sensor data gathered from the Pods on the V3, and interpret it for future Prototypes and Subsystems. Even though the research points have successfully been met in this mission, a lot of research points will still need more attention, as the experiment has revealed to us.

For this experiment a lot of members have been working hard to get where we are. Up to 25 students have been working on the V3 Prototype, mostly from Vienna. All of which are students in physics and engineering and we will take the experiences with us for

In conclusion, the whole Team Tumbleweed Crew is very grateful to have had the opportunity of working with the ÖWF on this project. We have gathered a lot of experience on the way and the experiment provided us with a lot of data, which

We want to thank everybody that has worked so hard with us to even make the experiment possible!

Team Tumbleweed

VFR-eFAST

Principal Investigator	
Name	Anton Ahlbäck
Affiliation	Dep. of Anaesthesia and Intensive Care, Örebro Univ. Hospital, Sweden
E-mail	anton.ahlback@gmail.com
Co-Investigators	
Jochen Hinkelbein, Department of Anaesthesiology and Intensive Care Medicine, University Hospital of Cologne, German Society of Aerospace Medicine, DGLRM; Munich, Germany European Society of Aerospace Medicine, ESAM; Cologne, Germany	
MSC Connections	
Mona Nasser (FP-Coordinator), mona.nasser@oewf.org Armin Hochrainer (Main RSS-Coordinator), armin.hochrainer@oewf.org	

Description

Trauma on exploration class missions to Mars is considered one of the most important risks to mission and crew. Non-invasive diagnostic tools such as ultrasonography are an important diagnostic part when attempting to identify potentially life-threatening injuries to the thorax and abdomen.

Proposed ultrasonography device Sonosite M-Turbo

Although it is expected that a crewed mission to Mars will have at least one trained medical professional, this might not always be the case. There is also always a significant risk that the crew medical officer will be the one who is sick or injured. Thus, the exam may need to be executed by individuals with minimal medical training. Also, at the time it is needed, that training may be on an estimate 2 – 3 years old.

The VFR-eFAST experiment investigated the feasibility of having non-medical personnel, in this case, analog astronauts, perform a focused ultrasonography of the abdomen and thorax. To properly simulate the time training and performing the ultrasonography, the analog astronauts were not prepared at all before conducting the experiment.

The experiment started with an approx. 20-minute instructional video on how to set up the ultrasonography, how to handle the probes, and how to perform the examination. The analog astronauts would then independently complete the exam on a live test subject and send the required views back to the MSC. The images were then be rated independently based on quality by experienced radiologists.

22. Complementary scientific activities

Although not formally selected through a full peer-review process, there were several opportunistic R&D activities scheduled for AMADEE-20.

BACTERMA Textile test

The ÖWF was tasked by the European Space Agency in partnership with the Vienna Textile Lab to explore the biocidal potential of secondary metabolites of bacteria. The aim was to identify factors that help reducing or terminating microbial strains on textiles and use them as microbial textile-dye.
Spaceflight enhances bacterial growth and diminishes disinfectant sensitivity in some conditions, including ISS's microbiome bioload posing a long-term hazard to human health.
Selected textile patches will be included into the undergarment of the Analogue, recording document the skin and textile conditions during this time with photographs and questionnaires. After the mission the textile patches would have been sent back to the Vienna Textile Lab where antimicrobial tests and a pH test would be performed.

Due skin health safety considerations, the hardware was delivered to the filed, however, the mission management decided to not proceed with the textile test to avoid unnecessary risks for the crew.

DEAR Textile test

The project DEAR of the European Space Agency, in cooperation with the ÖWF and OHB, studied effects of Regolith dust on optics, mechanisms and astronautic components. This project originated due to the need for an effective Lunar dust cleaning method. The special chemical and physical properties from lunar dust are responsible for a lot of different difficulties during Lunar Expeditions regarding health and technical issues.
Dust can make breathing for Astronauts difficult and may trigger chronic respiratory problems, and has also a considerable negative impact on technical items.
Therefore, to remove lunar dust from equipment, different cleaning methods were being tested including blast cleaning with supercritical CO2 jets, which would be tested on textile patches brought back from Analog Astronauts after the mission.

Dietology program

The University of Applied Sciences in Healthcare Upper Austria (Prof. Klaus Nigl) studied the nutritional behavior of the flight crew and is planning the meals and studied their impact on the crew health.

- Liaison: Klaus Nigl, M.A.; FH Gesundheitsberufe OÖ GmbH; Campus Gesundheit am Ordensklinikum Linz, Elisabethstraße 15-19; +43(0)50 344 221 10, +43(0)664 80344 221 10 klaus.nigl@fhgooe.ac.at

ESA 3d MELT printer

ESA developed a zero-g compatible 3d printer to be deployed during AMADEE-20 in the habitat to investigate its performance under field conditions. ESA's Manufacturing of Experimental Layer Technology (MELT) project printer had to be able to operate from any orientation, based on the 'fuse filament fabrication' process, it has been designed to fit within a standard ISS payload rack, and to meet the Station's rigorous safety standards.

The MELT printer can print a wide variety of thermoplastics from ABS (Acrylonitrile butadiene styrene), up to high-melting point engineering thermoplastics such PEEK (Polyether ether ketone), which is robust enough to substitute for metal materials in some cases.
Liasons:

- Ugo.Lafont@esa.int,
- Riccardo.Rampini@esa.int ,
- contracts officer: Vasileios.Angelopoulos@esa.int

Management aspects of the AMADEE missions

As part of a MSc thesis in Management and Production, the workflows, rules & guidelines and project management aspects of the AMADEE-20 expedition were studied to identify strengths, weaknesses, opportunities and threats.
University of Applied Sciences, Steyr/Austria; MSc-student: Dominik Rabl

INTERFAM / Analysis of the MSC-field interaction

INTERFAM focussed on the relationship between the Flight Crew and the MSC, meaning how close and connected the two teams felt, and the cohesiveness of the two teams during AMADEE-20. High closeness, high connectedness and high cohesiveness are seen as indicators of a good relationship between the teams. This study – as a part of the MSc thesis of Annbelle Mielitz/Univ. Bielefeld- shall contribute to future missions in a way that the relationship between the Flight Crew and the MSC can be monitored in future missions. This is important as the monitoring of the relationship will enable members of future missions to detect if the relationship is bad or not. If it is bad, interventions to improve the relationship can be implemented.
Contact: annabelle@mielitz.de

STEMRAD Radiation Protection Vest

(MSS ARPV-Experiment)

The Israeli/US company Stemrad developed a radiation protection vest to allow the body to recover after exposure by shielding the bone marrow and other stem cell-rich organs. https://stemrad.com

- Liaison: Rajarshi Pal Chowdhury, PhD; Lead Scientist, Space Exploration. StemRad, Inc. rajarshi@stemrad.com and STEMRAD CEO Oren Milstein, oren@stemrad.com

The objective of this experiment was to assess the user experience of analog astronauts wearing a radiation protective vest especially made for surfaces whose gravity is less than the Earth (The Mars or the Moon). The team gathered data on weight, comfort, and ergonomics issues faced by the astronauts wearing this vest while performing daily activities and recommendation for future improvements.

AA's wore the vest for a cumulative of 30-40 hours during their operation and wearing it 2 nights of sleeping (cumulatively 12-16 hours). This would be enough for generating required information. Each AA who participates on this experiment answered a questionnaire and returned to the PIs for evaluation after the field phase concluded.

23. Team and Equipment Shipping Logistics

Shipment

The shipment logistics was be managed by Gebrueder Weiss; this industrial partner also provided a shipment logistics team who coordinated the customs and shipment formalities and consulted on packing of experiment hardware.

The port of entry/exit was the Port of Ashdod, Israel.

Shipping team team:

Andreas Kunst, Seafreight Export Coordinator Air&Sea
Gebrüder Weiss Gesellschaft m.b.H. / Business Premises Hall in Tirol
Löfflerweg 35, A 6060 Hall in Tirol
andreas.kunst@gw-world.com

Israel team lead for shipping: Shachar Gutman, shachar@goa-log.com
Mobile 972-52-6028768, www.goa-log.com

24. A-20 Outreach & Education activities

Junior Researchers Program

Highschool students participated in AMADEE-20 “adopting” a respective experiment of the mission, visiting the Mission Support Center.

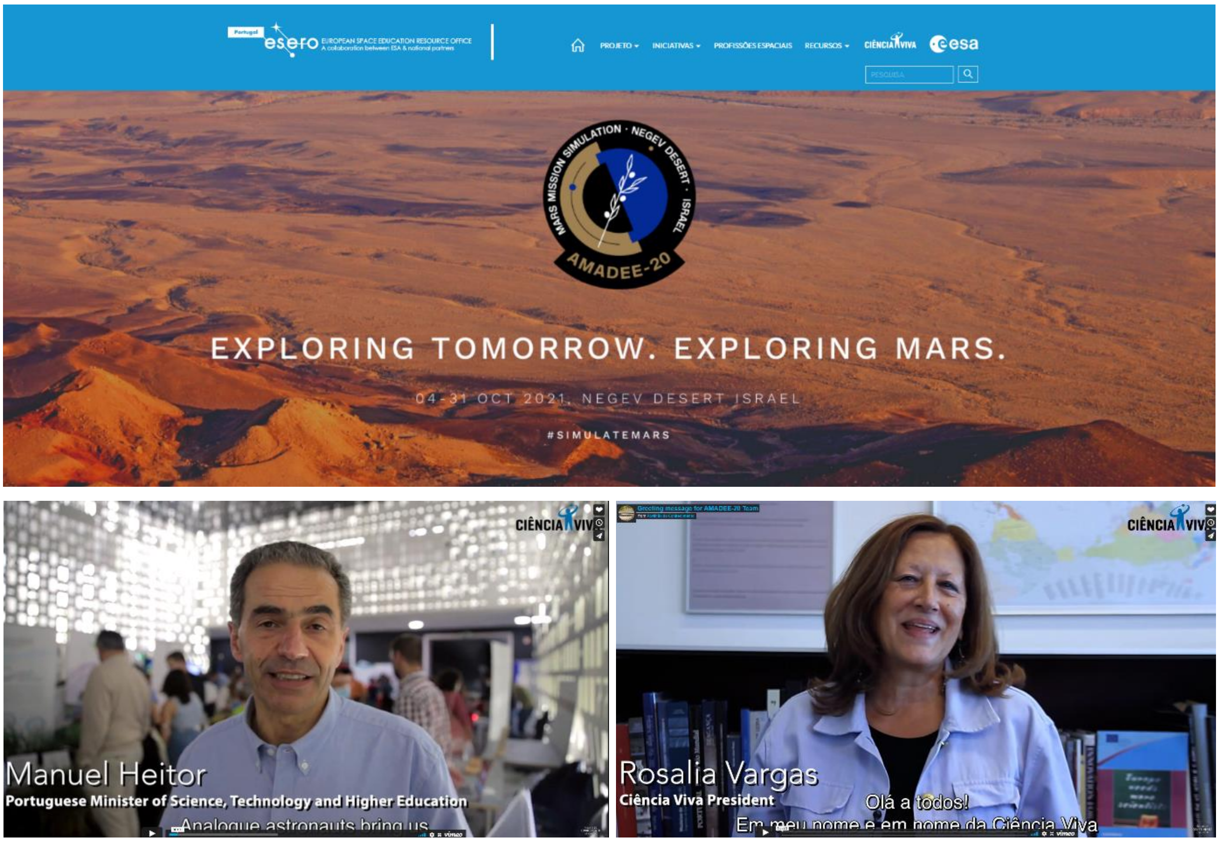


Image: ESERO AMADEE-20 website Portutgal, including greeting messages from the Portuguese minister of science and the vice president of Ciencia Viva.

ESERO Portugal

Both the Austrian Space Forum (as part of the OeWF Junior Researchers Program and the EU DiSTARS initiative) and ESERO Portugal teamed up to communicate STEM topics via the AMADEE-20 Mars analog simulation in October 2021 in the Israeli Negev-desert. In particular, as the crew commander, Joao Lousada was from Portugal, as well as one of the core experiments of the mission (MEROP, Univ.,of Lissabon) a set of educational inputs was delivered, processed and disseminated via ESERO Portugal.

Team

Austrian Space Forum	ESERO Portugal
Joao Lousada, A-20 Flight Crew Joao.lousada@oewf.org	João Dias, jedias@cienciaviva.pt ESERO Portugal Manager
Kristina Scheling, OeWF Education Kristina.schelling@oewf.org	Adelina Machado, amachado@cienciaviva.pt ESERO Portugal Educational Coordinator

Klaus Albrecht, OeWF Education coordinator Klaus.albrecht@oewf.org	Pedro Coimbra, pcoimbra@cienciaviva.pt ESERO Portugal Project Assistant

Input Austrian Space Forum

What	When	Notes
Every 2nd day a video message from the mission, from one of the following teams: Crew (esp. Lousada), Mission Support Center (Remote Science Support, Flight Planning and Flight Control), On-Site Support @ Israel and others	04-31Oct2021	1-2min video messages, quality suitable for social media. When João Lousada records the video, the language should be Portuguese. Otherwise in English.
Media material (access to B-roll footage and professional photos); most likely ca 10 neutral/unbranded video clips with general mission footage Provision of general mission material (text elements, images etc)	Before 10Oct2021	Usable for national media activities; material is for free dissemination (although with credit)
Provision of video footage / Interview with Joao Lousada with professional equipment	By 10Oct2021	ONLY if there is a specific request from a major PT media channel
At least 1 (2?) live-link session (ca 15min, plus pre/post time via MSC) from the Negev-desert	05-09Oct2021	From the base station to school classes
Interaction with MEROP team, eg classroom visits, live links from the MSC/RSS room during the mission?	October & November 2021	Via MEROP research team

Output ESERO PT

What	When	Notes
Establishing contact and dissemination of media material within PT	Oct2021	“Spreading the word” and recruitment of teachers/schools
Management of live links on the PT side	05-09Oct2021	PT-side of the live link to Joao Lousada
Social media activities (eg sharing, forwarding, echoing, maybe a an account take-over (tbd))	04-31Oct2021	To be coordinated with OeWF MSC/Media-team
Establish a bridge with Portugal Space for the sharing and dissemination of media material within Portugal.	04-31Oct2021	Portugal Space will also join the Social media activities

Post A-20 lecture tour

Organized by the host country, A-20 crew members presented mission highlights to Israeli students and the general public.

- Reisman University, student lecture
- Madatech College/Science Center
- Planetanya Science Center
- Technion University
- Merhavim school in Yavne (ca 150 students)

From the Austrian side, the following actions were taken

- Provide European Union ERASMUS+ program DiSTARS with AMADEE-20 mission photos to support the DiSTARS platform (to the platform there is a media-file archive attached)
- School-attendance at Mission Support Center (four classes from Reithmanngymnasium Innsbruck with their teachers visit the MSC). Four in-person sessions á 60 minutes.
- Visitors form VHS Innsbruck (Volkshochschule) at MSC, “young space explorers at the MSC”

Phots right: Impressions from public lectures after the mission concluded.

Photo below: OeWF Education coordinator Klaus Albrecht during a DiSTAR/Junior Researchers Program workshop at the MSC.

Israeli Ambassador Visit at the MSC

On 14Nov2021, the Israeli Ambassador to Austria, Mr. Mordechai Rodgold visited the Mission Support Center emphasizing the diplomatic support for AMADEE-20.

25. A-20 Mission Record / Chronology

This section provides a chronological overview on the mission activities. The source for this generic summary was the Science Data Archive, Image repositories and the Trello tool used by the MSC during AMADEE-20. The photos of the day were compiled by the media team including their description, the TRELLO records by the RECORDS position and the SDO team.

Field Activity Plan

Legends of Activity types
Preparation/Setup, Donning
Travel and Traverse
Scientific Experiments
(Suit) Support
Safety
Doffing/Packing, Checking/Repairs
Permanent/Monitoring
All Hands Activity
Media

color for separation lines

Recurring experiment schedule

MICROBIOME: Conducted every morning before breakfast by all field crew
Human Factors: Questionnaire filled out every evening for all field crew
MARSLOCK: Collection of crew feedback via questionnaires after each EVA and post-mission. Monitoring of airlock usage by cameras inside and outside the airlock.

26. Bridgehead Phase 04-09Oct2021

The bridgehead phase served as a period for unpacking hardware, allow for an acclimatization of the field crew and media activities. During this week, the last habitat setup steps were taken and the field office established at the Pangea center in Mitzpe Ramon.

Preceding the bridgehead phase, Judith Kuemmel/OOS CDR and Gernot Groemer/Leadership arrived in Tel Aviv already on 29Sep2021 to scout for challenges and breaking the seal of the shipping containers to start unpacking together with the OSS D-Mars team.

The station presented itself as a concluding construction site upon arrival, with the mainframe, walls, roof etc established. Also, the infrastructure for water, power and connectivity was established. Most of the interior set up, like laboratory dashboards, windows, furniture had yet to be setup. This caused an unscheduled additional workload for the field crew.

Towards the conclusion of the bridgehead phase starting ca 07Oct2021, the station was to be entered only with protective clothing (paper overall, gloves and overshoes) for the non-flight crew to reduce the biological contamination inside.

Mon, 04-Oct-2021	UTC	03:00	04:00	05:00	06:00	07:00	08:00
	UTC+2 (MSC)	05:00	06:00	07:00	08:00	09:00	10:00
	UTC+3 (Field)	06:00	07:00	08:00	09:00	10:00	11:00
PERSON:	POSITION:	Bridgehead Phase - Setup BASE					
Robert Wild	Field Crew		MB	Breakfast, Briefing	MOVE, PSY		
Thomas Wijnen	Field Crew		MB	Breakfast, Briefing	PSY		
Alon Tenzer	Field Crew		MB	Breakfast, Briefing	PSY		
Anika Mehlis	Field Crew		MB	Breakfast, Briefing	PSY	Interview	
João Lousada	CRW CDR		MB	Breakfast, Briefing	PSY		
Claudia Kobald	OSS			Breakfast, Briefing	Quartermaster		
Carmen Köhler	OSS			Breakfast, Briefing	TT, Setup BASE WiFi	TT	
Judith Kümmel	OSS CDR		MB	Breakfast, Briefing	OSS Commander		
Lukas Plazovnik	OSS			Breakfast, Briefing	TT, Setup BASE WiFi	TT	
Christian Schwarz	OSS		MB	Breakfast, Briefing	TT, Setup BASE WiFi	TT	
Florian Voggeneder	OSS		MB	Breakfast, Briefing	TT, Photo		TT
Liad Yosef	OSS		MB	Breakfast, Briefing			
Deepa Raju	OSS		MB	Breakfast, Briefing			
Marlène Cherruault	OSS			Breakfast, Briefing			
Gernot Grömer	OSS			Breakfast, Briefing	TT, Media		Interview, TT

Abbreviations: MOVE ... Setup MOVE, MB ... Microbiome, PSY ... Psychscale
Interviews: Anika: Phone interview with Dresdner Morgenpost, Gernot: phone interview
Questionnaires: Psychscale

Mon, 04-Oct-2021	UTC	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00
	UTC+2 (MSC)	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00
	UTC+3 (Field)	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00
PERSON:	POSITION:	Bridgehead Phase - Setup BASE							
Robert Wild	Field Crew	Lunch						Briefing	Dinner
Thomas Wijnen	Field Crew	Lunch						Briefing	Dinner
Alon Tenzer	Field Crew	Lunch						Briefing	Dinner
Anika Mehlis	Field Crew	Lunch						Briefing	Dinner
João Lousada	CRW CDR	Lunch						Briefing	Dinner
Claudia Kobald	OSS	Lunch, Teambuilding						Briefing	Dinner
Carmen Köhler	OSS	Lunch, Teambuilding		TT	Hab introduction		TT	Briefing	Dinner
Judith Kümmel	OSS CDR	Lunch, Teambuilding		OSS Commander				Briefing	Dinner
Lukas Plazovnik	OSS	Lunch, Teambuilding		TT	Hab introduction		TT	Briefing	Dinner
Christian Schwarz	OSS	Lunch, Teambuilding		TT	Hab introduction		TT	Briefing	Dinner
Florian Voggeneder	OSS	Lunch, Teambuilding		TT	Hab introduction		Photo	TT, Briefing	Dinner
Liad Yosef	OSS	Lunch, Teambuilding						Briefing	Dinner
Deepa Raju	OSS	Lunch, Teambuilding						Briefing	Dinner
Marlène Cherruault	OSS	Lunch, Teambuilding		TT	Hab introduction		TT	Briefing	Dinner
Gernot Grömer	OSS	Lunch, Teambuilding		TT	Media			TT, Briefing	Dinner

Abbreviations: MOVE ... Setup MO
Interviews: Anika: Phone interv
Questionnaires: Psychscale

Comments: Microbiome may als

Tue, 05-Oct-2021	UTC	03:00	04:00	05:00	06:00	07:00	08:00	09:00
	UTC+2 (MSC)	05:00	06:00	07:00	08:00	09:00	10:00	11:00
	UTC+3 (Field)	06:00	07:00	08:00	09:00	10:00	11:00	12:00
PERSON:	POSITION:	Bridgehead Phase						
Robert Wild	Flight Crew		Breakfast	Briefing, BME Training		TT (C1)		Lunch
Thomas Wijnen	Flight Crew		Breakfast	Briefing, BME Training		TT (C1)	MARSLOCK	Lunch
Alon Tenzer	Flight Crew		Breakfast	Briefing, BME Training		TT (C1)		Lunch
Anika Mehlis	Flight Crew		Breakfast	Briefing, BME Training		TT (C1)	MARSLOCK	Lunch
João Lousada	CRW CDR		Breakfast	Briefing, BME Training		TT (C1)		Lunch
Claudia Kobald	OSS		Breakfast	Briefing, BME Training	TT (CD)	WiFi [GEOS Compare 1, Micropot]		Lunch
Carmen Köhler	OSS		Breakfast	Briefing, BME Training	TT (CD)	Setup ExoScot		Lunch
Judith Kümmel	OSS CDR		Breakfast	Briefing, BME Training	OSS Commander			Lunch
Lukas Plazovnik	OSS		Breakfast	Briefing, BME Training	TT (CD)	WiFi [GEOS Compare 1, Micropot]		Lunch
Christian Schwarz	OSS		Breakfast	Briefing, BME Training	TT (C1)	Setup ExoScot		Lunch
Florian Voggeneder	OSS		Breakfast	Briefing, BME Training	TT (C1)	Photo		Lunch
Ignaty Romanov-Ch.	OSS		Breakfast	Briefing, BME Training	TT (C1)	WiFi [GEOS Compare 1, Micropot]		TT (C1), Lunch
Deepa Raju	OSS		Breakfast	Briefing, BME Training	TT (C1)			Lunch
Marlène Cherruault	OSS		Breakfast	Briefing, BME Training	Housekeeping			Lunch
Gernot Grömer	OSS		Breakfast	Briefing, BME Training	TT (C1)	Media / Instagram Takeover		Lunch
Car 1 (C1)		Sec Shift Change						
Car 2 (C2)								
Car David Michaeli, MSG-Team (CD)								
Razor 1								
Razor 2								
Razor Security 1								
Razor Security 2								

Abbreviations: MARSLOCK ... Setup MARSLOCK, WiFi ... Setup WiFi

Tue, 05-Oct-2021	UTC	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00
	UTC+2 (MSC)	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
	UTC+3 (Field)	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
PERSON:	POSITION:	Bridgehead Phase								
Robert Wild	Flight Crew			Prepare EVA		ARTE Sunset Shooting		Briefing	Dinner	
Thomas Wijnen	Flight Crew					ARTE Sunset Shooting		Briefing	Dinner	
Alon Tenzer	Flight Crew					ARTE Sunset Shooting		Briefing	Dinner	
Anika Mehlis	Flight Crew					ARTE Sunset Shooting		Briefing	Dinner	
João Lousada	CRW CDR			Prepare EVA		ARTE Sunset Shooting		Briefing	Dinner	
Claudia Kobald	OSS	Driving Training			TT (C1)	Quartermaster		Briefing	Dinner	
Carmen Köhler	OSS	Driving Training			Setup ExoScot		ARTE	TT (C1), Briefing	Dinner	
Judith Kümmel	OSS CDR	TT (C1), Driving Training			TT (C1)	OSS Commander		Briefing	Dinner	
Lukas Plazovnik	OSS	Setup ExoScot					ARTE	TT (C1), Briefing	Dinner	
Christian Schwarz	OSS	Setup ExoScot					ARTE	TT (C1), Briefing	Dinner	
Florian Voggeneder	OSS	Setup ExoScot			Photo			TT (C2), Briefing	Dinner	
Ignaty Romanov-Ch.	OSS	TT (C1)	Housekeeping		TT (C1)	Housekeeping	TT (C1)	Briefing	Dinner	
Deepa Raju	OSS	TT (C1), Driving Training			TT (C1)		TT (C2)	Briefing	Dinner	
Marlène Cherruault	OSS	TT (C1), Driving Training				ARTE Sunset Shooting		TT (C1), Briefing	Dinner	
Gernot Grömer	OSS	Media / Instagram Takeover						TT (C2), Briefing	Dinner	
Car 1 (C1)			Sec Shift Change						Sec Shift Change	
Car 2 (C2)										
Car David Michaeli, MSG-Team (CD)										
Razor 1										
Razor 2										
Razor Security 1										
Razor Security 2										

