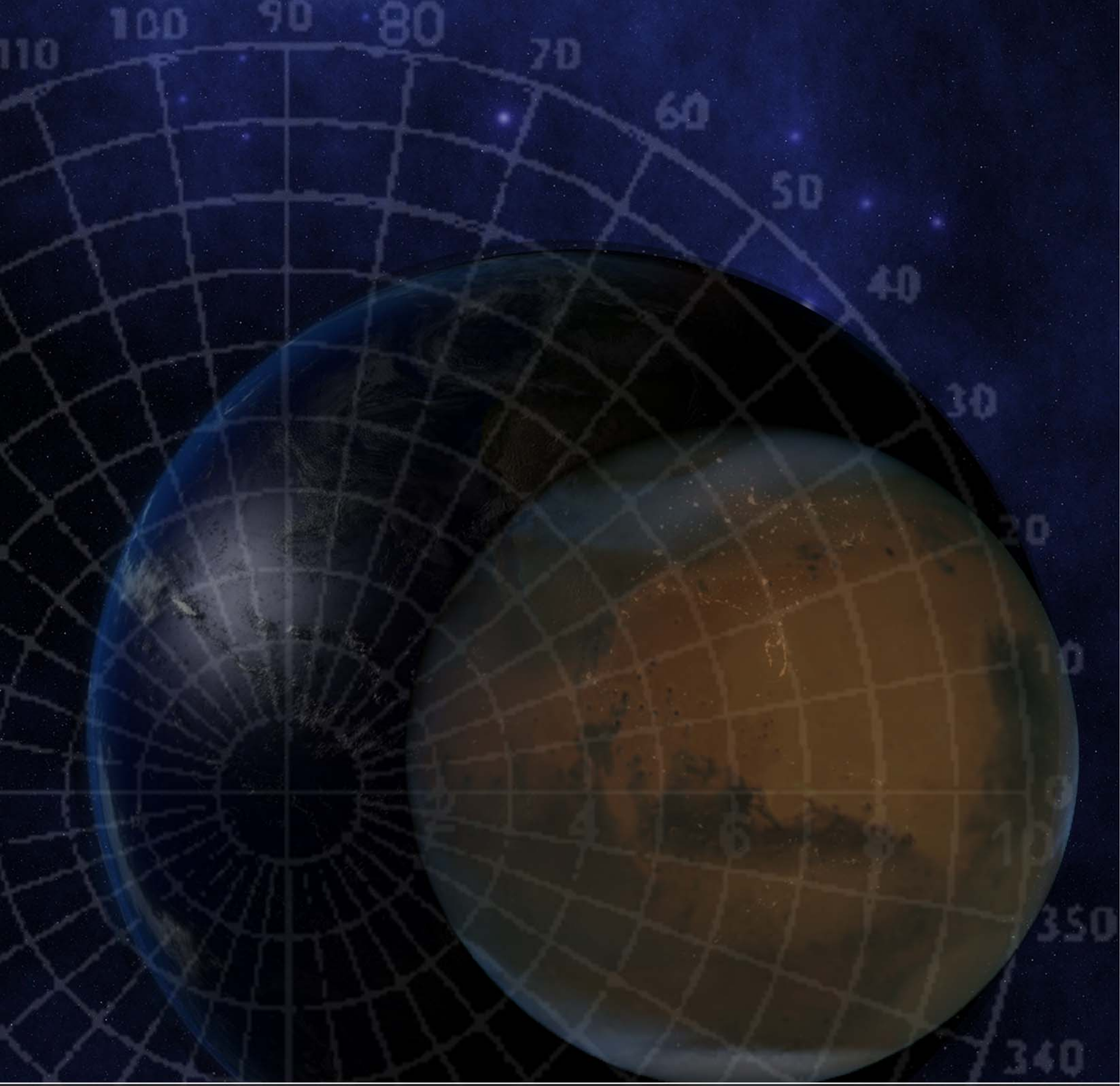

AustroMars
Mission Report

A project of the Austrian Space Forum, 2004-2006
V1.03

Gernot Groemer (Editor)

AustroMars

Mission Report

A project of the Austrian Space Forum
supported by the Austrian Federal Ministry for Transportation, Innovation and Technology under the Austrian Space Application Programme of the Austrian Research Promotion Agency in cooperation with the International Mars Society, Austrian industry and academic institutions.