Abbreviations: MARSLOCK ... Setu

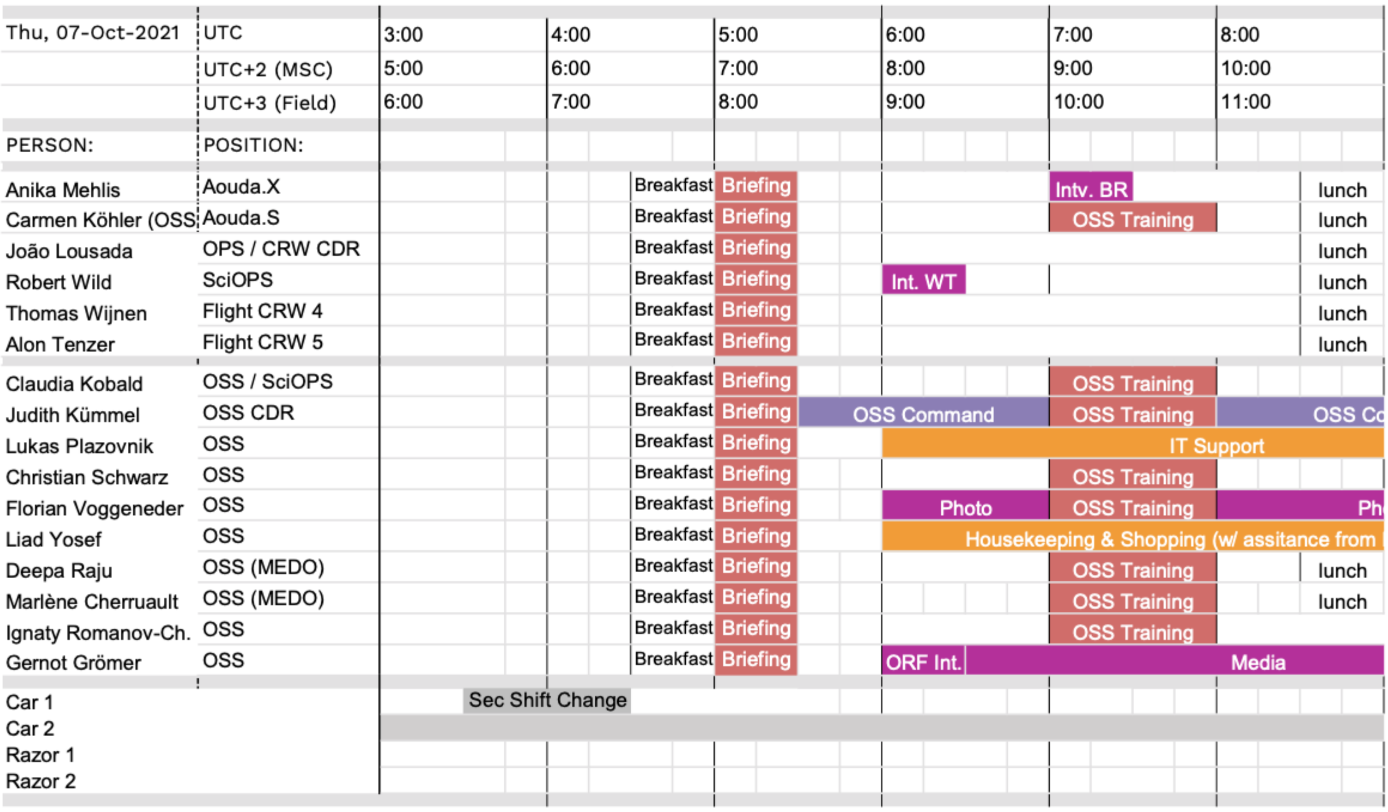
Wed, 06-Oct-2021	UTC / UTC+2 (MSC) / UTC+3 (Field)	03:00 / 05:00 / 06:00 — 04:00 / 06:00 / 07:00 — 05:00 / 07:00 / 08:00 — 06:00 / 08:00 / 09:00 — 07:00 / 09:00 / 10:00 — 08:00 / 10:00 / 11:00
PERSON:	POSITION:	Bridgehead Phase
João Lousada	Aouda.X	Breakfast, Briefing, Donning X
Robert Wild	Aouda.S	Breakfast, Briefing, Donning S
Thomas Wijnen	Flight Crew	Breakfast, Briefing, Support Donning
Alon Tenzer	Flight Crew	Breakfast, Briefing, Support Donning
Anika Mehlis	Flight Crew	Breakfast, Briefing, Support Donning & **take photo for DEAR**
Claudia Kobald	OSS / SciOPS	Breakfast, Briefing, Suit Ops and Communication
Carmen Köhler	OSS / OPS	Breakfast, Briefing, Suit Ops and Communication, Lunch
Judith Kümmel	OSS CDR	Breakfast, Briefing, OSS Commander
Lukas Plazovnik	OSS	Breakfast, Briefing, TT (C1), WiFi On, TT (C1), Housekeeping, Lunch
Christian Schwarz	OSS	Breakfast, Briefing, TT (C1), WiFi On, TT (C1), Lunch
Florian Voggeneder	OSS	Breakfast, Briefing, TT (C1), Photo (R1), Lunch
Liad Yosef	OSS	Breakfast, Briefing, Lunch
Deepa Raju	OSS	Breakfast, Briefing, Suit Telemetry for Safety, Lunch
Marlène Cherruault	OSS	Breakfast, Briefing, Suit Telemetry for Safety
Ignaty Romanov-Ch.	OSS	Breakfast, Briefing, General Support
Gernot Grömer	OSS	Breakfast, Briefing, TT (C1), Media, Lunch
Car 1		Sec Shift Change
Car 2		
Razor 1		Photo
Razor 2		
Razor Security 1		
Razor Security 2		

Abbreviations: MARSLOCK ... Setup MARSLOCK, WiFi ... Setup WiFi Q-I = Questionnaire InterFam

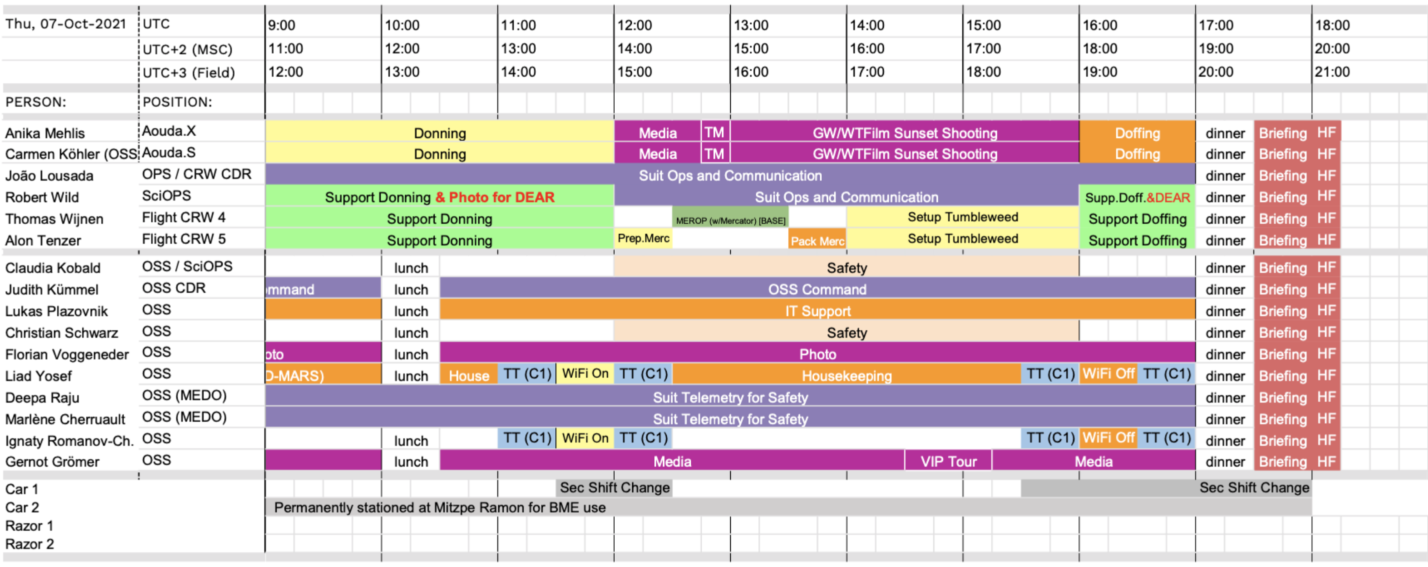
Wed, 06-Oct-2021	UTC / UTC+2 (MSC) / UTC+3 (Field)	09:00 / 11:00 / 12:00 — 10:00 / 12:00 / 13:00 — 11:00 / 13:00 / 14:00 — 12:00 / 14:00 / 15:00 — 13:00 / 15:00 / 16:00 — 14:00 / 16:00 / 17:00 — 15:00 / 17:00 / 18:00
PERSON:	POSITION:	Bridgehead Phase
João Lousada	Aouda.X	Lunch, GEOS Compare, Media, Micropotential A, Doffing, Briefing, Dinner, Q-I
Robert Wild	Aouda.S	Lunch, Media, GEOS Compare, Micropotential A, Doffing, Briefing, Dinner, Q-I
Thomas Wijnen	Flight Crew	Lunch, Aeroscan [H], MSSARPV training, Support Doffing, Briefing, Dinner, Q-I
Alon Tenzer	Flight Crew	Lunch, Setup Tumbleweed, MSSARPV training, Support Doffing, Briefing, Dinner, Q-I
Anika Mehlis	Flight Crew	Lunch, Setup Tumbleweed, MSSARPV training, Supp.Doff & DEAR, Briefing, Dinner, Q-I
Claudia Kobald	OSS / SciOPS	Lunch, Suit Ops and Communication, Briefing, Dinner
Carmen Köhler	OSS / OPS	Suit Ops and Communication, Briefing, Dinner
Judith Kümmel	OSS CDR	Lunch, OSS Commander, Briefing, Dinner
Lukas Plazovnik	OSS	TT (C1), Housekeeping, TT (C1), Briefing, Dinner
Christian Schwarz	OSS	TT (C1), Safety.X, WiFi Off, TT (C1), Briefing, Dinner
Florian Voggeneder	OSS	Photo (R1), TT (C1), Briefing, Dinner
Liad Yosef	OSS	TT (C1), Safety.S, WiFi Off, TT (C1), Briefing, Dinner
Deepa Raju	OSS	Suit Telemetry for Safety, Briefing, Dinner
Marlène Cherruault	OSS	Lunch, Suit Telemetry for Safety, Briefing, Dinner
Ignaty Romanov-Ch.	OSS	Lunch, General Support, Briefing, Dinner
Gernot Grömer	OSS	Media, TT (C1), Briefing, Dinner
Car 1		Sec Shift Change
Car 2		
Razor 1		Photo
Razor 2		
Razor Security 1		Safety X
Razor Security 2		Safety S

Abbreviations: MARSLOCK ... Setu

A (media) EVA was performed by Anika Mehlis (Aouda.X) and Carmen Köhler (Aouda.S) from 14:48 to 17:11. Due to a LOS, the EVA was interrupted from 15:56 to 16:43. The WiFi on the field is still work-in-progress with some areas connected, others not or only weakly.



Abbreviations: Prep = Preparation Merc = Mercator (Exoscot) ORF Int. = WhatsApp interview with ORF HF = Human Factors
Intv. BR = Interview Bayerischer Rundfunk TM = Taglicht media - exclusive
Int. WT = Interview Wiener Teitung



Abbreviations: Prep = Preparation

08Oct2021: Black Day, no activities scheduled

27. 09Oct2021 Activities

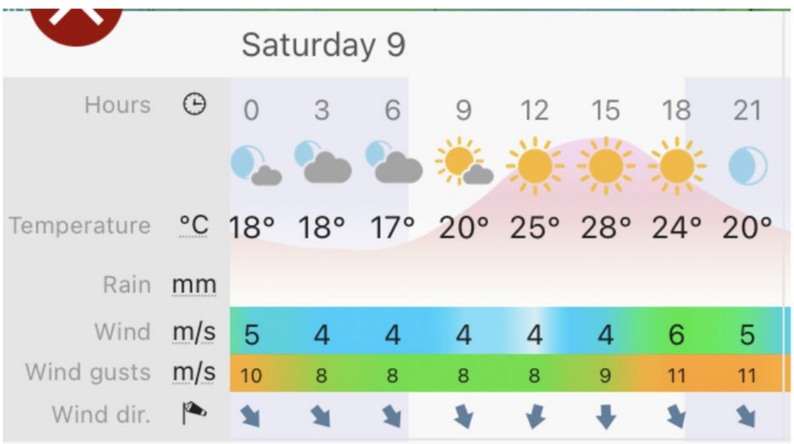
A ~3-hour EVA was performed by analog astronauts Carmen Köhler (Aouda.X) and Anika Mehlis (Aouda.S). After loss of telemetry in the Aouda.X suit (O2, CO2 and ECG missing), it was agreed to perform a MedQ every 30 min. After heat stress concerns by BME, the EVA was interrupted for a ~1 h break in the habitat. Thereafter, EVA resumed with filming activity for WTF media.
All AAs completed interviews with WTFilm. Joao conducted interviews with Portuguese media.
A trespassing team with a drone in an unauthorized area was reported in the afternoon. Both AMAZE and AEROSCAN affiliation could be excluded.

Experiments

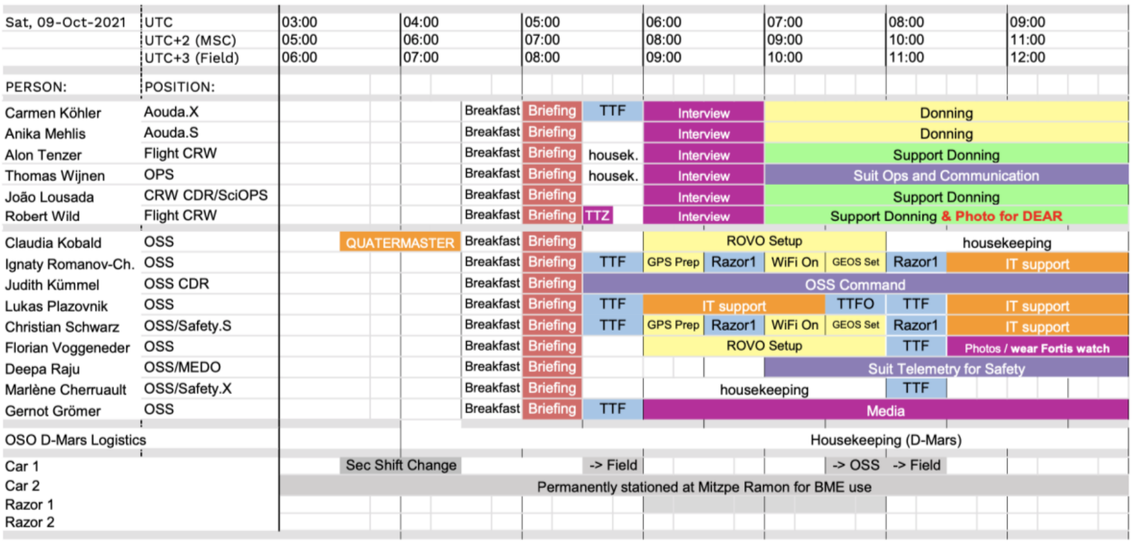
MICROPOTENTIAL	Open questions clarified with PI. Samples taken at M1 site.
DEAR	
GEOS	GEOS COMPARE cancelled due to missing WIFI coverage.
ROVO	SIM card issue, but base station setup conducted.
EXOSCOT	Cancelled because WIFI setup had priority.
AEROSCAN	Test flight not possible. Troubleshooting session scheduled.
INTERTEAM	Performed by Crew and MSC; rescheduled for OSS
ACT	

Weather

Sunset time (UTC+2)	17:10
Complete darkness (UTC+2)	18:38



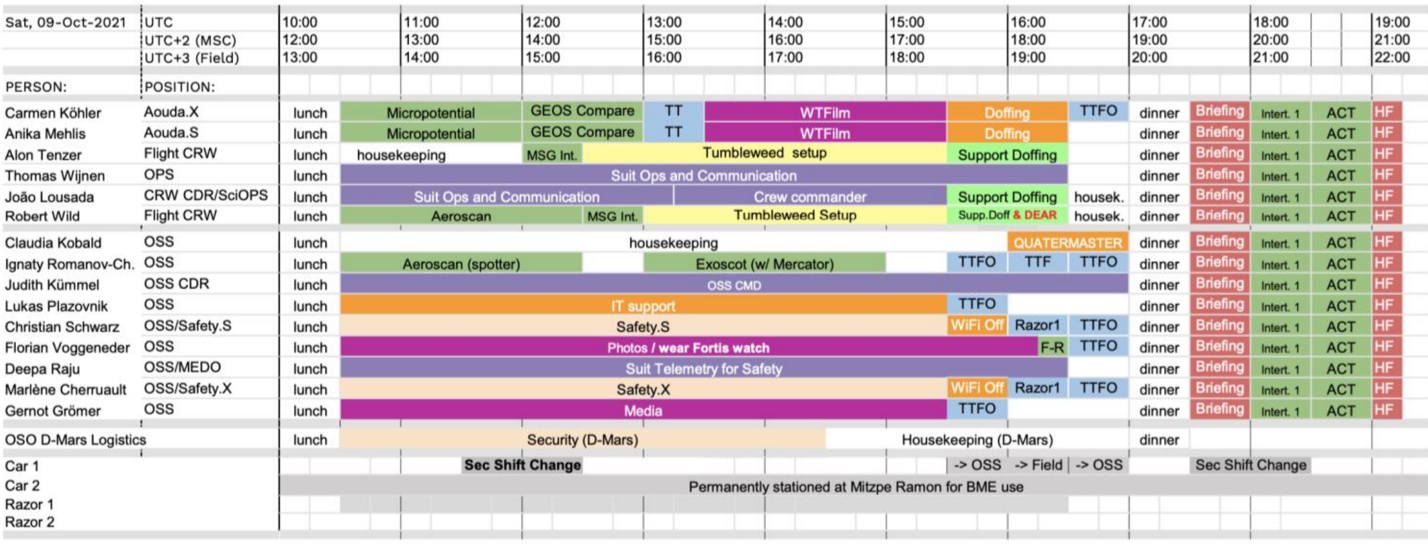
Field Activity Plan



Abbreviations:

MSG Int. = MSG individual interview
TTZ = Interview with Tiroler Tageszeitung
GEOS Set = Setup flags for GEOS Compare

HF = Human Factors psychological report
M-Charge = Mercator charging
Exo ctd. = Exoscot (w/ Mercator) & Batt.



Abbreviations:

GPS Prep = GPS Preparation
Batt. = Mercator battery change
F-R = Fortis report

ctd. = continued
Suit Tel = Suit Telemetry
TTFO = Traverse to Field Office

TW setup = Tumbleweed setup
Intert. 1 = Interteam 1
TTF = Traverse to Field

Field Impressions

28. 10Oct2021 Media Day

Activities

The AMADEE-20 media day was open to both the general media (complementing the TV crews already onsite for the major TV productions) and VIP visitors, such as member of the Israeli Ministry of Science and Technology, NPA, Police authorities, City of Mitzpe Ramon, MDA etc
The idea was to showcase the station under controlled conditions to a general public, whilst the international media will be informed about the start of the mission. To avoid too many media crews taking too much crew time, there was a "bucket" of media materials for free usage made available in high quality. Hence, on-site media teams only need their channel specific snippets, but not the beauty shots (habitat fly-over, astronauts exiting airlock etc).

We were writing OeWF history: The first time an all-female EVA (extravehicular activity) had been conducted by our two analog astronauts Anika Mehlis and Carmen Köhler. On the photo, you see them in our AOUDA-spacesuits, walking at the Mars analog site in the Negev desert in Israel. This was a unique opportunity in the bridgehead phase, as only Anika Mehlis will be part of the isolated flight crew and Carmen Köhler will support us within the On Site Support Team.

Photo: Students from the Tel Aviv College for Film record B-roll footage for the OeWF, interviewing AA Anika Mehlis and AA Carmen Koehler during the bridgehead phase.

Media Day schedule

- 11:00 arrival at Mitzpe Ramon: Safety briefing (eg either at a town hall room of the City of Mitzpe Ramon or the OSS Field Office), transfer to the crater.
- 12:00 arrival at hab: witnessing the last stages of the donning, several "stations" for guiding the groups
  - Stations: Habitat (walk in only with protective gear to maintain cleanliness), rovers/aerial vehicles, science station, spacesuits

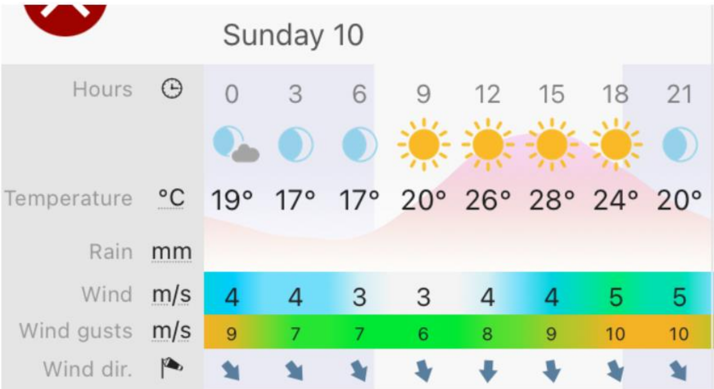
- 14:00 group photo, students & VIPs transfer back to Tel Aviv, media may stay slightly longer for individual interviews

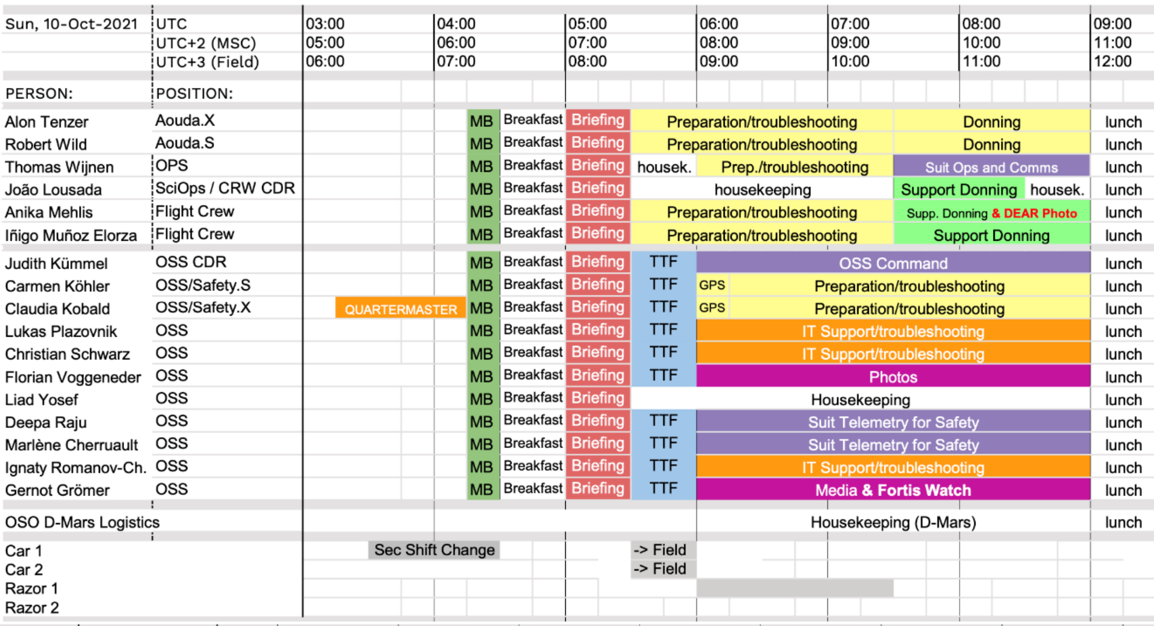
Photo: Austrian Ambassador Hanna Liko, habitat architect Alon Shikar, unknown, DG of the Israeli Ministry of Science and Technology/Shai-Lee Spigelman. and AA Alon Tenzer.