V. 1.03

“It's human nature to stretch, to go, to see, to understand.
Exploration is not a choice, really; it's an imperative. “

Michael Collins, Gemini and Apollo astronaut

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Chapter 1

Sponsors & Partners

As in any major space project, the success of this mission was based upon the commitment of many individuals and institutions whose professionalism and dedication made it happen. Many of the volunteers working for AustroMars have been involved in the participating institutions to some extent. At the very beginning of this report, we would like to extend our sincere gratitude to all entities connected to the project. The AustroMars team takes both pride and thankfulness in having worked together with so many excellent partners.

Main sponsor

bmvit

Austrian Federal Ministry for Transportation, Innovation and Technology,
in particular Secretary of State, Mag. Eduard Mainoni

Major partners

Austrian Research Promotion Agency,
in particular Mr. Harald Posch and Dr. Wolfgang Würz

The Mars Society, Denver Headquarters
in particular Dr. Robert Zubrin (President of The Mars Society) and Dr. Tony Muscatello (Director of MDRS operations)

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In particular Mr. Karl Valenta and Christian Granegger

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In particular Mr. Saupp

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in particular HR Prof. Dr. Eberhard Stüber

Chapter 2

Executive Summary

AustroMars was the simulation of a crewed expedition on the surface of planet Mars, taking place in April 2006 at the Mars Desert Research Station in Utah. Six carefully selected individuals performed 20 experiments in the fields of robotics, analogue planetary and life sciences as well as human exploration.

Preparatory activities and previous heritage

The project started in 2004 when – after a parabolic flight campaign project of the Austrian Space Forum – the forums management was making the fundamental decision to put more emphasis on space technology projects, adding to the high level of “grass root-style” outreach and education activities. One of the later crew members already had an experience as Health and Safety Officer for the Crew 11 of the Mars Desert Research Station in 2002 which since than had evolved both technically and scientifically. In addition to these previous experiences, in part for an eventual upcoming Mars simulation as well as for outreach purposes in connection with several large educative projects, the Austrian Space Forum decided to approach a technical school in Austria, the TGM Vienna, to initiate a 2 year project for a remote controlled rover which had the capability to perform in the desert.

There were several attempts to initiate AustroMars at various (technology) policy levels, which were unsuccessful. However, as the budget size turned out to be in an order of magnitude which could be obtained through public-private partnerships, another high level attempt was made through the office of the Vice-Chancellor of the Republic of Austria, Mr. Hubert Gorbach and subsequently the Secretary of State for Technology Development, Mag. Eduard Mainoni, whose office realized the potential AustroMars could offer. In 2005, a project proposal for the Austrian Space Applications Programme was submitted to the Austrian Research Promotion Agency's Aerospace Division under the lead of Mr. Harald Posch, leading to follow-up negotiations which finally led to a funding of 50% of the total project costs. As for the remaining other 50%, various entities from academia, research and industries were co-funding. Together with the substantial number of highly qualified volunteers, this combination made AustroMars a unique model for small astronautical projects.

Since mid-2005, intense management efforts utilizing the network of the Austrian Space Forum and its partner institutions led to the creation of an originally 20 people set-up team, which was then expanded to a 80 person group, ending in a 145 people team which was coordinated through a small core team at the University of Innsbruck's Institute for Astro- and Particlephysics and other teams across Austria. In October 2005 the first AustroMars Definition Workshop took place in the city of Salzburg, bringing together potential principal investigators as well as space technology experts. After this three day meeting, a scientific case for AustroMars was formulated and core teams were formed. What followed was a marvelous galvanization of space interest of enthusiastic volunteers, highly motivated scientists who saw a series of research opportunities, aerospace engineers who realized that AustroMars was an excellent chance to try out new procedures and materials, media representatives who instantaneously agreed to cover the mission, including a full-scale documentary and, finally, a dedicated management team which had the pleasure of coordinating a colorful, but highly skilled workforce in an unprecedented project for Austrian circumstances.
More workshops followed, e.g. at the University of Graz in December 2005, a digital infrastructure was established as physical meetings were the exception as opposed to countless teleconferences. A document tracking and knowledge management strategy was set up as well as an accounting infrastructure, hardware development and storage strategies had to be organized. After the submission of the AustroMars Reference Proposal and

preliminary negotiations at the Mars Society's headquarters in Denver/Colorado, the Mars Society agreed to allocate a three-week time slot at the station to allow for another week of training.