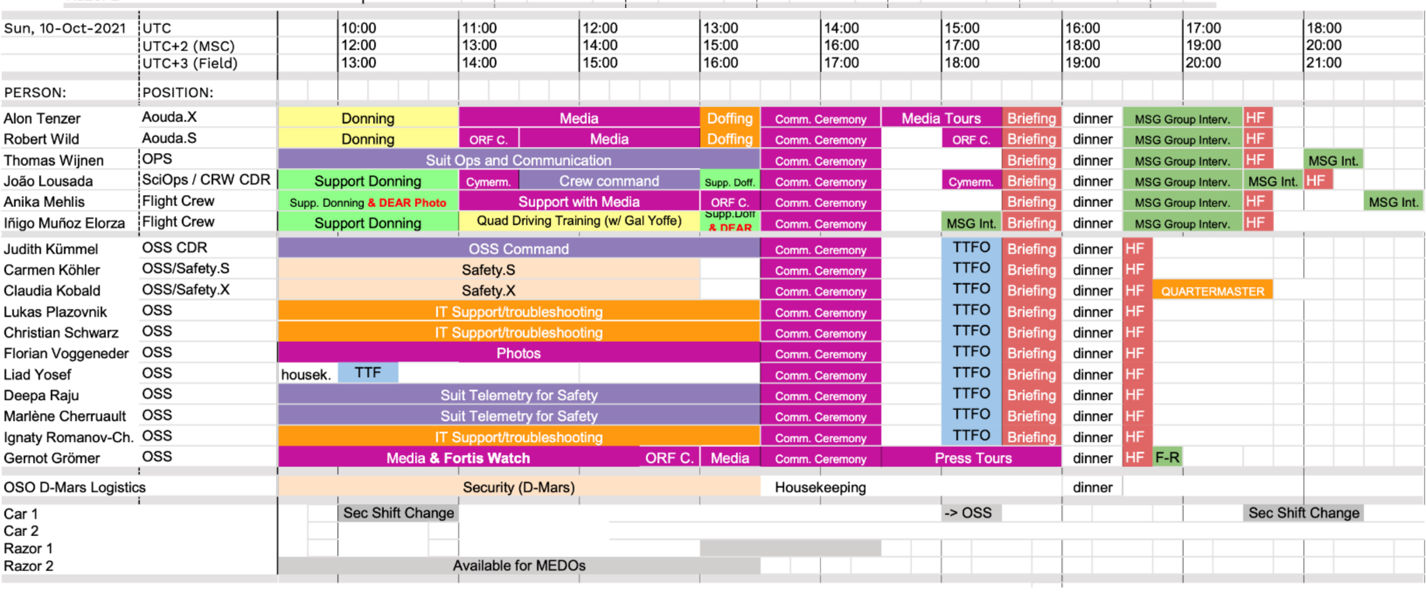
Photo: Ribbon Cutting Ceremony

Weather

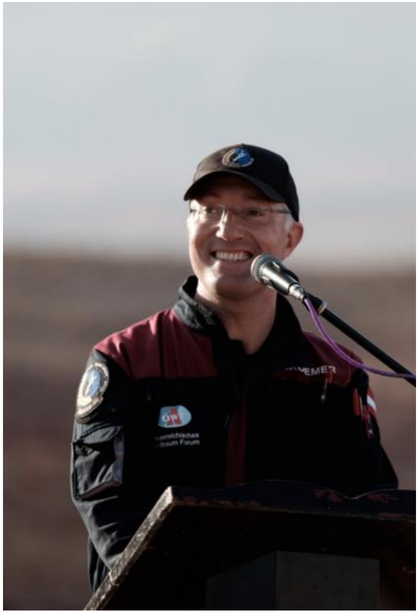
Sunset time (UTC+3)	18:16
Complete darkness (UTC+3)	19:36







Field Impressions



29. 11Oct2021 Activities

The isolation phase of the six-member field crew starts today. With their field research, the international science teams and the analog astronauts bring us a little closer to a future Mars mission. Our analog astronauts in their Aouda space suit simulators are seen in front of the crew's Mars habitat in the Ramon Crater in Israel. (c) OeWF (Florian Voggeneder)

The MSC was officially announced operational. A variety of experiments were conducted, by and large successfully. However, it was observed that a large fraction of experiments took significantly longer than their assigned slots. In addition, high helmet temperatures were noticed and a possible shift to earlier times were discussed for subsequent EVAs.

On BME side, the Aouda temp sensors were checked, and it was found that they are not very accurate (usually these sensors reported systematic higher values +1.5 to 3 K). The weather was hotter than expected and the BMEs were informed about this.

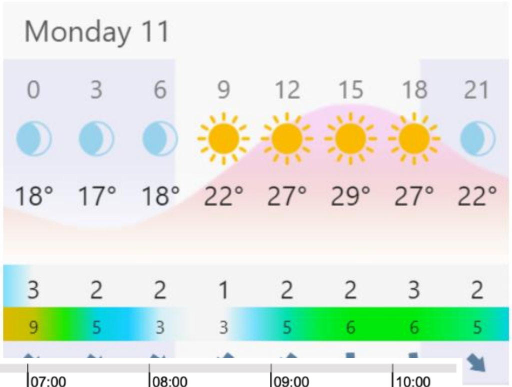
A firewall issue was being troubleshooted.

Experiments

EXOSCOT	Training performed
OGH	Fuel leak
MEROP	Successful troubleshooting, 1 run performed. Procedure T + O
PSYCHSCALE	
Retina	
INTERTEAM	performed by OSS and PI confirmed the data
ACT	Confusion with questionnaires, agreement with PI about repetition
VFR-eFAST	performed
STEMRAD	Joao and Anika wore the vest all day

Weather

Sunset time (UTC+3)	18:14
Complete darkness (UTC+3)	19:33



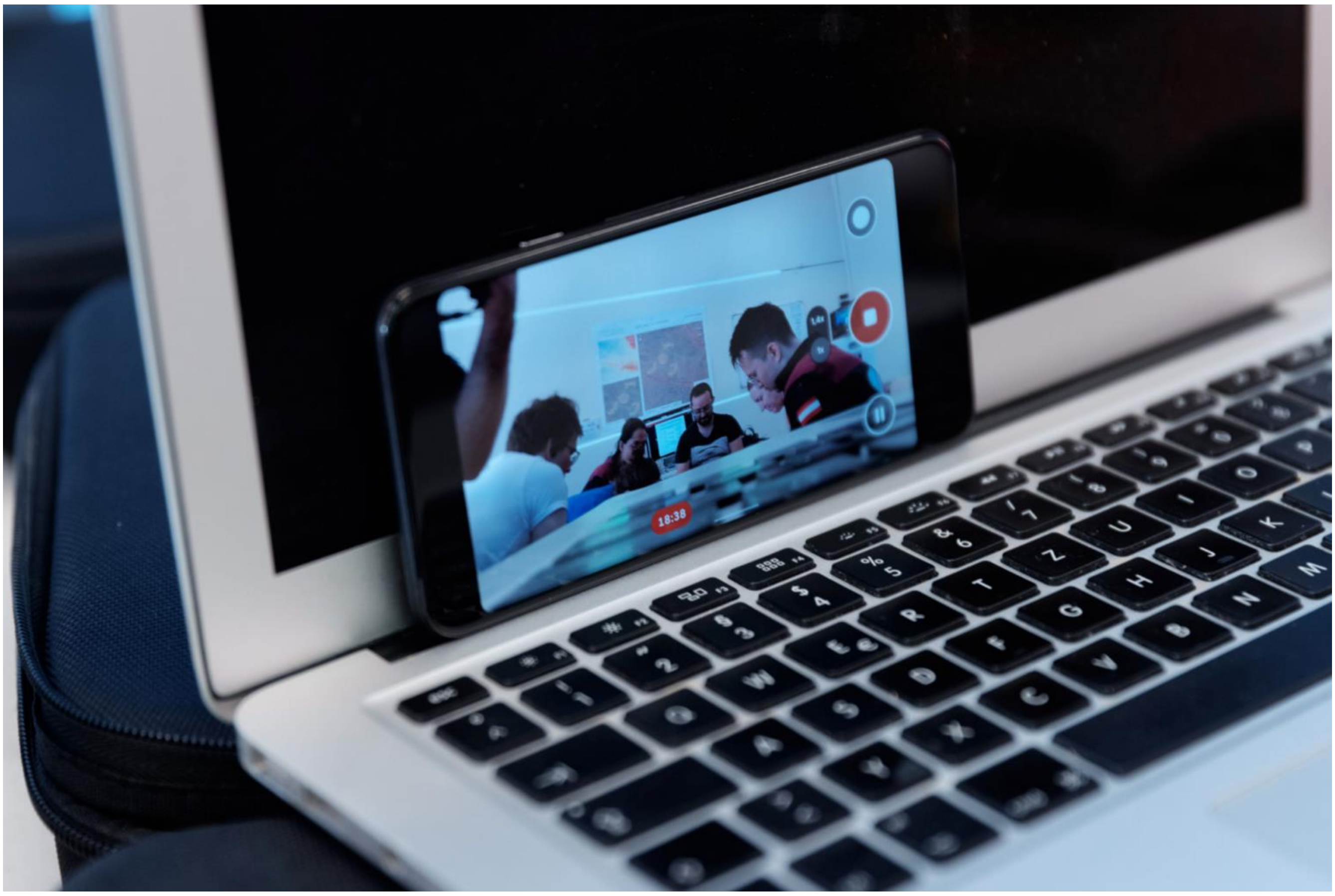
Mon, 04-Oct-2021	UTC / UTC+2 (MSC) / UTC+3 (Field)	03:00 / 05:00 / 06:00	04:00 / 06:00 / 07:00	05:00 / 07:00 / 08:00	06:00 / 08:00 / 09:00	07:00 / 09:00 / 10:00	08:00 / 10:00 / 11:00	09:00 / 11:00 / 12:00	10:00 / 12:00 / 13:00
PERSON:	POSITION:								
Robert Wild	Flight CRW		MB, Breakfast	Brief&VAS, Experiment revision & MEROP Preparation			ML Q	Experiment revision, MEROP TS	lunch&VAS
Alon Tenzer	Flight CRW		MB, Breakfast	Brief&VAS, Experiment revision			ML Q	Experiment revision	lunch&VAS
Thomas Wijnen	Flight CRW		MB, Breakfast	Brief&VAS, Experiment revision			ML Q	VFR e-fast (p)	lunch&VAS
Anika Mehlis	Flight CRW	Housek.	MB, Breakfast	Brief&VAS, Experiment revision			ML Q	VFR e-fast (e)	lunch&VAS
João Lousada	CRW CDR		MB, Breakfast	Brief&VAS, Experiment revision			ML Q	Experiment revision	lunch&VAS
Iñigo Muñoz Elorza	Flight CRW	Housek.	MB, Breakfast	Brief&VAS, Experiment revision & RETINA Preparation			ML Q	Experiment revision	lunch&VAS
Judith Kümmel	OSS CDR		MB, Breakfast	Briefing, Interteam 1 incl.Q	TTF	Exoscot training with PIs			lunch
Claudia Kobald	OSS		Breakfast	Briefing, Interteam 1 incl.Q	housekeeping / quartermaster				lunch
Danny Mattes	OSS		Breakfast	Briefing, Interteam 1 incl.Q	TTF	Exoscot training with PIs			lunch
Lukas Plazovnik	OSS		Breakfast	Briefing, Interteam 1 incl.Q	TTF	Exoscot training with PIs			lunch
Christian Schwarz	OSS		MB, Breakfast	Briefing	GPS, TTF	Prep. M, Exoscot training with PIs		MEROP TS	lunch
Florian Voggeneder	OSS		MB, Breakfast	Briefing	GPS, TTF	Prep. M, Exoscot training with PIs			lunch
Deepa Raju	OSS		MB, Breakfast	Briefing, Interteam 1 incl.Q	housekeeping				lunch
Marlène Cherruault	OSS		Breakfast	Briefing, Interteam 1 incl.Q	housekeeping				lunch

Mon, 04-Oct-2021	UTC / UTC+2 (MSC) / UTC+3 (Field)		11:00 / 13:00 / 14:00	12:00 / 14:00 / 15:00	13:00 / 15:00 / 16:00	14:00 / 16:00 / 17:00	15:00 / 17:00 / 18:00	16:00 / 18:00 / 19:00	17:00 / 19:00 / 20:00	18:00 / 20:00 / 21:00
PERSON:	POSITION:									
Robert Wild	Flight CRW	PSYCHSCALE	Maintenance		MEROP (w/Mercator)	Maintenance	Brief&VAS	dinner, ACT	HF	
Alon Tenzer	Flight CRW	PSYCHSCALE	Maintenance				Retina TS, Brief&VAS	dinner, ACT	HF	
Thomas Wijnen	Flight CRW	PSYCHSCALE	Housekeeping				Brief&VAS	dinner, ACT	HF	
Anika Mehlis	Flight CRW	PSYCHSCALE	Maintenance			Retina TS	Brief&VAS	dinner, ACT	HF	
João Lousada	CRW CDR	PSYCHSCALE	Maintenance				OGH F-R, Brief&VAS	dinner, ACT	HF	
Iñigo Muñoz Elorza	Flight CRW	PSYCHSCALE	Maintenance			Retina OP	Brief&VAS	dinner, ACT	HF	
Judith Kümmel	OSS CDR	SETUP / MAINTENANCE					TTFO, Briefing	dinner, ACT	HF	
Claudia Kobald	OSS	housekeeping / quartermaster					Briefing	dinner, ACT	HF	
Danny Mattes	OSS	SETUP / MAINTENANCE					TTFO, Briefing	dinner, ACT	HF	
Lukas Plazovnik	OSS	SETUP / MAINTENANCE					TTFO, Briefing	dinner, ACT	HF	
Christian Schwarz	OSS	Exoscot		M charge	SETUP / MAINTENANCE	Pack M.	TTFO, Briefing	dinner, ACT	HF	
Florian Voggeneder	OSS	SETUP / MAINTENANCE				OGH, Pack M.	TTFO, Briefing	dinner, ACT	HF	
Deepa Raju	OSS	housekeeping					Briefing	dinner, ACT	HF	
Marlène Cherruault	OSS	housekeeping					Briefing	dinner, ACT	HF	
OSO D-Mars Logistics		usekeeping (D-Mars)						dinner		
Car 1			Sec Shift Change			-> OSS				Sec Shift Change
Car 2										
Razor 1		N --- BROKEN --- BROKEN ---BROKEN --- BROKEN --- BROKEN --- BROKEN --- BROKEN --- BROKEN --- BROKEN --- BROKEN --- BROKEN ---								
Razor 2										

Abbreviations

Note: Interteam 2 must happen simultaneously in the habitat, OSS, and MSC. Interteam 1 does not have to be simultaneous and time is flexible. however, each team (AAs, OSS, MSC) has to perform it together

Field Impressions



30. 12Oct2021 First isolation EVA

Activities

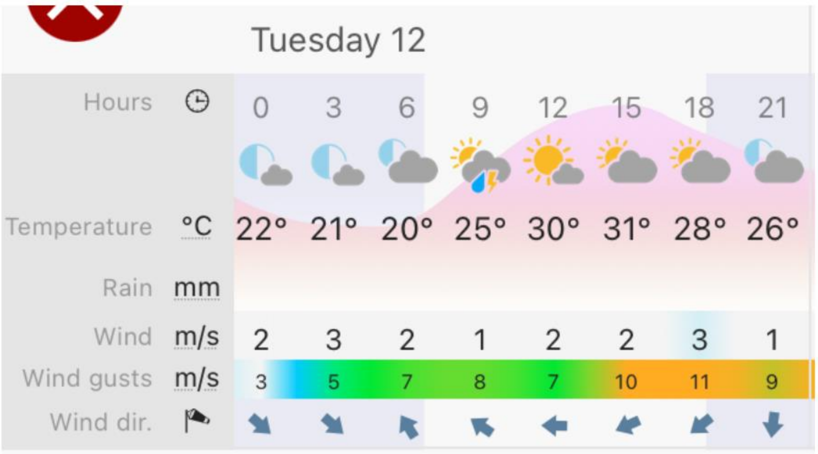
A successful EVA was performed from 12:27 - 13:06 with analog astronauts Thomas Wijnen (Aouda X) and Inigo Munoz Elorza (Aouda S). Aouda X experienced a ECG hardware malfunction. Given temperature, TP, and program, a GO was given for this short EVA. MP2 and GEOSCompare had to be cancelled.
BMEs put forward a suggestion to shift EVA to earlier slots in order to avoid high temperatures. Despite the short and only moderately demanding EVA, Heat Index reached dangerous values. As the local temperatures were not expected to decrease, earlier starts of EVAs were advised.

Experiments

INTERTEAM	performed by the 3 teams
MEROP	Stopped responding at a specific location. Interrupted by rain
EXOSCOT	Not charged for morning slot; re-scheduled
OGH	Performed during EVA, troubleshooting successful
AEROSCAN	New procedures tested

Weather

Sunset time (UTC+3)	18:14
Complete darkness (UTC+3)	19:34



Field Activity Plan

Mon, 12Oct2021

PERSON:	POSITION:	UTC 3:00 / UTC+2 (MSC) 5:00 / UTC+3 (Field) 6:00	4:00 / 6:00 / 7:00	5:00 / 7:00 / 8:00	6:00 / 8:00 / 9:00	7:00 / 9:00 / 10:00	8:00 / 10:00 / 11:00	9:00 / 11:00 / 12:00
Thomas Wijnen	Aouda.X		MB Breakfast	Brief&VAS MP prep	Donning			lun&VAS
Iñigo Muñoz Elorza	Aouda.S		MB Breakfast	Brief&VAS MP prep	Donning			lun&VAS
João Lousada	OPS / CRW CDR		MB Breakfast	Brief&VAS OPS prp	Suit Ops and Communication			lun&VAS
Robert Wild	SciOPS		MB Breakfast	Brief&VAS OPS prp	Support Donning & Photo for DEAR			lun&VAS
Anika Mehlis	Flight CRW 5		MB Breakfast	Brief&VAS AS prep	MarsLock Preparation / Support Donning			lun&VAS
Alon Tenzer	Flight CRW 6	Housek.	MB Breakfast	Brief&VAS housek.	Support Donning		Housekeeping	lun&VAS
Judith Kümmel	OSS CDR/Safety.S		MB Breakfast	Briefing GPS	TTF R2 WiFi On	R2		lunch
Danny Mattes	OSS /SafetyX		MB Breakfast	Briefing GPS	TTF R1 GEOS COMPARE Setup		R1	lunch
Christian Schwarz	OSS	Housek.	MB Breakfast	Briefing Housekeeping				lunch
Lukas Plazovnik	OSS		MB Breakfast	Briefing TTF	IT support			lunch
Claudia Kobald	OSS		MB Breakfast	Briefing TTF	Mercator prep. Exoscot (w/quad)		Chrg	lunch
Florian Voggeneder	OSS		MB Breakfast	Briefing TTF	Mercator prep.			lunch
Deepa Raju	OSS		MB Breakfast	Briefing TTF	Suit Telemetry for Safety			lunch
Marlène Cherruault	OSS		MB Breakfast	Briefing TTF	Suit Telemetry for Safety			lunch
OSO D-Mars Logistics					Housekeeping (D-Mars)			lunch
Car 1		Sec Shift Change		-> Field				
Car 2				-> Field				
Ranger 1								
Ranger 2								

Abbreviations:

MB = microbiome
Ifam = InterFam

GPS = GPS preparation & setup
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)
VL = Video Log
AS-D = Aeroscan deployment (remember to retrieve it after EVA)

Mon, 12Oct2021

PERSON:	POSITION:		UTC 10:00 / UTC+2 (MSC) 12:00 / UTC+3 (Field) 13:00	11:00 / 13:00 / 14:00	12:00 / 14:00 / 15:00	13:00 / 15:00 / 16:00	14:00 / 16:00 / 17:00	15:00 / 17:00 / 18:00	16:00 / 18:00 / 19:00	17:00 / 19:00 / 20:00	18:00 / 20:00 / 21:00
Thomas Wijnen	Aouda.X	TT	GEOS Compare 1	TT	Micropotential A,Hobo deploy	TT	Doffing Brief&VAS	dinner PSY IFam	Exp Prep/Rev Retina TS	Ex P/R HF	
Iñigo Muñoz Elorza	Aouda.S	OGH TT	GEOS Compare 1	TT	Micropotential A,Hobo deploy	TT	Doffing Brief&VAS	dinner PSY IFam	Exp Prep/Rev Interteam 2	HF	
João Lousada	OPS / CRW CDR	Suit Ops and Communication					Brief&VAS	dinner PSY IFam	Exp. Prep./Review	HF	
Robert Wild	SciOPS	Suit Ops and Communication					Supp. Doff. Brief&VAS	dinner PSY IFam	Retina TS Exp Prep/Rev	HF	
Anika Mehlis	Flight CRW 5	OGH Aeroscan troubleshoot		Housekeeping			MP strg Brief&VAS	dinner PSY IFam	Exp Prep/Rev Interteam 2	HF	
Alon Tenzer	Flight CRW 6	Exp. Prep./Review		MEROP (w/Mercator) [Base]			Doff & DEAR Brief&VAS	dinner PSY IFam	Retina OP	Ex P/R HF	
Judith Kümmel	OSS CDR/Safety.S	Ranger 1 / Safety.S					R1 WiFi Off R1	TTFO Briefing	dinner Interteam 2	HF	
Danny Mattes	OSS /SafetyX	Ranger 2 / Safety.X					R2 WiFi Off R2	TTFO Briefing	dinner	HF	
Christian Schwarz	OSS	Housekeeping						Briefing	dinner	HF	
Lukas Plazovnik	OSS	IT support					TTFO	Dinner Briefing	dinner	HF	
Claudia Kobald	OSS	Charging M-on		MEROP standby		Pack Mercator		TTFO Briefing	dinner Interteam 2	HF	
Florian Voggeneder	OSS	OGH Aeroscan troubleshoot				Pack Mercator		TTFO Briefing	dinner	HF	
Deepa Raju	OSS	Suit Telemetry for Safety					TTFO	Briefing	dinner	HF	
Marlène Cherruault	OSS	Suit Telemetry for Safety					TTFO	Briefing	dinner	HF	
OSO D-Mars Logistics		Security (D-Mars)					Housekeeping (D-Mars)		dinner		
Car 1			Sec Shift Change					-> OSS		Sec Shift Change	
Car 2							-> OSS				
Ranger 1											
Ranger 2											

Abbreviations:

AS prep = AEROSCAN prep
AS BD = AEROSCAN breakdown
Chrg = Charge Mercator
M-on = Turn Mercator ON
M-off = Turn Mercator OFF

MP prep = Micropotential preparation
MP strg = Micropotential storage
Exp. Prep./Rev. = Experiment Preparation & Review
PSY = Psychscale
TTFO = Transfer To Field Office

Note: Interteam 2 must happen simultaneously in the habitat, OSS, and MSC.

Field Impressions

31. 13Oct2021 Maintenance Day

Activities

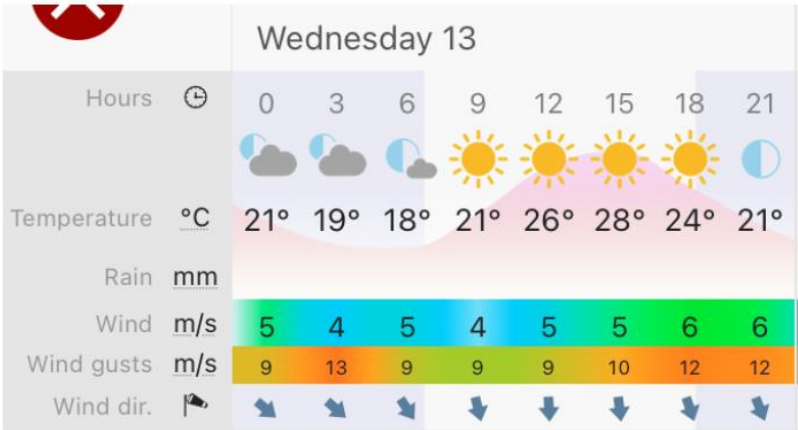
This mission day was a designated Maintenance day motivated by the high heat Stress Index of previous EVAs and the Aouda X ECG sensor failure. The situation was assessed to find solutions for these issues and the science program of the mission.

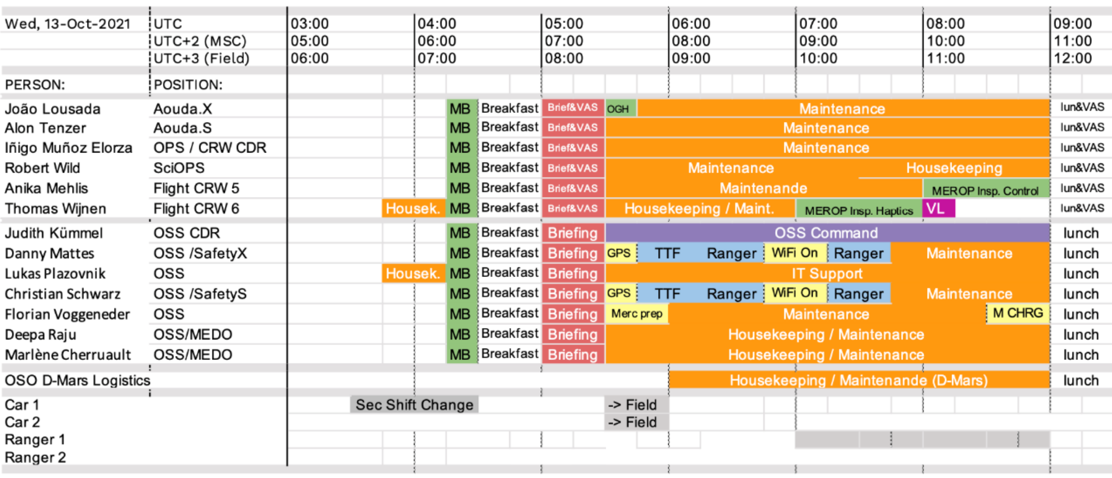
Experiments

MEROP	Inspection; exploration (complicated due to poor WIFI coverage)
OGH	Run completed

Weather

Sunset time (UTC+3)	18:12
Complete darkness (UTC+3)	19:32





Abbreviations:
Retina TS = Test Subject
Retina OP = Retina Operator
MB = microbiome
Merc.prep. = Mercator preparation
MSG 1 = MSG VAS **weekly** Questionnaire
GPS = GPS preparation & setup
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)
VL = Video Log

Field Activity Plan

Wed, 13-Oct-2021	UTC		10:00		11:00		12:00		13:00		14:00		15:00		16:00		17:00		18:00
	UTC+2 (MSC)		12:00		13:00		14:00		15:00		16:00		17:00		18:00		19:00		20:00
	UTC+3 (Field)		13:00		14:00		15:00		16:00		17:00		18:00		19:00		20:00		21:00
PERSON:	POSITION:																		
João Lousada	Aouda.X	Interteam 2		Maintenance			MSG 1	Exp. Prepare		Brief&VAS			dinner	Interteam 1		HF			
Alon Tenzer	Aouda.S	Interteam 2		Maintenance			MSG 1	Exp. Prepare		Brief&VAS			dinner	Interteam 1		HF			
Iñigo Muñoz Elorza	OPS / CRW CDR	Maintenance					MSG 1	Exp. Prepare		Brief&VAS			dinner	Interteam 1		HF			
Robert Wild	SciOPS	MEROP - Exploration Control					MSG 1	Exp. Prepare		Brief&VAS			dinner	Interteam 1		HF			
Anika Mehlis	Flight CRW 5	Maintenance					MSG 1	Exp. Prepare		Brief&VAS			dinner	Interteam 1		HF			
Thomas Wijnen	Flight CRW 6	Housekeeping					MSG 1	Exp. Prepare		Brief&VAS	Housekeeping		dinner	Interteam 1		HF			
Judith Kümmel	OSS CDR	OSS Command										Briefing	dinner	Interteam 1		HF			
Danny Mattes	OSS /SafetyX	OGH, Maintenance			Ranger	WiFi Off	Ranger	Maintenance				Briefing	dinner	Interteam 1		HF			
Lukas Plazovnik	OSS	IT support										Briefing	dinner	Interteam 1		HF			
Christian Schwarz	OSS /SafetyS	Maintenance			Ranger	WiFi Off	Ranger	Maintenance				Briefing	dinner	Interteam 1		HF			
Florian Voggeneder	OSS	Photos				Exoscot (w/quad)				Photos		Briefing	dinner	Interteam 1		HF			
Deepa Raju	OSS/MEDO	Interteam 2		Housekeeping / Maintenance								Briefing	dinner	Interteam 1		HF			
Marlène Cherruault	OSS/MEDO	Interteam 2		Housekeeping / Maintenance								Briefing	dinner	Interteam 1		HF			
OSO D-Mars Logistics		Housekeeping / Maintenance (D-Mars)											dinner						
Car 1			Sec Shift Change										-> OSS					Sec Shift Change	
Car 2													-> OSS						
Ranger 1																			
Ranger 2																			

Abbreviations:

AS prep = AEROSCAN prep
AS BD = AEROSCAN breakdown
Change BM = change batteries Mercator IF REQUIRED
M-on = Mercator ON
M-off = Mercator OFF

Note: **Interteam 2** must happen simultaneously in the habitat, OSS, and MSC.

Note: Interteam 1 does **not** need to happen simultaneously in the habitat, OSS, and MSC. Just each team has to cooperate. 6 Players **per team**.

32. 14Oct2021 EVA with TUMBLEWEED launch

Activities

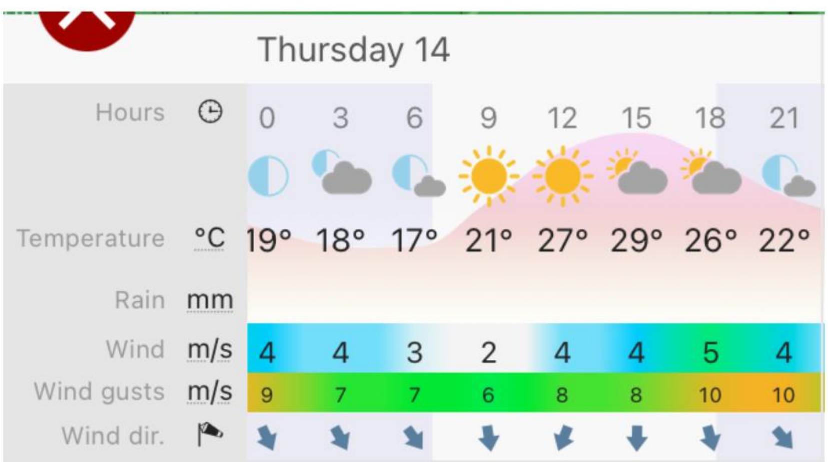
During a short EVA by Joao Lousada (Aouda.X) and Alon Tenzer (Aouda.S) between 09:39 and 11:13, the Heat Stress Index was mostly in the yellow range, and a continuous increase in temperature trending to the red zone (to stop EVA) was observed. Therefore, a provisional max. EVA duration of 1 hour was imposed.
In terms of scientific experiments, AMAZE ran into issues toward the end of its setup. TUMBLEWEED was conducted and its spherical rover released in flat terrain at a wind speed of 4.4 m/s. The bottom arc, and shortly after the LSEC4 snapped, dropping the battery pack in front of the structure. The resting system was initiated but the rover had to be stopped manually by a crew member.

Experiments

AMAZE	Problem at the end of setup, needs troubleshooting
OGH	Run completed
DEAR	Photos taken and sent
MEROP	2 inspections (control and Hynatpic)
ACT	Performed
TUMBLEWEED	Conducted; Rover suffered significant damage

Weather

Sunset time (UTC+3)	18:11
Complete darkness (UTC+3)	19:31



Field Activity Plan

Thu, 14-Oct-2021	UTC UTC+2 (MSC) UTC+3 (Field)	03:00 05:00 06:00	04:00 06:00 07:00	05:00 07:00 08:00	06:00 08:00 09:00	07:00 09:00 10:00	08:00 10:00 11:00	09:00 11:00 12:00
PERSON:	POSITION:							
João Lousada	Aouda.X	MB	Breakfast, Brief&VAS	Donning			AMAZE	Doffing
Alon Tenzer	Aouda.S	MB	Breakfast, Brief&VAS	Donning			AMAZE	Doffing
Anika Mehlis	OPS	MB	Breakfast, Brief&VAS	Suit Ops and Communication			Suit Ops & Communication	
Robert Wild	SciOPS & Insta TO	MB	Breakfast, Brief&VAS	Support Donning & Photo for DEAR			Suit Ops & Comm	Doff & DEAR
Iñigo Muñoz Elorza	CRW CDR	MB	Breakfast, Brief&VAS	MarsLock Preparation / Support Donning			Merop Insp. haptics	Supp. Doff.
Thomas Wijnen	Flight CRW 6	Housek., MB	Breakfast, Brief&VAS	Support Donning			Housekeeping	OGH
Judith Kümmel	OSS CDR	MB	Breakfast, Briefing	OSS Command				
Danny Mattes	OSS /SafetyX	MB	Breakfast, Briefing	GPS, TTF, Ranger	WiFi On, Ranger		Safety.X	
Lukas Plazovnik	OSS	Housek., MB	Breakfast, Briefing	IT				
Christian Schwarz	OSS /SafetyS	MB	Breakfast, Briefing	GPS, TTF, Ranger	WiFi On, Ranger		Safety.S	
Florian Voggeneder	OSS	MB	Breakfast, Briefing	TTF, Mercator charging & preparation / AMAZE GPS setup				OGH
Deepa Raju	OSS/MEDO	MB	Breakfast, Briefing	TTF, Suit Telemetry for Safety				
Marlène Cherruault	OSS/MEDO	MB	Breakfast, Briefing	TTF, Suit Telemetry for Safety				
Michael	Berghold	MB	Breakfast, Briefing				Housekeeping	
OSO D-Mars Logistics				Housekeeping (D-Mars)			Security (D-Mars)	
Car 1		Sec Shift Change		-> Field				
Car 2				-> Field				
Ranger 1								
Ranger 2								

Abbreviations:

GEOS Comp. 1 = GEOS Compare 1
Retina TS = Test Subject
Retina OP = Retina Operator
MB = microbiome
Insta TO = Instagram takeover

GPS = GPS preparation & setup
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)

Thu, 14-Oct-2021	UTC UTC+2 (MSC) UTC+3 (Field)		10:00 12:00 13:00	11:00 13:00 14:00	12:00 14:00 15:00	13:00 15:00 16:00	14:00 16:00 17:00	15:00 17:00 18:00	16:00 18:00 19:00	17:00 19:00 20:00
PERSON:	POSITION:									
João Lousada	Aouda.X	lun&VAS	H-D	Exp. revision		ACT, Merop Insp. haptics	Brief&VAS	dinner, HF		
Alon Tenzer	Aouda.S	lun&VAS		Exp. revision			ACT, Brief&VAS	dinner, HF		
Anika Mehlis	OPS	lun&VAS	TalkTops	Exp. revision			ACT, Brief&VAS	dinner, HF		
Robert Wild	SciOPS & Insta TO	lun&VAS		Exp. revision			ACT, Brief&VAS	dinner, HF		
Iñigo Muñoz Elorza	CRW CDR	lun&VAS	Housekeeping	Exp. revision	Housekeeping		ACT, Brief&VAS	dinner, HF		
Thomas Wijnen	Flight CRW 6	lun&VAS	Merop Insp. Control	Exp. revision			ACT, Brief&VAS	dinner, HF		
Judith Kümmel	OSS CDR	lunch	OSS Command				ACT		Briefing, dinner	HF
Danny Mattes	OSS /SafetyX	lunch	Tumbleweed				WiFi Off	Ranger, TTFO	Briefing, dinner	ACT, HF
Lukas Plazovnik	OSS	lunch	IT				ACT		Briefing, dinner	HF
Christian Schwarz	OSS /SafetyS	lunch		Exoscot (w/quad)		M.Charge	WiFi Off	Ranger, TTFO	Briefing, dinner	ACT, HF
Florian Voggeneder	OSS	lunch	Tumbleweed & Photos of Tumbleweed				ACT		Briefing, dinner	HF
Deepa Raju	OSS/MEDO	lunch		TTFO	Housekeeping / Maintenance		ACT		Briefing, dinner	HF
Marlène Cherruault	OSS/MEDO	lunch		TTFO	Housekeeping / Maintenance		ACT		Briefing, dinner	HF
Michael	Berghold	lunch					ACT		Briefing, dinner	HF
OSO D-Mars Logistics		lunch	Housekeeping	Exoscot (w/quad)		Housekeeping (D-Mars)			dinner	
Car 1			Sec Shift Change					-> OSS		Sec
Car 2								-> OSS		
Ranger 1										
Ranger 2										

Abbreviations:

Change BM = change batteries Mercator IF REQUIRED
M-on = Mercator ON
M-off = Mercator OFF
Merop Insp. = Merop Inspection
H-D: Humain Data download
M-Charge = Mercator charge

Field Impressions

33. 15Oct2021 EVA with AEROSCAN Test Flight

Activities

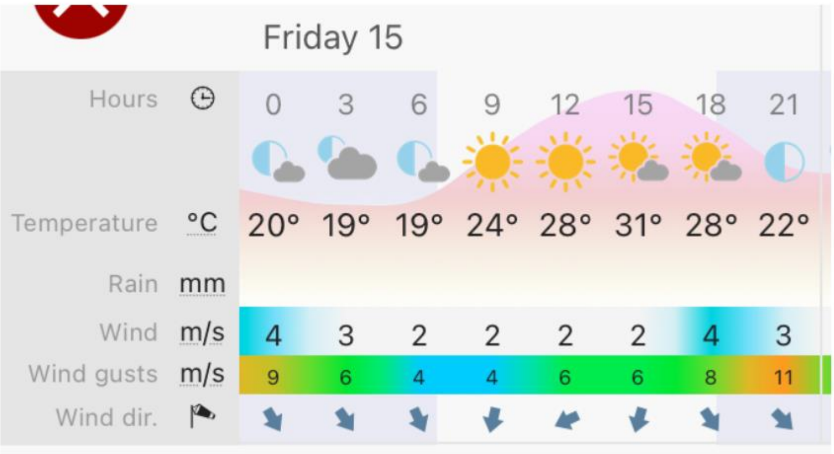
An EVA was conducted by Thomas Wijnen (Aouda.X) and Robert Wild (Aouda.S) from 9:19 to 10:41. A test flight with the AEROSCAN drone was conducted during the EVA. The drone experienced a loss of control and crashed.
Furthermore, the AA did BME exercises in order to help gain information on Heat Stress Indices. An initially approved extension of the EVA was revoked after a short period of time due to red zone crossing.

Experiments

AEROSCAN	Test flight conducted, drone crashed
ROBOAUTO	Troubleshooting regarding SIM cards
EXOSCOT	Run toward the northern area of interest.
VFR-eFAST	Performed successfully
DEAR	Performed
RETINA	Performed
OGH	Run completed
MEROP	Inspection performed

Weather

Sunset time (UTC+3)	18:10
Complete darkness (UTC+3)	19:30



Field Activity Plan

Fri, 15-Oct-2021 — Mission Day 12

Time							
UTC	02:00	03:00	04:00	05:00	06:00	07:00	08:00
UTC+2 (MSC)	04:00	05:00	06:00	07:00	08:00	09:00	10:00
UTC+3 (Field)	05:00	06:00	07:00	08:00	09:00	10:00	11:00

PERSON:	POSITION:	Activities (in time order)
Thomas Wijnen	Aouda.X	MB; Breakfast; Brief&VAS; Donning; Aeroscan&Exercise; Doffing; lun&VAS
Robert Wild	Aouda.S	MB; Breakfast; Brief&VAS; Donning; Aeroscan&Exercise; Doffing; lun&VAS
João Lousada	CRW CDR	MB; Breakfast; Brief&VAS; Support Donning & Photo for DEAR; Housekeeping; Doff & DEAR; lun&VAS
Alon Tenzer	OPS	MB; Breakfast; Brief&VAS; Support Donning & MarsLock; Housekeeping; Supp. Doff.; lun&VAS
Anika Mehlis	SciOps	MB; Breakfast; Brief&VAS; Support Donning; Suit Ops & Comm; OGH; lun&VAS
Iñigo Muñoz Elorza	Flight Crew	MB; Breakfast; Brief&VAS; Suit Ops and Communication; Suit Ops and; lun&VAS
Judith Kümmel	OSS / SciOPS	MB; Breakfast; Brief&VAS; OSS Command; lunch
Danny Mattes	OSS /SafetyX	Breakfast; Brief&VAS; GPS; TTF; Ranger; WiFi On; Ranger; Safety.X; OGH; lunch
Lukas Plazovnik	OSS CDR	Breakfast; Brief&VAS; IT / Handover Lukas → Michael; lunch
Marlène Cherruault	MEDO /SafetyS	Breakfast; Brief&VAS; GPS; TTF; Ranger; WiFi On; Ranger; Safety.S; lunch
Florian Voggeneder	OSS	MB; Breakfast; Brief&VAS; TTF; Mercator charging & preparation; Aeroscan Spotter; Marks; lunch
Deepa Raju	OSS/MEDO	MB; Breakfast; Brief&VAS; Polaris Console; Suit Telemetry; lunch
Claudia Kobald	OSS	Breakfast; Brief&VAS; ROBO Auto; Prepare; TTF; RO
Christian Schwarz	OSS	MB; Breakfast; Brief&VAS; Housekeeping; TTF
Michael Berghold	OSS	Breakfast; Brief&VAS; IT / Handover Lukas → Michael; lunch
OSO D-Mars Logistics		Housekeeping (D-Mars); Security (D-Mars); lun&VAS
Car 1		Sec Shift Change
Car 2		Permanently stationed at Mitzpe Ramon for BME use
Razor 1		
Razor 2		

Abbreviations:

Retina TS = Test Subject
Retina OP = Retina Operator
MB = microbiome

GPS = GPS preparation & setup
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)
Marks = set markers for Merop C (see procedures)

Fri, 15-Oct-2021 — Mission Day 12

Time							
UTC	09:00	10:00	11:00	12:00	13:00	14:00	15:00
UTC+2 (MSC)	11:00	12:00	13:00	14:00	15:00	16:00	17:00
UTC+3 (Field)	12:00	13:00	14:00	15:00	16:00	17:00	18:00

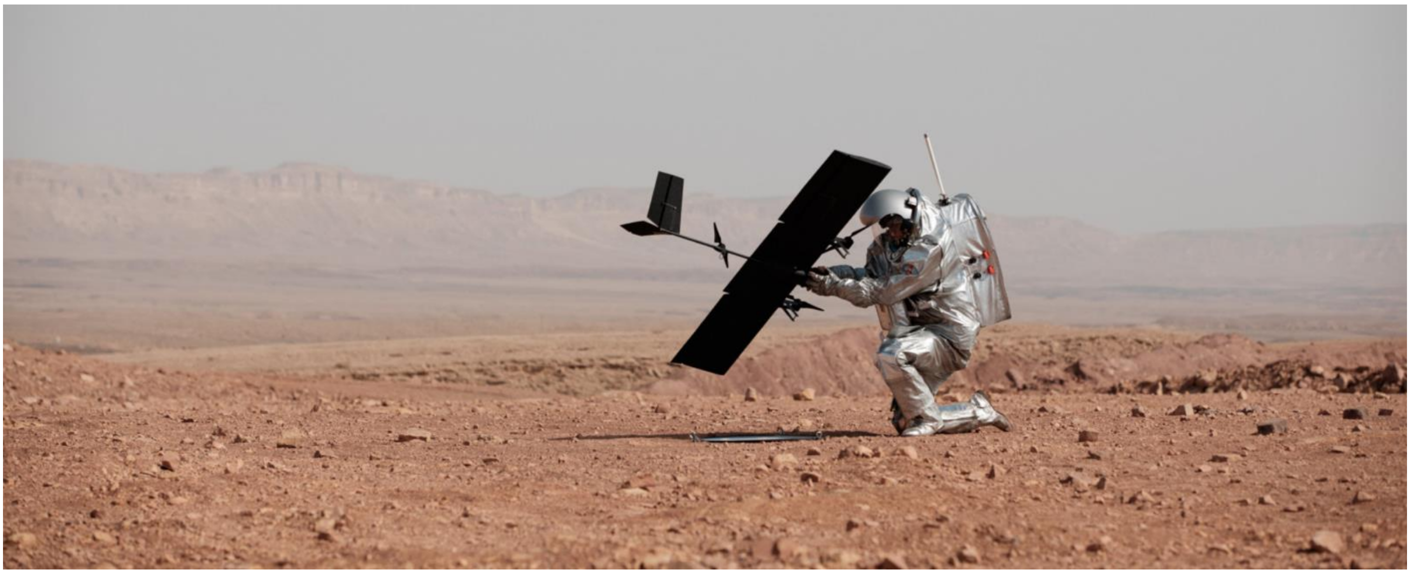
PERSON:	POSITION:	Activities (in time order)
Thomas Wijnen	Aouda.X	VFReFast (p); Exp. Review; Leisure; Ret. (p); Brief&VAS; dinner; HF
Robert Wild	Aouda.S	V; Exp.Review; Leisure; Exp.Review; Housekeeping; Brief&VAS; dinner; HF; Housek.
João Lousada	CRW CDR	Housekeeping; H-D; Exp. Review; Leisure; Retina (e); Brief&VAS; dinner; HF
Alon Tenzer	OPS	Housekeeping; Exp. Review; Leisure; Merop Insp. Control; Brief&VAS; dinner; HF
Anika Mehlis	SciOps	Merop Insp. Haptics; MDR; Leisure; Exp. Review; Brief&VAS; dinner; HF
Iñigo Muñoz Elorza	Flight Crew	VFReFast (e); VL; Exp. Review; Leisure; Ret. (p); Housekeeping; Brief&VAS; dinner; HF; Housek.
Judith Kümmel	OSS / SciOPS	OSS Command; Leisure; Briefing; dinner; HF
Danny Mattes	OSS /SafetyX	Leisure; Tumbleweed troubleshooting; OGHQ; WiFi Off; TTFO; Briefing; dinner; HF
Lukas Plazovnik	OSS CDR	IT / Handover Lukas → Michael; Leisure; Briefing; dinner; HF
Marlène Cherruault	MEDO /SafetyS	flexible - field to decide; WiFi Off; TTFO; Briefing; dinner; HF
Florian Voggeneder	OSS	Tumbleweed troubleshooting; Leisure; Briefing; dinner; HF
Deepa Raju	OSS/MEDO	TTF; Housekeeping; Leisure; Briefing; dinner; HF
Claudia Kobald	OSS	BO; lunch; Housekeeping; Leisure; Briefing; dinner; HF
Christian Schwarz	OSS	TTF; lunch; Exoscot (w/quad); M.Charge; ROVO; Leisure; Briefing; dinner; HF
Michael Berghold	OSS	IT / Handover Lukas → Michael; Leisure; Briefing; dinner; HF
OSO D-Mars Logistics		Housekeeping; Exoscot (w/quad); Housekeeping (D-Mars)
Car 1		Sec Shift Change
Car 2		
Razor 1		
Razor 2		

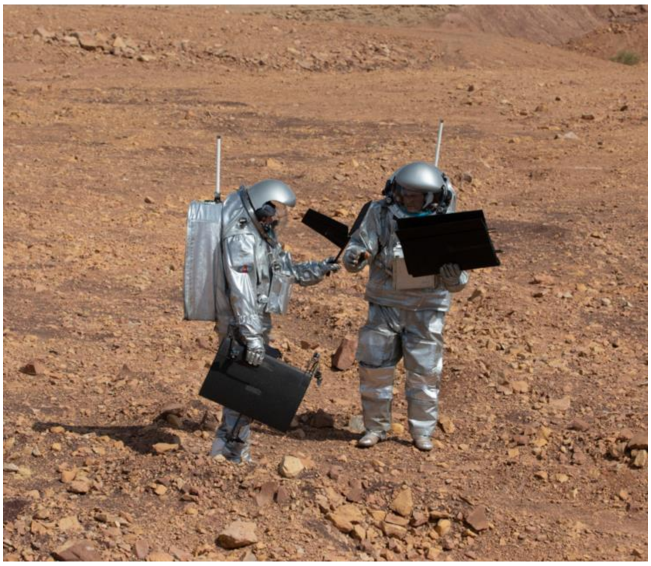
Abbreviations:

M-on = Mercator ON
M-off = Mercator OFF
Merop Insp. = Merop Inspection
H-D: Humain Data download

OGHQ = OGH Questionnaire
ROVO = Rovo Report
VL = Video Log
MDR = Video for MDR Wissen

Field Impressions





34. 16Oct2021 Black Day

Activities

Discussions regarding ECG alternative for Aouda.X. Hand over from FD Tlustos to FD Stumptner.

Experiments

no active experiment work (passive daily experiments running)

35. 17Oct2021 Unscheduled double EVA

Activities

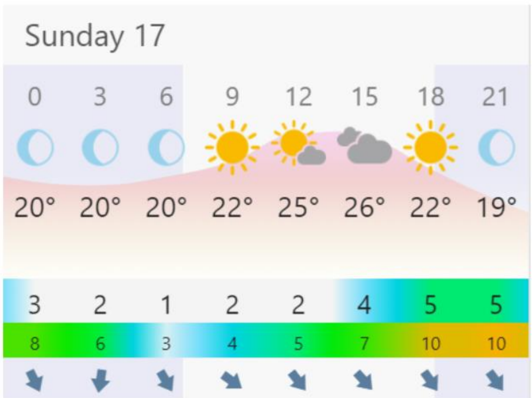
Anika Mehlis (Aouda.X) and Inigo Munoz Elorza (Aouda.S) conducted EVAs from 08:38 to 11:06. The double donning was a crew decision not coordinated with MSC. In the course of this action, ECG Sensor from A.S was transferred to A.X in an attempt to replace the malfunctioning sensor.
A suggestion to use both suits for longer range was discussed and rejected. A.X shall only be used close to the habitat for the remainder of the AMADEE20 mission.

Experiments

MICROPOTENTIAL	Done by Aouda.S
DEAR	Performed
OGH	Generator Diesel Refuel was done
ACT	Questionnaires filled out
INTERTEAM 1	Experiment conducted

Weather

Sunset time (UTC+2)	18:07
Complete darkness (UTC+2)	19:27



Field Activity Plan

Sun, 17-Oct-2021 Mission Day 14	UTC UTC+2 (MSC) UTC+3 (Field)	02:00 / 04:00 / 05:00 → 09:00 / 11:00 / 12:00
PERSON:	POSITION:	
Anika Mehlis	Aouda.X	MB · Breakfast · Brief&VAS · Housekeeping · MEROP Troublesh.
Iñigo Muñoz Elorza	Aouda.S	MB · Breakfast · Brief&VAS · Donning · Micropotential · Doffing
Robert Wild	OPS	MB · Breakfast · Brief&VAS · Suit Ops and Communication
Thomas Wijnen	SciOps	MB · Breakfast · Brief&VAS · Support Donning & Photo for DEAR · Suit Ops and Communication · Doff &DEAR
João Lousada	CRW CDR	MB · Breakfast · Brief&VAS · Support Donning & MarsLock · Housekeeping · Supp.Doff.
Alon Tenzer	Flight Crew	MB · Breakfast · Brief&VAS · AEROSCAN + AMAZE troubleshooting · Housekeeping
Judith Kümmel	OSS	MB · Breakfast · Briefing · OSS Command
Danny Mattes	OSS	GPS · Breakfast · Briefing · TTF · Mercator charging & preparation · MERCATOR spotter
Marlène Cherruault	MEDO	GPS · Breakfast · Briefing · TTF · Ranger2 · WiFi On · Ranger2 · TTFO
Florian Voggeneder	OSS	MB · Breakfast · Briefing · housekeeping · TTF
Deepa Raju	OSS /SafetyS	MB · Breakfast · Briefing · TTF · Suit Telemetry for Safety
Claudia Kobald	OSS	Breakfast · Briefing · TTF · Ranger2 · WiFi On · Ranger2 · Marks · Safety.S
Christian Schwarz	OSS	MB · Breakfast · Briefing · TTF · Ranger1 · WiFi Setup · Ranger1 · Clean Solar Panels
Michael Berghold	OSS	Breakfast · Briefing · TTF · Ranger1 · WiFi Setup · Ranger1 · IT Support
Dominik Jäger	OSS	Breakfast · Briefing · Familiarisation
Simone Paternostro	OSS	Breakfast · Briefing · Familiarisation
Mikhail Ryazanskiy	OSS	Breakfast · Briefing · Familiarisation
OSO D-Mars Logistics		Housekeeping (D-Mars) · Security (D-Mars)
Car 1 Car 2 Ranger 1 Ranger 2		Sec Shift Change

Abbreviations:

Retina TS = Test Subject
Retina OP = Retina Operator
MB = microbiome

GPS = GPS preparation & setup
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)
Marks = set markers for Merop C (see procedures)

Sun, 17-Oct-2021 Mission Day 14	UTC UTC+2 (MSC) UTC+3 (Field)	10:00 / 12:00 / 13:00 → 18:00 / 20:00 / 21:00
PERSON:	POSITION:	
Anika Mehlis	Aouda.X	lun&VAS · Exp. Review · ACT · Housekeeping · Brief&VAS · dinner · Interteam 1 · HF · Housek.
Iñigo Muñoz Elorza	Aouda.S	lun&VAS · VL · Exp. Review · ACT · Brief&VAS · dinner · Interteam 1 · HF
Robert Wild	OPS	lun&VAS · Housekeeping · Exp. Review · ACT · Brief&VAS · dinner · Interteam 1 · HF
Thomas Wijnen	SciOps	lun&VAS · Housekeeping · Exp. Review · ACT · Brief&VAS · dinner · Interteam 1 · HF
João Lousada	CRW CDR	lun&VAS · H-D · Exp. Review · ACT · Brief&VAS · dinner · Interteam 1 · HF
Alon Tenzer	Flight Crew	lun&VAS · OGH · Exp. Review · MEROP Insp.Control · ACT · Brief&VAS · dinner · Interteam 1 · HF · Housek.
Judith Kümmel	OSS	lunch · OSS Command · ROVO · ACT · Briefing · dinner · HF
Danny Mattes	OSS	lunch · Exoscot (w/quad) · MERCATOR spotter · TTFO · ACT · Briefing · dinner · HF
Marlène Cherruault	MEDO	lunch · Housekeeping · ACT · Briefing · dinner · HF
Florian Voggeneder	OSS	lunch · OGH · OGHR · TTFO · ACT · Briefing · dinner · HF
Deepa Raju	OSS /SafetyS	lunch · TTFO · ACT · Briefing · dinner · HF
Claudia Kobald	OSS	lunch · TTFO · ACT · Briefing · dinner · Interteam 1 · HF
Christian Schwarz	OSS	lunch · Exoscot (w/quad) · WiFi Off · TTFO · ACT · Briefing · dinner · Interteam 1 · HF
Michael Berghold	OSS	lunch · IT Support · WiFi Off · TTFO · ACT · Briefing · dinner · Interteam 1 · HF
Dominik Jäger	OSS	lunch · Familiarisation · ACT · Briefing · dinner · Interteam 1 · HF
Simone Paternostro	OSS	lunch · Familiarisation · ACT · Briefing · dinner · Interteam 1 · HF
Mikhail Ryazanskiy	OSS	lunch · Familiarisation · ACT · Briefing · dinner · Interteam 1 · HF
OSO D-Mars Logistics		lunch · Housekeeping (D-MARS)
Car 1 Car 2 Ranger 1 Ranger 2		Sec Shift Change · Sec Shift Change

Abbreviations:

M-on = Mercator ON
M-off = Mercator OFF
Merop Insp. = Merop Inspection
H-D = Humain Data download

OGHR = OGH Report
ROVO = Rovo Report
VL = Video Log

Field Impressions

36. 18Oct2021 Geological sampling

Activities

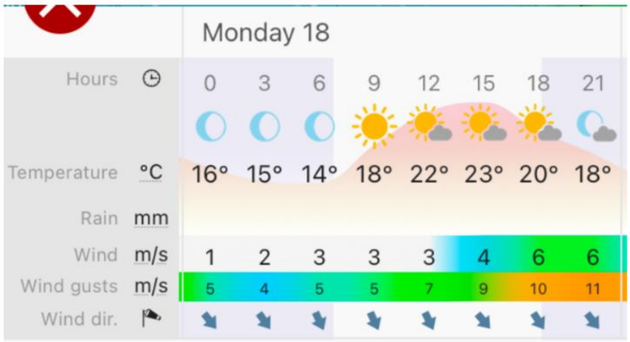
An EVA was performed by Thomas Wijnen (Aouda.X) and Alon Tenzer (Aouda.S) from 8:34 to 11:18. Today's main EVA activities were GEOS near the habitat (A.X) and MICROPOTENTIAL sampling (A.S). MICROPOTENTIAL samples were taken at several sites, and processing of samples was done in the Hab (procedure D). In the afternoon, TUMBLEWEED and EXOSCOT experiments were done by OSS.

Experiments

GEOS	Samples taken from various POIs
MICROPOTENTIAL	Sampling, processing of samples
INTERTEAM 2	Conducted by field and MSC teams
DEAR	
PSYCHSCALE	
VFR-e	

Weather

Sunset time (UTC+3)	18:07
Complete darkness (UTC+3)	19:27



Field Activity Plan

Mon, 18-Oct-2021 — Mission Day 15

UTC: 02:00 | 03:00 | 04:00 | 05:00 | 06:00 | 07:00 | 08:00 | 09:00
UTC+2 (MSC): 04:00 | 05:00 | 06:00 | 07:00 | 08:00 | 09:00 | 10:00 | 11:00
UTC+3 (Field): 05:00 | 06:00 | 07:00 | 08:00 | 09:00 | 10:00 | 11:00 | 12:00

PERSON:	POSITION:	Activities
Thomas Wijnen	Aouda.X	MB, Breakfast, Brief&VAS, Donning, GEOS, Doffing, lun&VAS
Alon Tenzer	Aouda.S	MB, Breakfast, Brief&VAS, Donning, TT, Micropotential, TT, Doffing, lun&VAS
Robert Wild	OPS	MB, Breakfast, Brief&VAS, Suit Ops and Communication, lun&VAS
João Lousada	SciOps/CRW CDR	Housek., MB, Breakfast, Brief&VAS, Support Donning & Photo for DEAR, Suit Ops and Communication, Doff. DEAR, lun&VAS
Iñigo Muñoz Elorza	Flight Crew	Housek., MB, Breakfast, Brief&VAS, MarsLock Preparation / Support Donning, Exp. Review, Leisure, Supp.Doff., lun&VAS
Anika Mehlis	Flight Crew	MB, Breakfast, Brief&VAS, Support Donning, housekeeping, Supp.Doff., lun&VAS
Judith Kümmel	OSS	MB, Breakfast, Briefing, OSS Command, lunch
Danny Mattes	OSS / SafetyX	GPS, Breakfast, Briefing, TTF, Leisure, Safety A.X, lunch
Marlène Cherruault	MEDO /SafetyS	GPS, Breakfast, Briefing, TTF, Ranger1, WiFi On, Ranger1, Leisure, Safety A.S, lunch
Florian Voggeneder	OSS	MB, Breakfast, Briefing, TTF, Clean Solar Panels, Leisure, Photos + ROVO, lunch
Deepa Raju	OSS/MEDO	MB, Breakfast, Briefing, TTF, Suit Telemetry for Safety, lunch
Claudia Kobald	OSS	Housek., Breakfast, Briefing, TTF, Ranger1, WiFi On, Ranger1, Leisure, lunch
Christian Schwarz	OSS	MB, Breakfast, Briefing, TTF, Mercator charging & preparation, Marks, lunch
Michael Berghold	OSS	Housek., Breakfast, Briefing, TTF, IT Support, lunch
Dominik Jäger	OSS	Breakfast, Briefing, Housekeeping, Polares Console, lunch
Simone Paternostro	OSS	Breakfast, Briefing, Polares Console, Leisure, lunch
Mikhail Ryazanskiy	OSS	Breakfast, Briefing, Leisure, Housekeeping, lunch
OSO D-Mars Logistics		Housekeeping (D-Mars), Security (D-Mars), lunch
Car 1		Sec Shift Change
Car 2		Permanently stationed at Mitzpe Ramon for BME use
Ranger 1		
Ranger 2		

Abbreviations:
MB = microbiome
GPS = GPS preparation & setup
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)
Marks = MEROP marks for inspection

Mon, 18-Oct-2021 — Mission Day 15

UTC: 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00
UTC+2 (MSC): 12:00 | 13:00 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00 | 19:00 | 20:00
UTC+3 (Field): 13:00 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00 | 19:00 | 20:00 | 21:00

PERSON:	POSITION:	Activities
Thomas Wijnen	Aouda.X	Marslock, PSY, VFR-e fast (p), Exp. Review, Housekeeping, Brief&VAS, dinner, Leisure, Interfam, HF
Alon Tenzer	Aouda.S	Marslock, PSY, VFR-e fast (e), Exp. Review, Housekeeping, Brief&VAS, dinner, Leisure, Interfam, HF
Robert Wild	OPS	Marslock, PSY, Aeroscan troublesh., Exp. Review, Brief&VAS, dinner, Housek., Leisure, Interfam, HF
João Lousada	SciOps/CRW CDR	Marslock, PSY, Interteam 2 Run 2, H-D, Exp. Review, Brief&VAS, dinner, Leisure, Interfam, HF
Iñigo Muñoz Elorza	Flight Crew	OGH, PSY, Interteam 2 Run 2, MEROP inspec., Brief&VAS, dinner, Housek., Leisure, Interfam, HF
Anika Mehlis	Flight Crew	Marslock, PSY, MP-D, Exp. Review, Brief&VAS, dinner, Leisure, Interfam, HF
Judith Kümmel	OSS	OSS Command, ROVO, Briefing, dinner, HF
Danny Mattes	OSS / SafetyX	OGH, Tumbleweed, TTFO, OQ, Briefing, dinner, HF
Marlène Cherruault	MEDO /SafetyS	Tumbleweed, TTFO, Briefing, dinner, HF
Florian Voggeneder	OSS	Exoscot, Mercator spotter, TTFO, Briefing, dinner, HF
Deepa Raju	OSS/MEDO	Leisure, Ranger1, WiFi Off, Ranger1, TTFO, Briefing, dinner, HF
Claudia Kobald	OSS	Exoscot, Ranger1, WiFi Off, Ranger1, TTFO, Briefing, dinner, HF
Christian Schwarz	OSS	Leisure, ROVO troubleshooting, TTFO, Briefing, dinner, HF
Michael Berghold	OSS	IT Support, TTFO, ROVO troubleshooting, Leisure, Briefing, dinner, HF
Dominik Jäger	OSS	Leisure, Briefing, dinner, HF
Simone Paternostro	OSS	Interteam 2 Run 2, Briefing, dinner, HF
Mikhail Ryazanskiy	OSS	Housekeeping, Interteam 2 Run 2, Housekeeping, Briefing, dinner, HF, Housekeeping
OSO D-Mars Logistics		Housekeeping (D-MARS), dinner
Car 1		Sec Shift Change, Sec Shift Change
Car 2		
Ranger 1		
Ranger 2		

Abbreviations:
H-D: Humain Data download
ROVO = ROVO report
PSY = Psychscale
OQ = OGH Questionnaire
MP-D = Micropotential D

37. 19Oct2021 GEOS and SHARE

Activities

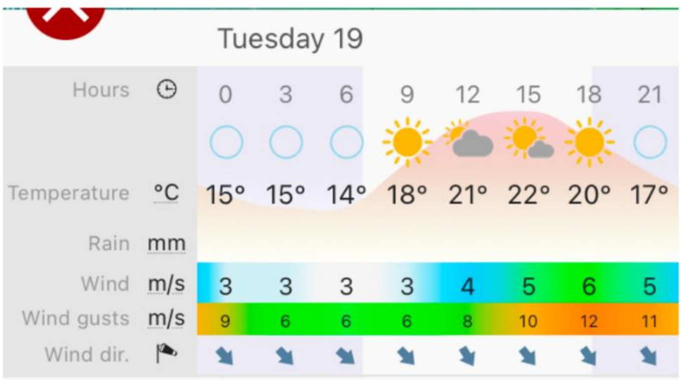
Joao Lousada (Aouda.X) and Anika Mehlis (Aouda.S) conducted EVAs from 9:40 to 12:39. The duration was 2:59, but AAs had to return to the base twice to regain comm. EVA activities concentrated on GEOS experiment near the habitat with A.X and SHARE experiment with ROVO for A.S. OSS did Tumbleweed testing in the afternoon. EXOSCOT completed its runs.

Experiments

GEOS	Samples taken from various POIs
SHARE	Performed navigation experiment
TUMBLEWEED	Tests performed
EXOSCOT	Runs completed
DEAR	Conducted
AMAZE	Issues with the GPS antenna
ACT	Survey filled out

Sunset time (UTC+3)	18:06
Complete darkness (UTC+3)	19:26

Weather



Field Activity Plan

Tue, 19-Oct-2021 Mission Day 16	UTC / UTC+2 (MSC) / UTC+3 (Field)	02:00 / 04:00 / 05:00	03:00 / 05:00 / 06:00	04:00 / 06:00 / 07:00	05:00 / 07:00 / 08:00	06:00 / 08:00 / 09:00	07:00 / 09:00 / 10:00	08:00 / 10:00 / 11:00	09:00 / 11:00 / 12:00
PERSON:	POSITION:								
João Lousada	Aouda.X	MB	Breakfast, Brief&VAS	Donning			GEOS (w/ quad for resting)		Doffing, lun&VAS
Anika Mehlis	Aouda.S	MB	Breakfast, Brief&VAS	Donning			TT, SHARE (w/ ROVO for resting)	TT	Doffing, lun&VAS
Alon Tenzer	OPS	Housek., MB	Breakfast, Brief&VAS	Suit Ops and Communication					lun&VAS
Iñigo Muñoz Elorza	SciOps	MB	Breakfast, Brief&VAS	Support Donning & Photo for DEAR			Suit Ops and Communication		Doff. DEAR, lun&VAS
Robert Wild	Flight Crew	Housek., MB	Breakfast, Brief&VAS	MarsLock Preparation / Support Donning			Leisure	Housekeeping	Supp.Doff., lun&VAS
Thomas Wijnen	Flight Crew	MB	Breakfast, Brief&VAS	Support Donning			GEOS Finish Samples		OGH, lun&VAS
Judith Kümmel	OSS	MB	Breakfast, Briefing	OSS Command					lunch
Danny Mattes	OSS / SafetyX	GPS	Breakfast, Briefing	Polaris Console- please remember to take breaks!					lunch
Marlène Cherruault	MEDO /SafetyS	GPS	Breakfast, Briefing	TTF, Ranger1	WiFi On, Ranger1	Leisure	Safety A.X		lunch
Florian Voggeneder	OSS	MB	Breakfast, Briefing	TTF, Mercator charging & preparation + ROVO				Marks	OGH, lunch
Deepa Raju	OSS/MEDO	MB	Breakfast, Briefing	Suit Telemetry for Safety - please remember to take breaks!					lunch
Christian Schwarz	OSS	MB	Breakfast, Briefing	TTF, Ranger1	WiFi On, Ranger1	Leisure	Safety A.S		lunch
Michael Berghold	OSS		Breakfast, Briefing	IT Support		Leisure	IT Support		lunch
Dominik Jäger	OSS		Breakfast, Briefing					Housekeeping	lunch
Simone Paternostro	OSS		Breakfast, Briefing	TTF, Ranger1	WiFi On, Ranger1	Leisure	Safety A.S		lunch
Mikhail Ryazanskiy	OSS		Breakfast, Briefing					Housekeeping	lunch
OSO D-Mars Logistics						Housek. (D-Mars)	Security (D-Mars)		lunch
Car 1			Sec Shift Change						
Car 2									
Ranger 1									
Ranger 2									

Abbreviations:
MB = microbiome
GPS = GPS preparation & setup
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)
Marks = MEROP marks for inspection

Tue, 19-Oct-2021 Mission Day 16	UTC / UTC+2 (MSC) / UTC+3 (Field)	10:00 / 12:00 / 13:00	11:00 / 13:00 / 14:00	12:00 / 14:00 / 15:00	13:00 / 15:00 / 16:00	14:00 / 16:00 / 17:00	15:00 / 17:00 / 18:00	16:00 / 18:00 / 19:00
PERSON:	POSITION:							
João Lousada	Aouda.X	GEOS Finish Samples		Exp. Review	H-D	ACT, Brief&VAS, dinner	HF, TS	
Anika Mehlis	Aouda.S	VL, Leisure		Exp. Review		ACT, Brief&VAS, dinner	HF, TS	
Alon Tenzer	OPS	Housek., Leisure		Exp. Review	Housek.	ACT, Brief&VAS, dinner	Housek., HF	
Iñigo Muñoz Elorza	SciOps	Housek., Leisure		Exp. Review		ACT, Brief&VAS, dinner	HF	
Robert Wild	Flight Crew	AMAZE Indoor Test		Exp. Review	Housek.	ACT, Brief&VAS, dinner	Housek., HF	
Thomas Wijnen	Flight Crew	GenTes, Leisure		Exp. Review		ACT, Brief&VAS, dinner	HF, Retina Operator	
Judith Kümmel	OSS	OSS Command				ROVO, ACT	Briefing, dinner	HF
Danny Mattes	OSS / SafetyX	Tumbleweed Test			TTFO	ACT	Briefing, dinner	HF
Marlène Cherruault	MEDO /SafetyS	Tumbleweed Test			TTFO	ACT	Briefing, dinner	HF
Florian Voggeneder	OSS	Exocsot (w/quad)				TTFO, ACT	Briefing, dinner	OQ, HF
Deepa Raju	OSS/MEDO	Polaris Console - please remember to take breaks!				ACT	Briefing, dinner	HF
Christian Schwarz	OSS	Exocsot (w/quad)				TTFO, ACT	Briefing, dinner	HF
Michael Berghold	OSS	IT Support			Exocsot Data Tr.	ACT	Briefing, dinner	HF
Dominik Jäger	OSS				Housekeeping	ACT	Briefing, dinner	HF
Simone Paternostro	OSS	GenTes				ACT	Briefing, dinner	HF
Mikhail Ryazanskiy	OSS				Housekeeping	ACT	Briefing, dinner	HF
OSO D-Mars Logistics		Housekeeping (D-Mars)					dinner	
Car 1			Sec Shift Change					
Car 2		Permanently stationed at Mitzpe Ramon for BME use						
Ranger 1								
Ranger 2								

Abbreviations:
H-D: Humain Data download
ROVO = ROVO report
GenTest = Generator Test
OQ = OGH Questionnaire
MP-D = Micropotential D
VL = VideoLog
Retina TS = Retina Test Subject
Exocsot Data Tr. = Exocsot Data Transfer

Field Impressions

38. 20Oct2021 Maintenance day

Activities

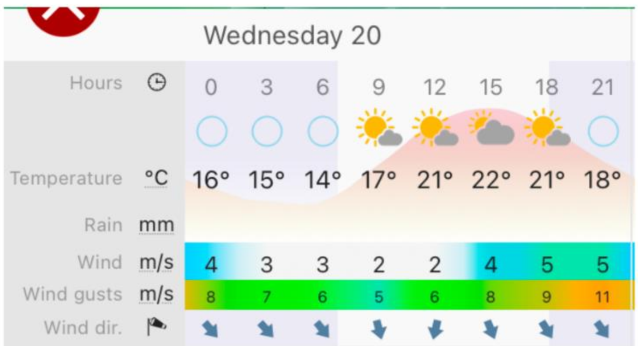
No EVA were conducted. The day was dedicated to maintenance.
An attempt to repair the AEROSCAN drone was made. OSS were able to run two traverses with TUMBLEWEED, where some of its arcs cracked on the second run.

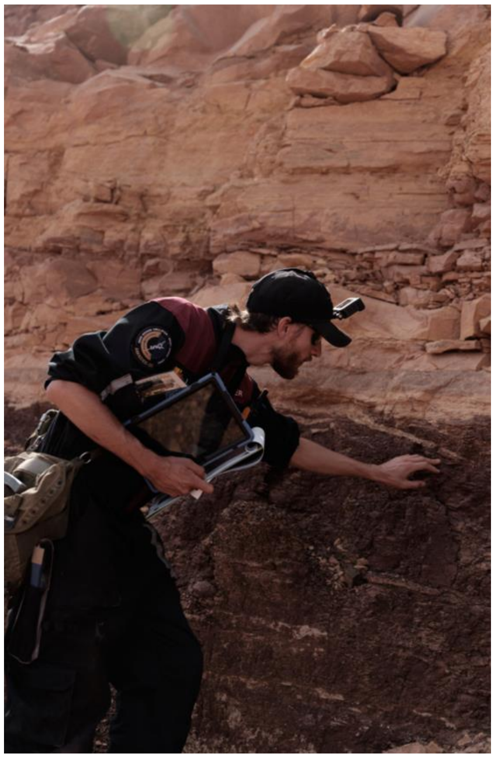
Experiments

INTERTEAM 1	Run 3 completed
VFR-eFAST	Completed
TUMBLEWEED	2 traverses
EXOSCOT	completed the Southern Area of Interest run driving Mercator manually from a Ranger.

Sunset time (UTC+3)	18:05
Complete darkness (UTC+3)	19:25

Weather





Field Activity Plan

Wed, 20-Oct-2021	UTC	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00
Mission Day 17	UTC+2 (MSC)	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00
	UTC+3 (Field)	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
PERSON:	POSITION:								GENERATOR
Thomas Wijnen	Flight Crew	MB & Breakfast at your convenience	Brief&VAS	Leisure	OGH	Interteam1 Run 3	GEOS Micrometeorite	W-VAS	lun&VAS
Iñigo Muñoz Elorza	Flight Crew	MB & Breakfast at your convenience	Brief&VAS	Leisure	W-VAS	Interteam1 Run 3	Maintenance	lun&VAS	
João Lousada	Flight Crew	MB & Breakfast at your convenience	Brief&VAS	Leisure	W-VAS	Interteam1 Run 3	Housek. / Maintenance	lun&VAS	
Robert Wild	Flight Crew	MB & Breakfast at your convenience	Brief&VAS	Leisure	W-VAS	Interteam1 Run 3	Maintenance	lun&VAS	
Anika Mehlis	Flight Crew	MB & Breakfast at your convenience	Brief&VAS	Leisure	W-VAS	Interteam1 Run 3	Housek. / Maintenance	lun&VAS	
Alon Tenzer	Flight Crew	MB & Breakfast at your convenience	Brief&VAS	Leisure	W-VAS	Interteam1 Run 3	Maintenance	lun&VAS	
Judith Kümmel	OSS CDR	MB & Breakfast at your convenience	Briefing	OSS Command - please remember to take breaks!	lunch				
Danny Mattes	OSS / Safety	Breakfast at your convenience	Briefing	TTF	OGH	Safety - ROVO Spotter	lunch		
Marlène Cherruault	OSS/MEDO	Breakfast at your convenience	Briefing	Leisure	lunch				
Florian Voggeneder	OSS	MB & Breakfast at your convenience	Briefing	Maintenance / Training / etc. - at OSS discretion	lunch				
Deepa Raju	OSS/MEDO	MB & Breakfast at your convenience	Briefing	Polaris Console - please remember to take breaks!	lunch				
Christian Schwarz	OSS	MB & Breakfast at your convenience	Briefing	Leisure	lunch				
Michael Berghold	OSS	Breakfast at your convenience	Briefing	IT Support + Housekeeping	lunch				
Dominik Jäger	OSS	Breakfast at your convenience	Briefing	GEOS (w/ Ranger 1)	lunch				
Simone Paternostro	OSS	Breakfast at your convenience	Briefing	TTF	Mercator charging & preparation + ROVO	lunch			
Mikhail Ryazanskiy	OSS	Breakfast at your convenience	Briefing	GEOS (w/ Ranger 1)	OGH	lunch			
OSO D-Mars Logistics		Housekeeping (D-Mars)	lunch						
Car 1		Sec Shift Change							
Car 2		Permanently stationed at Mitzpe Ramon for BME use							
Ranger 1									
Ranger 2									

Abbreviations: MB = microbiome
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)
W-VAS = MSG weekly VAS Questionnaire

Wed, 20-Oct-2021	UTC	10:00	11:00	12:00	13:00	14:00	15:00	16:00	
Mission Day 17	UTC+2 (MSC)	12:00	13:00	14:00	15:00	16:00	17:00	18:00	
	UTC+3 (Field)	13:00	14:00	15:00	16:00	17:00	18:00	19:00	
PERSON:	POSITION:	MAINTENANCE							
Thomas Wijnen	Flight Crew	Leisure	Maintenance	VFR-EFAST (p)	Exp. Review	Brief&VAS	dinner	HF	
Iñigo Muñoz Elorza	Flight Crew	Leisure	Maintenance	Housekeeping	Exp. Review	Brief&VAS	dinner	HF	
João Lousada	Flight Crew	Leisure	AMAZE Troubleshooting	VFR-EFAST (e)	Exp. Review	Brief&VAS	dinner	HF	
Robert Wild	Flight Crew	Leisure	AMAZE Troubleshooting	Housekeeping	Exp. Review	Brief&VAS	dinner	HF	
Anika Mehlis	Flight Crew	Leisure	Housek.	Aeroscan Troubleshooting	Exp. Review	Brief&VAS	dinner	HF	
Alon Tenzer	Flight Crew	Leisure	Housek.	Aeroscan Troubleshooting	Exp. Review	Brief&VAS	dinner	HF	
Judith Kümmel	OSS CDR	OSS Command - please remember to take breaks!	ROVO	Briefing	dinner	Interteam1 Run 3	HF		
Danny Mattes	OSS / Safety	Leisure	Tumbleweed Test	TTFO	OQ	Briefing	dinner	Interteam1 Run 3	HF
Marlène Cherruault	OSS/MEDO	Leisure	Tumbleweed Test	TTFO	Briefing	dinner	Interteam1 Run 3	HF	
Florian Voggeneder	OSS	Exoscot (w/quad)	Leisure	Briefing	dinner	Interteam1 Run 3	HF		
Deepa Raju	OSS/MEDO	Polaris Console - please remember to take breaks!	Leisure	Briefing	dinner	Interteam1 Run 3	HF		
Christian Schwarz	OSS	Exoscot (w/quad)	Leisure	Briefing	dinner	Interteam1 Run 3	HF		
Michael Berghold	OSS	IT Support + Housekeeping	Briefing	dinner	Interteam1 Run 3	HF			
Dominik Jäger	OSS	GEOS (w/ Ranger 1)	Briefing	dinner	Interteam1 Run 3	HF			
Simone Paternostro	OSS	Leisure	Tumbleweed Test	TTFO	Briefing	dinner	Interteam1 Run 3	HF	
Mikhail Ryazanskiy	OSS	GEOS (w/ Ranger 1)	Briefing	dinner	Interteam1 Run 3	HF			
OSO D-Mars Logistics		Housekeeping (D-Mars)	dinner						
Car 1		Sec Shift Change							
Car 2									
Ranger 1									
Ranger 2									

Abbreviations: H-D: Humain Data download
ROVO = ROVO report
OQ = OGH Questionnaire
Retina TS = Retina Test Subject
Exoscot Data Tr. = Exoscot Data Transfer

39. 21Oct2011 Single suit EVA

Activities

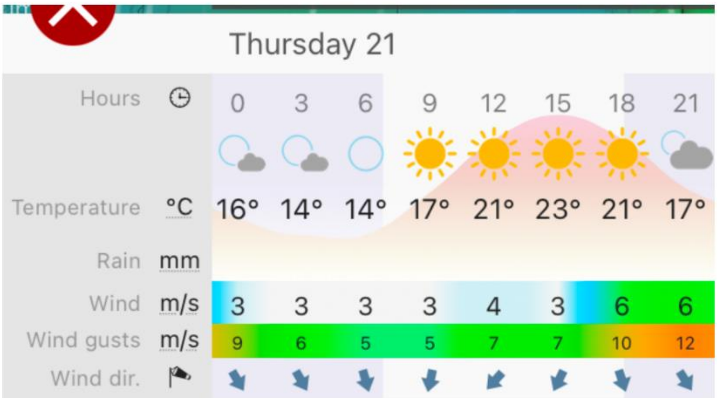
An EVA was conducted by Thomas Wijnen with Aouda.S from 8:13 to 9:21. Aouda.X was not used. The main EVA task for the day was the MICROPOTENTIAL experiment. Troubleshooting of the AMAZE drone was done by the AAs. OSS had Tumbleweed and GEOS unsuited experiments in the afternoon.

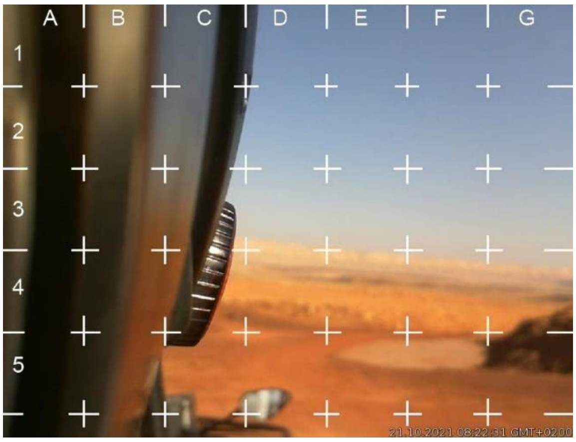
Experiments

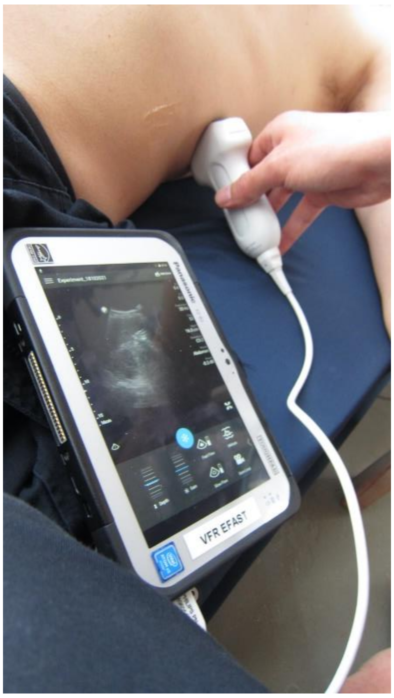
MICROPOTENTIAL	Samples taken
DEAR	Done
VFR-eFAST	Experiment conducted
TUMBLEWEED	NOGO due to high windspeeds
ACT	Done
OGH	Values reported

Sunset time (UTC+3)	18:04
Complete darkness (UTC+3)	19:24

Weather







Field Activity Plan

Thu, 21-Oct-2021 Mission Day 18	UTC / UTC+2 (MSC) / UTC+3 (Field)	02:00 / 04:00 / 05:00	03:00 / 05:00 / 06:00	04:00 / 06:00 / 07:00	05:00 / 07:00 / 08:00	06:00 / 08:00 / 09:00	07:00 / 09:00 / 10:00	08:00 / 10:00 / 11:00	09:00 / 11:00 / 12:00
PERSON:	POSITION:								
Iñigo Muñoz Elorza	Aouda.X	MB-full	Breakfast; Brief&VAS	AMAZE Troubleshooting			Housekeeping		OGH; lun&VAS
Thomas Wijnen	Aouda.S	MB-full	Breakfast; Brief&VAS	Donning			MicroPotential (w/quad for resting)		Doffing; SCl
Alon Tenzer	SciOps	MB-full	Breakfast; Brief&VAS	Suit Ops and Communication					
Anika Mehlis	OPS	MB-full	Breakfast; Brief&VAS	Support Donning & Photo for DEAR			Suit Ops & Communication		Supp.Doff.
João Lousada	CREW CDR	Housek.; MB-full	Breakfast; Brief&VAS	MarsLock Preparation / Support Donning				MEROP troubleshoot	Doff. DEAR
Robert Wild	Flight Crew	Housek.; MB-full	Breakfast; Brief&VAS	AMAZE Troubleshooting	VL			Housek.	Leisure; lun&VAS
Judith Kümmel	OSS	MB-full	Breakfast; Briefing	TTF; Ranger1	WiFi On; Ranger1	Leisure	Safety A.S		lunch
Deepa Raju	OSS / SafetyS	GPS	Breakfast; Briefing	TTF; Ranger1	WiFi On; Ranger1	Leisure	Safety A.S		lunch
Marlène Cherruault	MEDO / SafetyS		Breakfast; Briefing	MEDO					lunch
Florian Voggeneder	OSS CDR	MB-full	Breakfast; Briefing	OSS Command					lunch
Danny Mattes	OSS	MB-full	Breakfast; Briefing	GEOS					lunch
Christian Schwarz	OSS	MB-full	Breakfast; Briefing	TTF; Leisure					lunch
Michael Berghold	OSS	GPS	Breakfast; Briefing	TTF; Mercator charging & preparation				Marks	Leisure; lunch
Dominik Jäger	OSS		Breakfast; Briefing	GEOS					OGH; lunch
Simone Paternostro	OSS		Breakfast; Briefing	Polares Console & Housekeeping - please remember to take breaks!					lunch
Mikhail Ryazanskiy	OSS		Breakfast; Briefing	TTF; Mercator charging & preparation				Marks	Leisure; lunch
OSO D-Mars Logistics				Housekeeping (D-Mars)			Security (D-Mars)		lunch
Car 1			Sec Shift Change						
Car 2			Permanently stationed at Mitzpe Ramon for BME use						
Ranger 1									
Ranger 2									

Abbreviations:
MB-full = microbiome full sampling
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)
SCl. = Suit cleaning
VL = VideoLog

Thu, 21-Oct-2021 Mission Day 18	UTC / UTC+2 (MSC) / UTC+3 (Field)	10:00 / 12:00 / 13:00	11:00 / 13:00 / 14:00	12:00 / 14:00 / 15:00	13:00 / 15:00 / 16:00	14:00 / 16:00 / 17:00	15:00 / 17:00 / 18:00	16:00 / 18:00 / 19:00
PERSON:	POSITION:							
Iñigo Muñoz Elorza	Aouda.X	Leisure; Housek.	Aeroscan Troubleshooting		Exp. Review	ACT; Brief&VAS	dinner; HF	
Thomas Wijnen	Aouda.S	lun&VAS; Leisure	VFR-eFAST (p)		Exp. Review	ACT; Brief&VAS	dinner; HF	Housek.
Alon Tenzer	SciOps	lun&VAS; Leisure	Aeroscan Troubleshooting		Exp. Review	ACT; Brief&VAS	dinner; HF	Housek.
Anika Mehlis	OPS	lun&VAS; Leisure	MEROP Insp.Ctrl.		Exp. Review	ACT; Brief&VAS	dinner; HF	
João Lousada	CREW CDR	lun&VAS; Leisure		MEROP Insp.Ctrl.	Exp. Review	ACT; Brief&VAS	dinner; HF	
Robert Wild	Flight Crew	MEROP Insp.Hapt.	Housekeeping	VFR-eFAST (e)	Exp. Review	ACT; Brief&VAS	dinner; HF	
Judith Kümmel	OSS	Leisure				ACT; Briefing	dinner; HF	
Deepa Raju	OSS / SafetyS	Leisure; GEOS				ACT; Briefing	dinner; HF	
Marlène Cherruault	MEDO / SafetyS	Leisure; Tumbleweed				ACT; Briefing	dinner; HF	
Florian Voggeneder	OSS CDR	OSS Command			ROVO	ACT; Briefing	dinner; HF	
Danny Mattes	OSS	Leisure; Tumbleweed				ACT; Briefing	dinner; HF	
Christian Schwarz	OSS	Mercator Spotter			OQ	ACT; Briefing	dinner; HF	
Michael Berghold	OSS	IT Support				ACT; Briefing	dinner; HF	
Dominik Jäger	OSS	Leisure; GEOS				ACT; Briefing	dinner; HF	
Simone Paternostro	OSS	Polares Console & Housekeeping - please remember to take breaks!				ACT; Briefing	dinner; HF	
Mikhail Ryazanskiy	OSS	General Support, Training etc.				ACT; Briefing	dinner; HF	
OSO D-Mars Logistics		Housekeeping (D-MARS)					dinner	
Car 1			Sec Shift Change					
Car 2								
Ranger 1					TTFO			
Ranger 2								

Abbreviations:
H-D: Humain Data download
ROVO = ROVO report
OQ = OGH Questionnaire
SCl. = Suit cleaning

40. 22Oct2021 Single suit EVA

Activities

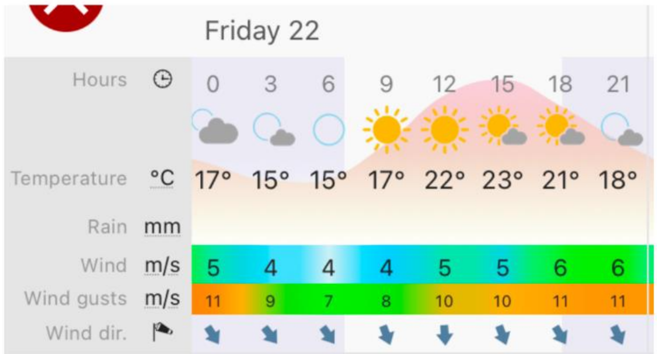
Robert Wild conducted an EVA in Aouda.S from 08:02 to 11:14 (duration: 3h14min). The main EVA task of the day was the SHARE 3 experiment.
The AAs did AMAZE drone troubleshooting together with the PIs in the habitat.

Experiments

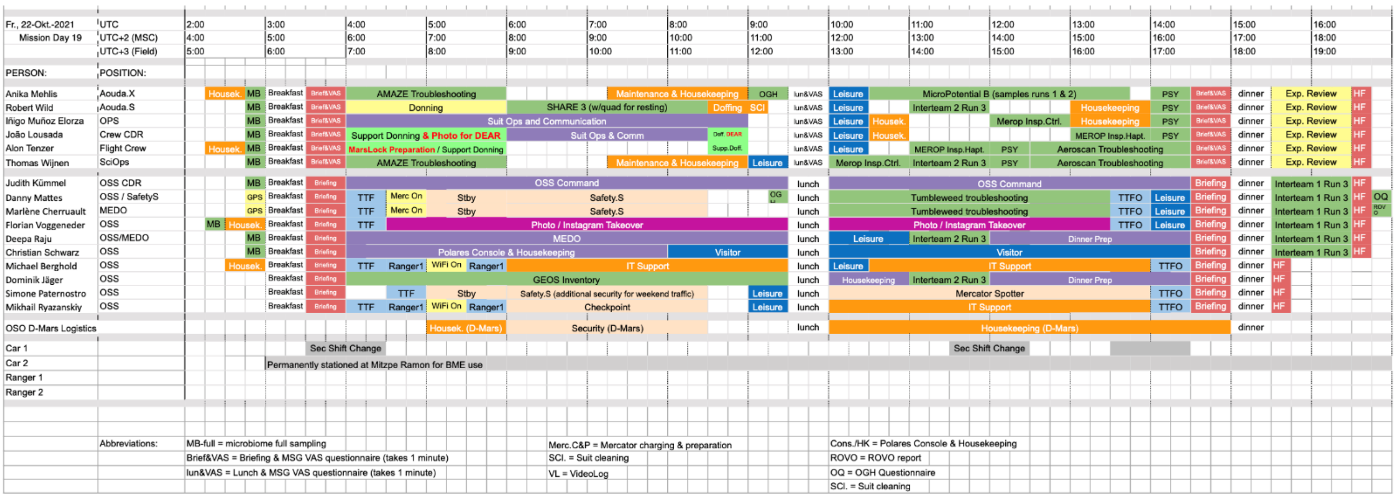
SHARE 3	Experiment conducted, only a subset of the instructions could be achieved.
DEAR	Done
INTERTEAM 2	INTERTEAM 2 completed
OGH	Report and images taken
TUMBLEWEED	NOGO due to strong winds

Sunset time (UTC+3)	18:03
Complete darkness (UTC+3)	19:23

Weather



Field Activity Plan



Field Impressions

23Oct2021 Black Day, rest day for field crew and MSC, no active experiment work (passive experiments were continuing)

41. 24Oct2021 Hard work: 14 experiments in a single day

Activities

Both AAs worked tried to make the AMAZE drone fly at the beginning of their EVA. Following the PI's troubleshooting instructions on the copter took longer than expected. While Inigo Munoz Elorza in AOUDA.X continued to work on the drone, Alon Tenzer switched to another run of MICROPOTENTIAL. Meanwhile the OSS crew was able to let TUMBLEWEED roll for two more runs into the desert. One of the runs caused damage on different arcs of the rover and it required an abort. Thomas was able to do another test of the VFR-eFAST ultrasonic equipment. The MEROP control unit was well staffed this day: 3 runs by 3 different people were conducted successfully. Dominik Jäger and Christian Schwarz (OSS) performed a GEOS compare run to collect different rock samples for further analysis. The end of the flight crew's day was the 4th INTERTEAM exp1 run followed by a well-deserved dinner.

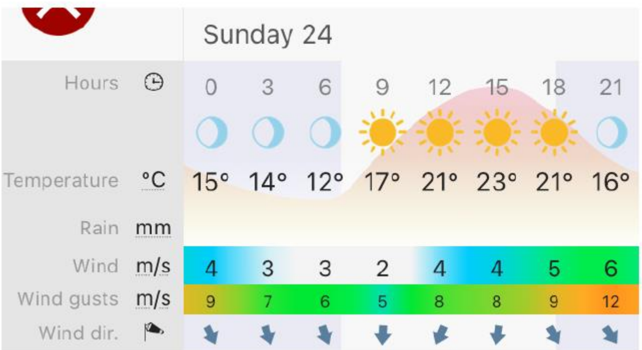
EVA time: 2h31min for AOUDA.S and AOUDA.X
11:23-13:54 CEST / 2h31min

Experiments

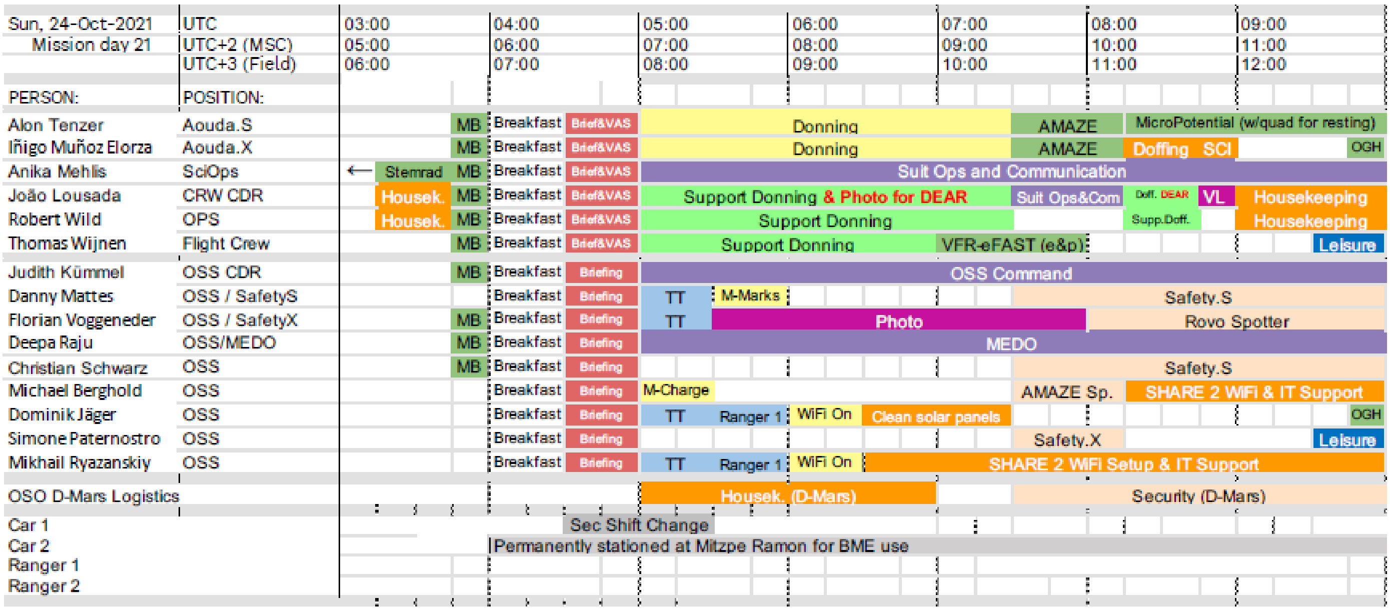
AMAZE	troubleshooting
MICRO-POTENTIAL	MP1 / MP2 / MP4 sampled
STEMRAD	worn over night
VFR-eFAST	run performed
MEROP	1 inspection run
MARSLOCK	AA questionnaires filled
ACT	questionnaires filled
TUMBLEWEED	2 runs performed
GEOS	compare sampling performed
INTERTEAM	exp1 run4 conducted
STEMRAD	questionnaires filled

Weather

Sunset time (UTC+3)	18:02
Complete darkness (UTC+3)	19:22

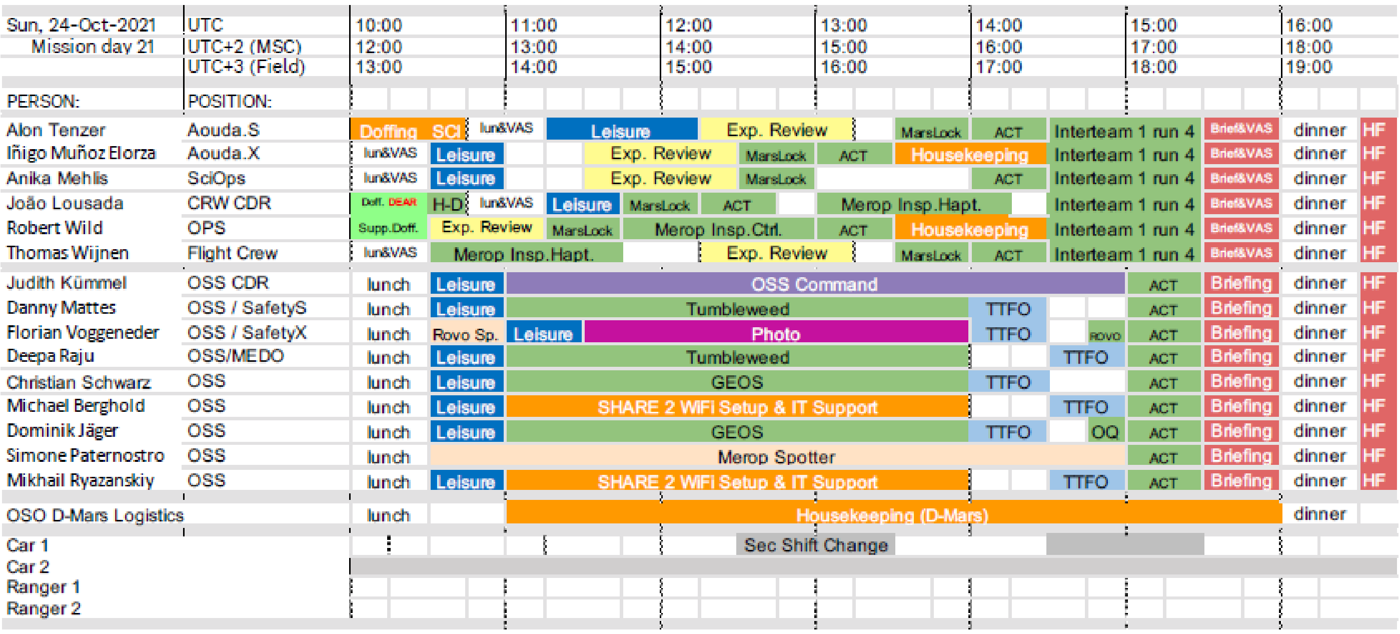


Field Activity Plan



Abbreviations: MB = Microbiome
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)

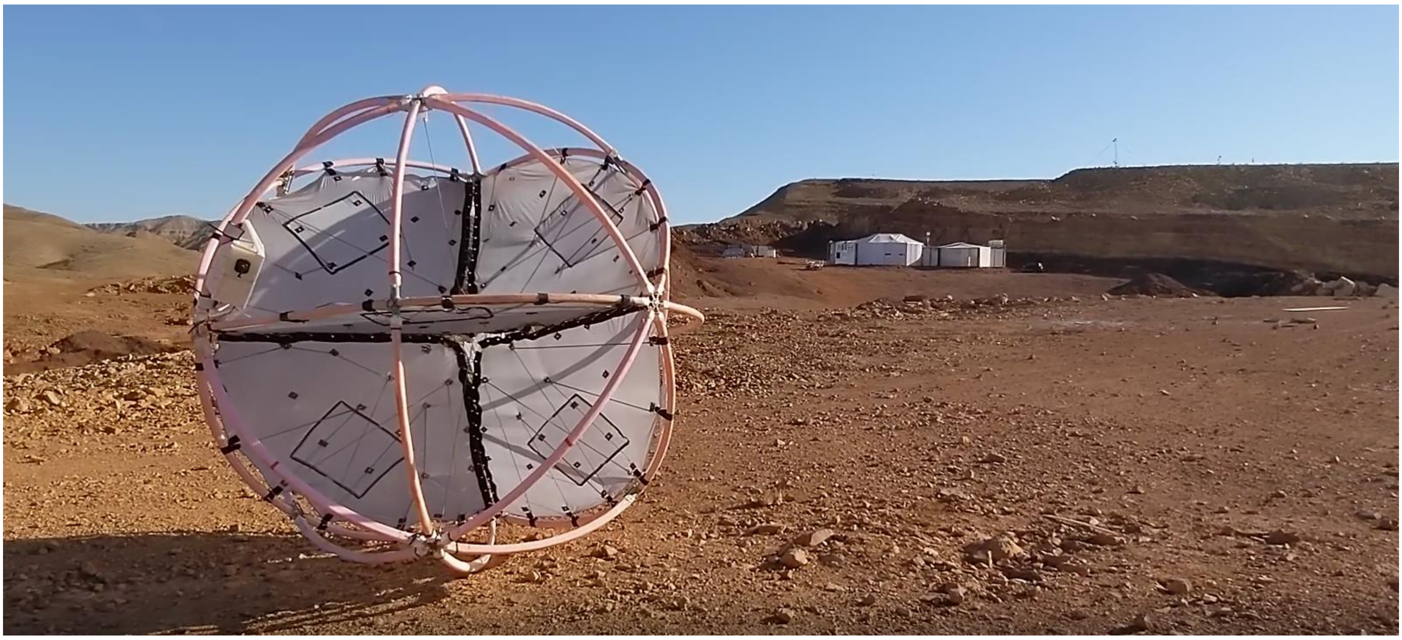
AMAZE Sp. = AMAZE Spotter
VL = VideoLog
M-Marks = Marks for Merop
M-Charge = Mercator & Rovo charging



Abbreviations: H-D: Humain Data download
ROVO = ROVO report
Rovo Sp. = Rovo Spotter

OQ = OGH Questionnaire
SCI. = Suit cleaning

Field Impressions



42. 25Oct2021 Guiding & observing HAB surrounding

Activities

After donning, Anika Mehlis in AOUDA.S and Thomas Wijnen in AOUDA.X started with the AMAZE experiment. Due to technical issues the drone wasn't able to fly that day. An extensive communication with the PI brought important improvements from this point on. After cancelling AMAZE for this day, the EVA was aborted for AOUDA.X and doffing started at 10:21 CEST. The EVA for AOUDA.S was still ongoing. Another SHARE run was scheduled for mission day 26 and successfully performed. During the EVA, Robert Wild performed another MEROP inspection run from the Habitat. After the return (EVA duration: 2h57min) and Doffing of AOUDA.S (end of Doffing: 12:32 CEST) several crew members performed MEROP inspection runs. At the end of the scientific day, an INTERFAM and a RETINA run were conducted. The OSS crew performed their 4th INTERTEAM run and continued with an INTERFAM run as well. The flight crew used some time slots all over the day to prepare the second AEROSCAN drone for a test flight.

Experiments

AMAZE	troubleshooting on drone
SHARE	experiment conducted
MEROP	3 runs performed
INTERFAM	experiment conducted
INTERTEAM	OSS exp1 run4 performed
RETINA	run performed
MARSLOCK	Donning / Doffing recorded

Weather

Sunset time (UTC+3)	18:00
Complete darkness (UTC+3)	19:20

Field Activity Plan

Mon, 25-Oct-2021 — **MISSION DAY: 26**

UTC: 03:00 – 10:00 | UTC+2 (MSC): 05:00 – 12:00 | UTC+3 (Field): 06:00 – 13:00

PERSON:	POSITION:	Activities (UTC 03:00 → 10:00)
Anika Mehlis	Aouda.S	MB, Breakfast, Brief&VAS, Donning, AMAZE, SHARE 3 (W/quad for resting), Doffing SCI
Thomas Wijnen	Aouda.X	MB, Breakfast, Brief&VAS, Donning, AMAZE, Doffing SCI, Leisure, OGH, Leisure, lun&
Alon Tenzer	Flight Crew	Housekeeping, MB, Breakfast, Brief&VAS, Suit Ops and Communication
Inigo Munoz	Flight Crew	Housekeeping, MB, Breakfast, Brief&VAS, Support Donning & Photo for DEAR, Suit Ops & C., Doff. DEAR, Housekeeping, Doff. DEAR, lun&
Joao Lousada	Flight Crew	MB, Breakfast, Brief&VAS, MarsLock Preparation / Support Donning, Supp.Doff., Supp.Doff., lun&
Robert Wild	Flight Crew	MB, Breakfast, Brief&VAS, Support Donning, Media DW, VL, MEROP Insp. Ctrl., lun&
Judith Kümmel	OSS	MB, Breakfast, Briefing, OSS Command, lunch
Danny Mattes	OSS / SafetyS	Breakfast, Briefing, TT, M-Marks, Safety. S, OGH, lunch
Florian Voggeneder	OSS / SafetyX	MB, Breakfast, Briefing, TT, Photo, Safety. X, Photo, lunch
Deepa Raju	OSS/MEDO	MB, Breakfast, Briefing, MEDO, lunch
Michael Berghold	OSS	Breakfast, Briefing, M-charge, TT, Ranger 1, WiFi On, AMAZE Sp., SHARE for WiFi & IT support, lunch
Dominik Jäger	OSS	Breakfast, Briefing, TT, MEROP Sp., lun
Simone Paternostro	OSS	Breakfast, Briefing, TT, Ranger 1, WiFi On, Safety. S, lunch
OSO D-Mars Logistics		Housek. (D-Mars), Security (D-Mars), lunch
Car 1		Sec Shift Change
Car 2		Permanently stationed at Mitzpe Ramon for BME use
Ranger 1		
Ranger 2		

Abbreviations

DW= video recording for Deutsche Welle
MB = Microbiome
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)

AMAZE Sp. = AMAZE Spotter
VL = VideoLog
M-Marks = Marks for Merop
M-Charge = Mercator & Rovo charging

Mon, 25-Oct-2021 — **MISSION DAY: 26**

UTC: 11:00 – 17:00 | UTC+2 (MSC): 13:00 – 19:00 | UTC+3 (Field): 14:00 – 20:00

PERSON:	POSITION:	Activities (UTC 11:00 → 17:00)
Anika Mehlis	Aouda.S	lun&VAS, Leisure, Lessons learned, Exp. Review, IF, Brief&VAS, dinner, HF
Thomas Wijnen	Aouda.X	VAS, MEROP Insp. Hapt., Exp. Review, Housekeeping, IF, Brief&VAS, dinner, HF
Alon Tenzer	Flight Crew	lun&VAS, Leisure, MEROP Insp. Hapt., Exp. Review, IF, Retina Run 4 (p), Brief&VAS, dinner, HF
Inigo Munoz	Flight Crew	VAS, Leisure, Exp. Review, IF, Retina Run 4 (p), Brief&VAS, dinner, HF
Joao Lousada	Flight Crew	VAS, Leisure, H-D, Lessons learned, Exp. Review, Housekeeping, IF, Brief&VAS, dinner, HF
Robert Wild	Flight Crew	VAS, Leisure, Lessons learned, Exp. Review, IF, Retina Run 4 (e), Brief&VAS, dinner, HF
Judith Kümmel	OSS	OSS Command, IF, Briefing, dinner, HF
Danny Mattes	OSS / SafetyS	SHARE for WiFi & IT suppor, TT, Interteam 1 run 4, IF, Briefing, dinner, OQ, HF
Florian Voggeneder	OSS / SafetyX	Photo, TT, Interteam 1 run 4, IF, Briefing, dinner, HF
Deepa Raju	OSS/MEDO	Interteam 1 run 4, IF, Briefing, dinner, HF
Michael Berghold	OSS	SHARE for WiFi & IT support, TT, Interteam 1 run 4, IF, Briefing, dinner, HF
Dominik Jäger	OSS	ch, MEROP Sp., TT, IF, Briefing, dinner, HF
Simone Paternostro	OSS	TT, Interteam 1 run 4, IF, Briefing, dinner, HF
OSO D-Mars Logistics		use, Interteam 1 run 4, dinner, dinner
Car 1		Sec Shift Change
Car 2		
Ranger 1		
Ranger 2		

Abbreviations

H-D: Humain Data download
ROVO = ROVO report
Rovo Sp. = Rovo Spotter

OQ = OGH Questionnaire
SCI. = Suit cleaning
IF=InterFam

Field Impressions

43. 26Oct2021 Working on airtime

Activities

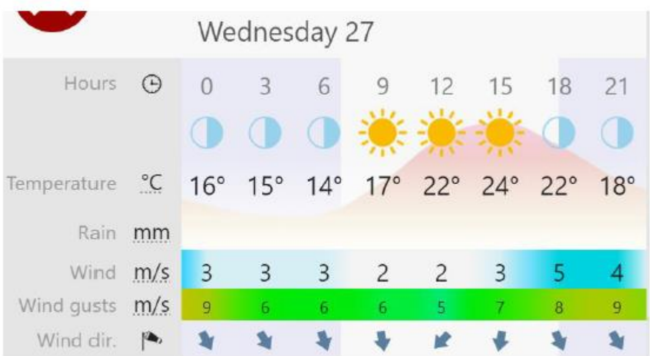
At the beginning of the EVA the two AAs Robert Wild and Inigo Munoz performed troubleshooting procedures on the AMAZE drone. After a short traverse they started to startup the copter. Unfortunately, they had to return to habitat without having a successful flight. After collecting the samples for Micro-Potential Robert Wild in AOUDA.S moved on to the SHARE experiment. To be prepared for the upcoming INTERTEAM run and get some leisure time, the EVA ended after 3h54min. AEROSCAN performed a successful mission task autonomously but did not land properly. The flight crew tried to force the drone to return and land. After a failed “return to land” command the crew performed a “Disarm” command. Unfortunately unsuccessful. A search and rescue team went out ot locate the drone. Inigo Munoz in AOUDA.X took a short break in the habitat and went back out again. After 3h16min he ended his EVA. Meanwhile in the habitat, Anika Mehlis performed another successful MEROP run. That day she continued with MICRO-POTENTIAL and Joao Lousada took over the MEROP control station. The whole crew participated the 5th INTERTEAM run in the late afternoon. The end of day experiment was ACT.
The EVA duration was 3h16min for A.X and 3h54min for A.S.

Experiments

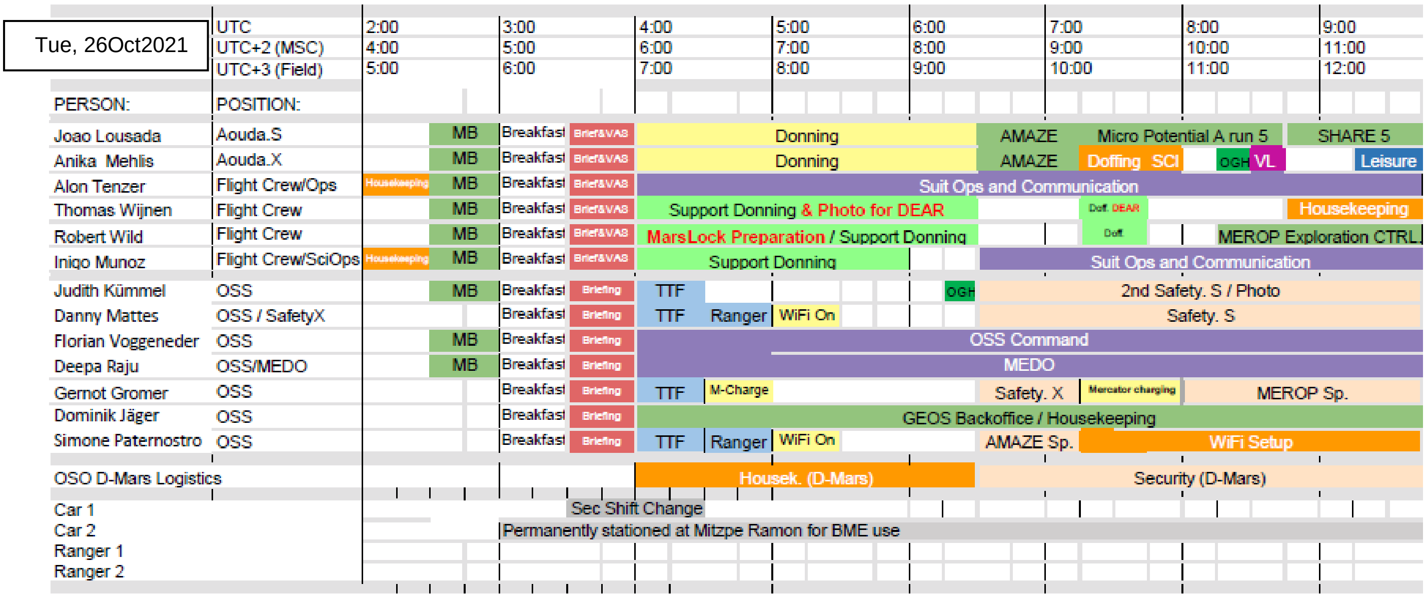
AMAZE	troubleshooting
MICRO-POTENTIAL	experiment conducted
SHARE	experiment conducted
MEROP	1st successful complete run
PSYCHSCALE	
INTERTEAM	exp 1 run 5 completed
ACT	questionnaire completed
MARSLOCK	Donning / Doffing recorded

Weather

Sunset time (UTC+3)	17:57
Complete darkness (UTC+3)	19:18



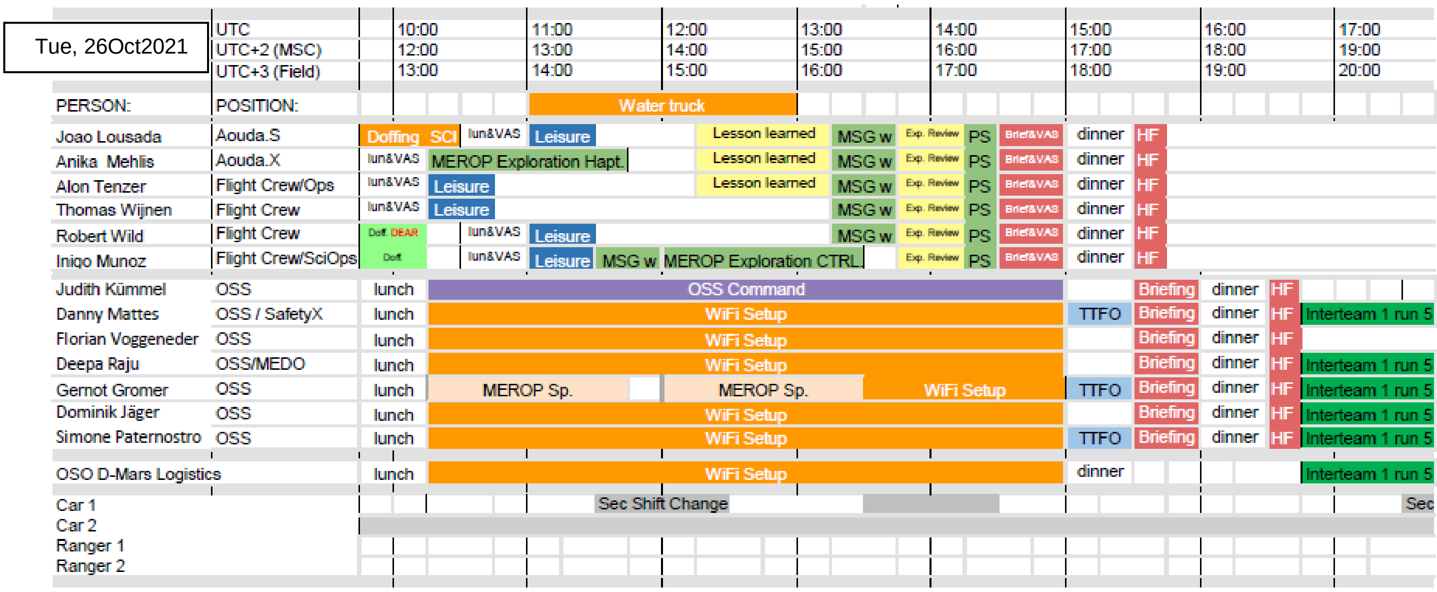
Field Activity Plan



Abbreviations

MB = Microbiome
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)
Suit Ops & C.= Suit Ops and Communicatio

AMAZE Sp. = AMAZE Spotter
VL = VideoLog
M-Marks = Marks for Merop
M-Charge = Mercator & Rovo charging



Abbreviations

H-D: Humain Data download
ROVO = ROVO report
Rovo Sp. = Rovo Spotter
Mc.Ch.= Mercator charging
MEROP Exploration Hapt.= MEROP Exploration Haptics
MSG w=MSG weekly questionnaire

OQ = OGH Questionnaire
SCl. = Suit cleaning
PS=PsychScale
TQ= Team questions (SHARE)

Field Impressions

44. 27Oct2021 Hours in the suit

Activities

The work for the OSS crew was dominated by setting up the WIFI for the upcoming GEOS experiment runs. A lot of troubleshooting work was going on on the AMAZE drone. Both AAs tried to make the AMAZE drone fly. Different options for a solution have been provided by the PI. Unfortunately, no successful run was conducted this day.
Joao Lousada in AOUDA.S performed another successful SHARE run and also collected samples for the MICRO-POTENTIAL experiment. After 4h13min he returned safely to the Habitat and ended his EVA. Anika Mehlis in AOUDA.X supported the troubleshooting on AMAZE and checked the OGH parameters. After 3h01min Anika returned to the Habitat and Doffing started after the “close-to-Habitat” EVA.

Experiments

AMAZE	troubleshooting, no run conducted
MICRO-POTENTIAL	samples taken as planned
SHARE	run 5 performed
MEROP	run 1 conducted, several connectivity issues
MSG	questionnaires completed
PSYCHSCALE	questionnaires completed
INTERTEAM	performed by OSS crew
AEROSCAN	connectivity issues and fly-away incident
MARSLOCK	Donning / Doffing recorded

Weather

Sunset time (UTC+3)	17:57
Complete darkness (UTC+3)	19:18

Wednesday 27									
Hours		0	3	6	9	12	15	18	21
Temperature	°C	16°	15°	14°	17°	22°	24°	22°	18°
Rain	mm								
Wind	m/s	3	3	3	2	2	3	5	4
Wind gusts	m/s	9	6	6	6	5	7	8	9
Wind dir.									

Field Activity Plan

Wed, 27-Oct-2021 Mission day:28	UTC / UTC+2 (MSC) / UTC+3 (Field)	2:00 / 4:00 / 5:00	3:00 / 5:00 / 6:00	4:00 / 6:00 / 7:00	5:00 / 7:00 / 8:00	6:00 / 8:00 / 9:00	7:00 / 9:00 / 10:00	8:00 / 10:00 / 11:00	9:00 / 11:00 / 12:00
PERSON:	POSITION:								
Joao Lousada	Aouda.S	MB	Breakfast, Brief&VAS	Donning		AMAZE	Micro Potential A run 5	SHARE 5	
Anika Mehlis	Aouda.X	MB	Breakfast, Brief&VAS	Donning		AMAZE	Doffing SCI	OGH, VL	Leisure
Alon Tenzer	Flight Crew/Ops	Housekeeping, MB	Breakfast, Brief&VAS	Suit Ops and Communication					
Thomas Wijnen	Flight Crew	MB	Breakfast, Brief&VAS	Support Donning & Photo for DEAR			Doff DEAR	Housekeeping	
Robert Wild	Flight Crew	MB	Breakfast, Brief&VAS	MarsLock Preparation / Support Donning			Doff	MEROP Exploration CTRL	
Inigo Munoz	Flight Crew/SciOps	Housekeeping, MB	Breakfast, Brief&VAS	Support Donning		Suit Ops and Communication			
Judith Kümmel	OSS	MB	Breakfast, Briefing	TTF		OGH, 2nd Safety. S / Photo			
Danny Mattes	OSS / SafetyX		Breakfast, Briefing	TTF, Ranger	WiFi On	Safety. S			
Florian Voggeneder	OSS	MB	Breakfast, Briefing	OSS Command					
Deepa Raju	OSS/MEDO	MB	Breakfast, Briefing	MEDO					
Gernot Gromer	OSS		Breakfast, Briefing	TTF, M-Charge		Safety. X	Mercator charging	MEROP Sp.	
Dominik Jäger	OSS		Breakfast, Briefing	GEOS Backoffice / Housekeeping					
Simone Paternostro	OSS		Breakfast, Briefing	TTF, Ranger	WiFi On	AMAZE Sp.	WiFi Setup		
OSO D-Mars Logistics				Housek. (D-Mars)		Security (D-Mars)			
Car 1			Sec Shift Change						
Car 2			Permanently stationed at Mitzpe Ramon for BME use						
Ranger 1									
Ranger 2									

Abbreviations

MB = Microbiome
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)
Suit Ops & C.= Suit Ops and Communicatio

AMAZE Sp. = AMAZE Spotter
VL = VideoLog
M-Marks = Marks for Merop
M-Charge = Mercator & Rovo charging

Wed, 27-Oct-2021 Mission day:28	UTC / UTC+2 (MSC) / UTC+3 (Field)	10:00 / 12:00 / 13:00	11:00 / 13:00 / 14:00	12:00 / 14:00 / 15:00	13:00 / 15:00 / 16:00	14:00 / 16:00 / 17:00	15:00 / 17:00 / 18:00	16:00 / 18:00 / 19:00	17:00 / 19:00 / 20:00
PERSON:	POSITION:		Water truck						
Joao Lousada	Aouda.S	Doffing SCI, lun&VAS	Leisure	Lesson learned	MSG w, Exp. Review	PS, Brief&VAS	dinner, HF		
Anika Mehlis	Aouda.X	lun&VAS, MEROP Exploration Hapt.		Lesson learned	MSG w, Exp. Review	PS, Brief&VAS	dinner, HF		
Alon Tenzer	Flight Crew/Ops	lun&VAS, Leisure		Lesson learned	MSG w, Exp. Review	PS, Brief&VAS	dinner, HF		
Thomas Wijnen	Flight Crew	lun&VAS, Leisure			MSG w, Exp. Review	PS, Brief&VAS	dinner, HF		
Robert Wild	Flight Crew	Doff DEAR, lun&VAS	Leisure		MSG w, Exp. Review	PS, Brief&VAS	dinner, HF		
Inigo Munoz	Flight Crew/SciOps	Doff, lun&VAS	Leisure, MSG w	MEROP Exploration CTRL	Exp. Review	PS, Brief&VAS	dinner, HF		
Judith Kümmel	OSS	lunch, OSS Command					Briefing	dinner, HF	
Danny Mattes	OSS / SafetyX	lunch, WiFi Setup					TTFO, Briefing	dinner, HF	Interteam 1 run 5
Florian Voggeneder	OSS	lunch, WiFi Setup					Briefing	dinner, HF	
Deepa Raju	OSS/MEDO	lunch, WiFi Setup					Briefing	dinner, HF	Interteam 1 run 5
Gernot Gromer	OSS	lunch, MEROP Sp.		MEROP Sp.	WiFi Setup		TTFO, Briefing	dinner, HF	Interteam 1 run 5
Dominik Jäger	OSS	lunch, WiFi Setup					Briefing	dinner, HF	Interteam 1 run 5
Simone Paternostro	OSS	lunch, WiFi Setup					TTFO, Briefing	dinner, HF	Interteam 1 run 5
OSO D-Mars Logistics		lunch, WiFi Setup					dinner		Interteam 1 run 5
Car 1			Sec Shift Change						Sec
Car 2									
Ranger 1									
Ranger 2									

Abbreviations

H-D: Humain Data download
ROVO = ROVO report
Rovo Sp. = Rovo Spotter
Mc.Ch.= Mercator charging
MEROP Exploration Hapt.= MEROP Exploration Haptics
MSG w=MSG weekly questionnaire

OQ = OGH Questionnaire
SCI. = Suit cleaning
PS=PsychScale
TQ= Team questions (SHARE)

Field Impressions

45. 28Oct2021 Black-Day

Activities

Black day. The flight crew adapted the troubleshooting instructions for the AMAZE drone provided by the PI. Enabling the WIFI coverage for the upcoming GEOS experiment was achieved by the OSS crew.

Due to medical issues, the AA to perform the GEOS experiment had to be reselected.

Experiments

AMAZE	troubleshooting

Weather

no forecast available for this day

46. 29Oct2021 AMAZE got wings

Activities

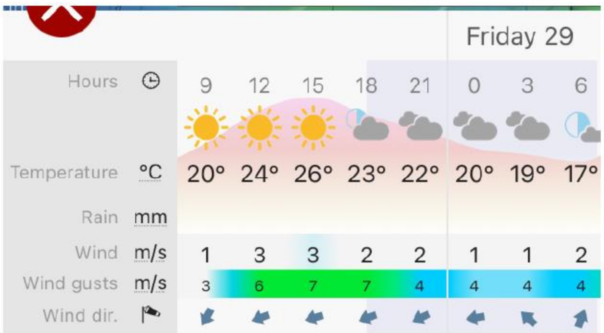
Successful EVAs with both suits have been performed this day. Connection problems due to bad WIFI coverage in the North region caused some work on alternatives for the planned experiment runs. Due to fast reacting crew members (both MSC and Field) successful runs have been enabled. Alon Tenzer in AOUDA.X ended his EVA after 1h58min and Inigo Munoz in AOUDA.S after 3h12min. After some troubleshooting activities, a successful AMAZE flight was conducted right at the last to possibility to do so. by A.X. After the flight, A.X moved back to Habitat for doffing and A.S started the second half of the EVA after a short cooling break at 11:03. While observing the heat stress index of A.S, POI 1 and 2 of GEOS have been sampled successfully. Due to high ambient and suit temperatures, another cooling break in the habitat was necessary. After consultation with the BME team the FD decided to stop the EVA at 12:24.
Parallel to the scientific tasks, basic TODOs like refilling drinking water had to be performed.
EVA duration was 1h58min for A.X and 3h12min for A.S.

Experiments

AMAZE	troubleshooting, first successful flight
GEOS	sampling of POI 1+2
MEROP	3 exploration runs performed
TUMBLEWEED	successful 1min run
PSYCHSCALE	not conducted (but on 28th)
INTERFAM	experiment conducted
ACT	questionnaires completed
INTERTEAM	two additional questionnaires filled out
MARSLOCK	Donning / Doffing recorded

Sunset time (UTC+3)	17:55
Complete darkness (UTC+3)	19:16

Weather



Field Activity Plan

Fri, 29-Oct-2021 — **Mission day 26**

UTC: 02:00 | 03:00 | 04:00 | 05:00 | 06:00 | 07:00 | 08:00 | 09:00
UTC+2 (MSC): 04:00 | 05:00 | 06:00 | 07:00 | 08:00 | 09:00 | 10:00 | 11:00
UTC+3 (Field): 05:00 | 06:00 | 07:00 | 08:00 | 09:00 | 10:00 | 11:00 | 12:00

PERSON:	POSITION:	Activities (in time order)
Robert Wild	Aouda.S	MB · Breakfast · Brief&VAS · Donning · AMAZE · GEOS
Alon Tenzer	Aouda.X	MB · Breakfast · Brief&VAS · Donning · AMAZE · Doffing SCl · Leisure
Joao Lousada	Flight Crew	Housek. · MB · Breakfast · Brief&VAS · Support Donning · Supp. Doffing · MEROP Exploration CTRL.
Thomas Wijnen	Flight Crew/SciOps	MB · Breakfast · Brief&VAS · Support Donning & Photo for DEAR · Suit Ops and Communication
Anika Mehlis	Flight Crew/Ops	MB · Breakfast · Brief&VAS · Suit Ops and Communication · Doff. DEAR · Leisure
Inigo Munoz	Flight Crew	Housek. · MB · Breakfast · Brief&VAS · MarsLock Preparation / Support Donning · VL · OGH · Housekeeping
Judith Kümmel	OSS	MB · Breakfast · Briefing · OSS Command
Danny Mattes	OSS / Safety.S	Breakfast · Briefing · TTF · Ranger · WiFi On · Safety.S
Florian Voggeneder	OSS / Safety.S	MB · Breakfast · Briefing · TTF · Ranger · WiFi On · Safety.S / Photo
Deepa Raju	OSS/MEDO	MB · Breakfast · Briefing · MEDO
Gernot Gromer	OSS	Breakfast · Briefing · TTF · M-Charge · AMAZE Sp. · OGH · MEROP Spotter
Dominik Jäger	OSS	Breakfast · Briefing · Housekeeping/packing
Simone Paternostro	OSS/ Safety.X	Breakfast · Briefing · TTF · Safety.X · M-Marks
OSO D-Mars Logistics		Housek. (D-Mars) · Security (D-Mars)
Car 1		Sec Shift Change
Car 2		Permanently stationed at Mitzpe Ramon for BME use
Ranger 1		
Ranger 2		

Abbreviations

MB = Microbiome
Brief&VAS = Briefing & MSG VAS questionnaire (takes 1 minute)
lun&VAS = Lunch & MSG VAS questionnaire (takes 1 minute)

AMAZE Sp. = AMAZE Spotter
VL = VideoLog
M-Marks = Marks for Merop
M-Charge = Mercator & Rovo charging

Fri, 29-Oct-2021 — **Mission day 26**

UTC: 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00
UTC+2 (MSC): 12:00 | 13:00 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00
UTC+3 (Field): 13:00 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00 | 19:00

PERSON:	POSITION:	Activities (in time order)
		Water Refill
Robert Wild	Aouda.S	Doffing SCl · lun&VAS · Leisure · MEROP Exploration CTRL. · Exp. Review · PS · I-F · ACT · Brief&VAS · dinner · HF
Alon Tenzer	Aouda.X	lun&VAS · Doff. DEAR · GEOS analysis · Exp. Review · Housekeeping · PS · I-F · ACT · Brief&VAS · dinner · HF
Joao Lousada	Flight Crew	lun&VAS · Leisure · H-D · Exp. Review · Housekeeping · PS · I-F · ACT · Brief&VAS · dinner · HF
Thomas Wijnen	Flight Crew/SciOps	lun&VAS · Leisure · Lesson learned · Exp. Review · PS · I-F · ACT · Brief&VAS · dinner · HF
Anika Mehlis	Flight Crew/Ops	lun&VAS · MEROP Exploration Hapt. · Lesson learned · Exp. Review · PS · I-F · ACT · Brief&VAS · dinner · HF
Inigo Munoz	Flight Crew	lun&VAS · Supp. Doffing · Leisure · Lesson learned · Exp. Review · PS · I-F · ACT · Brief&VAS · dinner · HF
Judith Kümmel	OSS	lunch · OSS Command · ROVO · Lesson learned · ACT · Briefing · dinner
Danny Mattes	OSS / Safety.S	lunch · Tumbleweed · TTFO · Lesson learned · ACT · Briefing · dinner
Florian Voggeneder	OSS / Safety.S	lunch · Photo · TTFO · Lesson learned · ACT · Briefing · dinner
Deepa Raju	OSS/MEDO	lunch · Lesson learned · ACT · Briefing · dinner
Gernot Gromer	OSS	lunch · MEROP Spotter · TTFO · Lesson learned · ACT · Briefing · dinner
Dominik Jäger	OSS	lunch · Housekeeping/packing · Lesson learned · ACT · Briefing · dinner
Simone Paternostro	OSS/ Safety.X	lunch · Field Console/Tumbleweed Setup · Tumbleweed · TTFO · Lesson learned · ACT · Briefing · dinner
OSO D-Mars Logistics		lunch · Housek. (D-Mars) · dinner
Car 1		Sec Shift Change
Car 2		
Ranger 1		
Ranger 2		

Abbreviations

H-D: Humain Data download
ROVO = ROVO report
Rovo Sp. = Rovo Spotter
Mc.Ch.= Mercator charging

OQ = OGH Questionnaire
SCl. = Suit cleaning
PS=PsychScale
MEROP Exploration Hapt.= MEROP Exploration Haptics

I-F = InterFam

47. 30Oct2021 preparing for re-entry

Activities

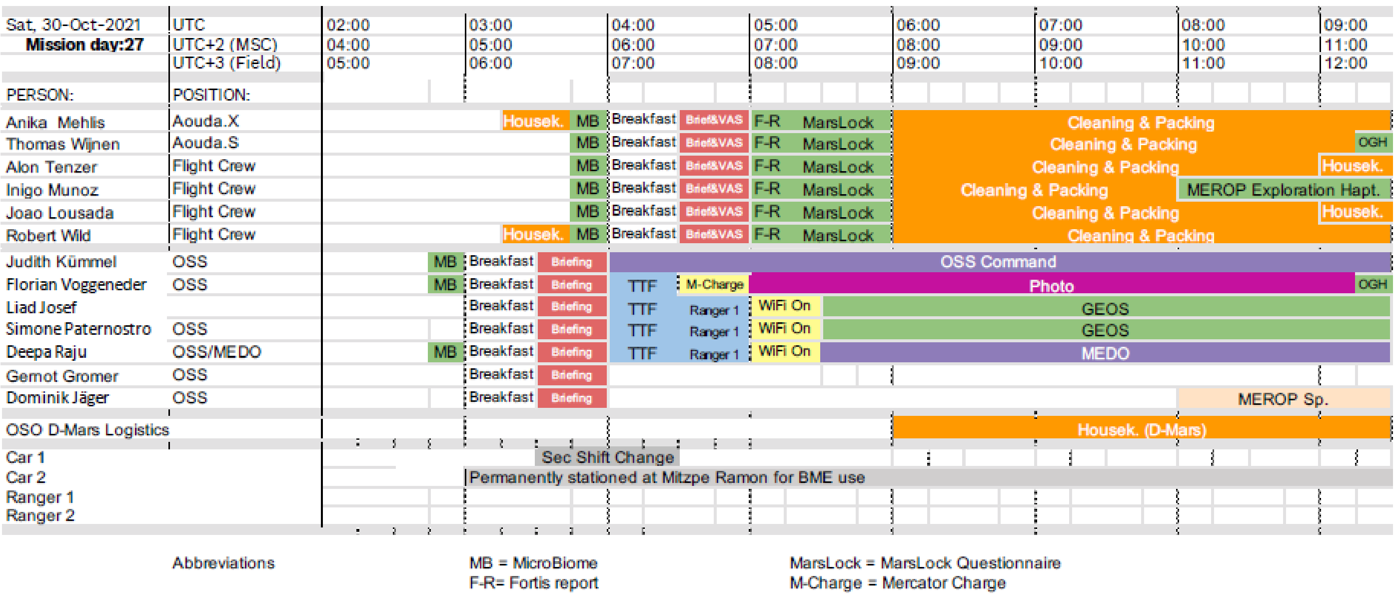
The second-to-last mission day was used for cleaning and packaging. The AOUDA.S suit got beautified for the habitat tour on the following day. Preparations for a meeting with the President of Israel and the Walk-Out ceremony were performed.
A team of two crew members performed unsuited GEOS runs in the south area of the Habitat. The AEROSCAN drone was found by the GEOS sampling team approx. 300m away from the initial search sector.

Experiments

GEOS	unsuited sampling in area “South”
AEROSCAN	SAR of drone successful
MEROP	last experiment run conducted
FORTIS	reports on Fortis watch
MARSLOCK	questionnaires finished

Weather

no forecast provided



Sat, 30-Oct-2021 **Mission day:27**	UTC UTC+2 (MSC) UTC+3 (Field)		10:00 12:00 13:00	11:00 13:00 14:00	12:00 14:00 15:00	13:00 15:00 16:00	14:00 16:00 17:00	15:00 17:00 18:00
PERSON:	POSITION:							
Anika Mehlis	Aouda.X	lun&VAS	Leisure, MEROP Exploration CTRL.		Cleaning & Packing		Brief&VAS	dinner, HF
Thomas Wijnen	Aouda.S	lun&VAS	Leisure, Cleaning & Packing		MEROP Exploration Hapt.	Housekeeping	Brief&VAS	dinner, HF
Alon Tenzer	Flight Crew	lun&VAS	Leisure, Cleaning & Packing				Brief&VAS	dinner, HF
Inigo Munoz	Flight Crew	lun&VAS	Leisure, Cleaning & Packing				Brief&VAS	dinner, HF
Joao Lousada	Flight Crew	lun&VAS	Leisure, Cleaning & Packing				Brief&VAS	dinner, HF
Robert Wild	Flight Crew	lun&VAS	Leisure, Cleaning & Packing			Housekeeping	Brief&VAS	dinner, HF
Judith Kümmel	OSS	lunch	OSS Command				Briefing	dinner, HF, ROVO
Florian Voggeneder	OSS	lunch	Photo				Briefing	dinner, HF, OQ
Liad Josef		lunch	GEOS			TTFO	Briefing	dinner, HF
Simone Paternostro	OSS	lunch	GEOS			TTFO	Briefing	dinner, HF
Deepa Raju	OSS/MEDO	lunch	MEDO			TTFO	Briefing	dinner, HF
Gernot Gromer	OSS	lunch					Briefing	dinner, HF
Dominik Jäger	OSS	lunch	MEROP Sp.				Briefing	dinner, HF
OSO D-Mars Logistics		lunch	Housekeeping (D-Mars)					dinner
Car 1				Sec Shift Change				
Car 2								
Ranger 1								
Ranger 2								

Abbreviations

ROVO = Rovo Report
OQ = OGH Questionnaire

Photo: Introducing a new tradition: Signing the airlock with the names of the flight crew and patching up the mission badge.

Field Impressions

48. 31Oct2021 Walk-Out Day

Activities

Reaching the end of the mission, it was all about the walk-out of the AAs in the morning. Even at the MSC it was an emotional moment to know that the AAs just stepped out of the habitat after 3 weeks in isolation. After this special moment, the official "Walk-Out day" started. Way more journalists, politicians and space enthusiasts than expected participated. The official part started with a poster session of the Innovation Day in the Pangea Restaurant in Mitzpe Ramon. After an hour of presentations, the Innovation Day members moved to the crater.

Experiments

MICRO-BIOME	Experiment conducted
HUMAIN	post-mission questionnaires filled out
AEROSCAN	packaging started

Weather: no forecast provided

Sun, 31-Oct-2021 **MISSION DAY: 28**	UTC / UTC+2 (MSC) / UTC+3 (Field)	02:00 / 04:00 / 05:00	03:00 / 05:00 / 06:00	04:00 / 06:00 / 07:00	05:00 / 07:00 / 08:00	06:00 / 08:00 / 09:00	07:00 / 09:00 / 10:00	08:00 / 10:00 / 11:00
PERSON:	POSITION:							
Alon Tenzer	Flight Crew	MB	Breakfast, Brief&VAS	Packing/Cleaning				
Anika Mehlis	Flight Crew	MB	Breakfast, Brief&VAS	Packing/Cleaning				
Inigo Munoz	Flight Crew	Housek, MB	Breakfast, Brief&VAS	Packing/Cleaning				
Joao Lousada	CREW CDR	MB	Breakfast, Brief&VAS	Packing/Cleaning				
Thomas Wijnen	Flight Crew	MB	Breakfast, Brief&VAS	Packing/Cleaning				Housekeeping
Robert Wild	Flight Crew	Housek, MB	Breakfast, Brief&VAS	Packing/Cleaning				Housekeeping
Liad Josef	Aouda.S							
Judith Kümmel	OSS	MB	Breakfast, Briefing	OSS Command				Snack, TT
Simone Paternostro	OSS		Breakfast, Briefing	Packing/Cleaning				Snack, TT
Florian Voggeneder	OSS	MB	Breakfast, Briefing	Media			Snack	TT
Gernot Gromer	OSS		Breakfast, Briefing	Media			Snack	TT
Deepa Raju	OSS/MEDO	MB	Breakfast, Briefing	Packing/Cleaning			Snack	TT
Michael Berghold	OSS		Breakfast, Briefing	Packing/Cleaning			Snack	TT
Dominik Jäger	OSS		Breakfast, Briefing	Packing/Cleaning				Snack, TT
OSO D-Mars Logistics				Housekeeping (D-MARS)				lunch
Car 1			Sec Shift Change					
Car 2			Permanently stationed at Mitzpe Ramon for BME use					

Sun, 31-Oct-2021 **MISSION DAY: 28**	UTC / UTC+2 (MSC) / UTC+3 (Field)	09:00 / 11:00 / 12:00	10:00 / 12:00 / 13:00	11:00 / 13:00 / 14:00	12:00 / 14:00 / 15:00	13:00 / 15:00 / 16:00	14:00 / 16:00 / 17:00	15:00 / 17:00 / 18:00
PERSON:	POSITION:							
Alon Tenzer	Flight Crew	lunch	Leisure	Walk out ceremony		Transfer to Hotel, Dinner, Leisure		
Anika Mehlis	Flight Crew	lunch	Leisure	Walk out ceremony		Transfer to Hotel, Dinner, Leisure		
Inigo Munoz	Flight Crew	lunch	Leisure	Walk out ceremony		Transfer to Hotel, Dinner, Leisure		
Joao Lousada	CREW CDR	lunch	Leisure	Walk out ceremony		Transfer to Hotel, Dinner, Leisure		
Thomas Wijnen	Flight Crew	lunch	Leisure	Walk out ceremony		Transfer to Hotel, Dinner, Leisure		
Robert Wild	Flight Crew	lunch	Leisure	Walk out ceremony		Transfer to Hotel, Dinner, Leisure		
Liad Josef	Aouda.S			Light Donning, Walk out ceremony		Doffing, Transfer to Hotel, Dinner, Leisure		
Judith Kümmel	OSS	Preparation and walk out ceremony		Supp.Donning, Walk out ceremony		Supp.Doffing, Walk out ceremony	Briefing	dinner, HF
Simone Paternostro	OSS	Preparation and walk out ceremony		Supp.Donning, Walk out ceremony		Supp.Doffing, Walk out ceremony	Briefing	dinner, HF
Florian Voggeneder	OSS	Media					Briefing	dinner, HF
Gernot Gromer	OSS	Media					Briefing	dinner, HF
Deepa Raju	OSS/MEDO	Preparation and walk out ceremony					Briefing	dinner, HF
Michael Berghold	OSS	Preparation and walk out ceremony					Briefing	dinner, HF
Dominik Jäger	OSS	Preparation and walk out ceremony					Briefing	dinner, HF
OSO D-Mars Logistics		Housekeeping (D-MARS)						dinner
Car 1				Sec Shift Change				
Car 2								

Field Impressions

49. 02Nov2021 Reception President of Israel

Both due to the high public visibility of the AMADEE-20 expedition, as well as its highly international character, we were invited to the president of Israel, Isaac Herzog on 02Nov2021. The evening included a showcasing of selected Israeli space industries as well as a number of short presentations about the mission to the president. The Minister for Foreign Affairs of Ireland was also participating in a preceding short exhibit presented to the president and the first lady of Israel. Dignitaries also included Hannah Liko, the Austrian Ambassador to Israel as well as Ori Uron, the newly appointed Director General of the Israel Space Agency, and several diplomats.

- End of the AMADEE-20 Report –