Science and Technology Programme

AustroMars focused on science and technology: 20 experiments were conducted in close cooperation with various academic institutions ranging from geology to human factors research, from robotics to micro-biology. This report only describes the experiments in principle; the scientific findings are still "work in progress". The amount of data obtained through the mission "suffices for another 2 or 3 years of research", as one of the principal investigators put it. In September 2006 there was a first Scientific Conference on AustroMars which will lead to a first proceeding in early 2007. The quality of some of the experiments, especially in the human factors research, was remarkable. For example, one of the experiments, the Fatigue Monitoring System, which was conducted in cooperation with the company Object Tracker and Sowoon Technologies under the lead of Luzian Wolf, was awarded a technology spin-off prize (CAST-award) in December 2006.

AM11 BioMars

During a human Mars mission the contamination of soil samples (especially when looking for traces of life) means a major microbiological challenge. Within the scope of BioMars for the first time the amount of forward (i.e. from the habitat to the Martian environment) but also backward contamination (i.e. the possibility of introducing biological material from the environment into the habitat and eventually into the ecosystem of our planet) has been quantified. The BioMars team analysed the magnitude of contamination via microspherules (microscopically small plastic balls) which are able to fluoresce and other microbiological techniques.

AM12 TeleMars

An astronomical outpost on Mars exhibits advantages also because of its location like observing of objects in our solar system from two different point of views (Earth and Mars) or the observation of Mars' atmosphere by monitoring its absorption behaviour (for example obverse the light of well analysed stars). So astronomers can measure short term variations concerning the chemical composition exactly. Within the scope of AustroMars, handling of a small telescope on Mars was also revised.

AM13 PhysioMars

A heavy lifesupport system in a backpack, a lot of EVAs: Already weakend by a journey in zero gravity lasting several months, the crew of a Mars mission suffers when conducting unaccustomed muscular burden. Physiotherapical methods are able to lower the risk of injuries and at the same time will increase the efficiency of the astronauts. For the first time a MDRS crew got a brief training in physiotherapy to identify muscular burden patterns and to implement simple countermeasures (massage etc.).

AM14 GeoMars

One of the most important tasks of Mars exploration is the geophysical and geological characterisation of the surface, e.g. to search for traces of water and information about the red planet's climatic history. With the help of remote sensing data, pictures made by a flying robot and an unmanned rover as well as the AustroMars flight crew the choice of the best locations for taking soil samples, the ideal way of sample handling and on-site analysis were simulated.

AM15 MedMars

"Mobile Monitoring of Patients" is one of medicine's booming branches. During the AustroMars mission it was used to monitor the crew completely when on EVA. A monitoring system was build into the lifesupport system and data were relayed to the habitat and the mission control center. Additionally emergency medical aid treatment (like recovering of a hurt analogue-astronaut) was evaluated including mountain rescue techniques, and tests were conducted with various medical contingency situations.

AM16 PsychoMars

When six people live together in a 24 square metres station in a hostile environment for two weeks, there exists a risk for extreme psychological situations which imperils the success of the mission seriously. The PsychoMars experiment studied how stress developed under these extraordinary conditions and which countermeasures the psychologists in the mission control center can apply. For these purposes measurements of hormones in the saliva, video observation and written test batteries were used. Additionally the selection process for finding the best crew configuration was part of these experiments.

AM17 LBNP

The Lower-Body-Negative-Pressure test means that the final candidates for the flight crew selection are lying on a rotatable couch. In a cylinder which seals the lower body from the waistline downwards the airpressure is lowered until the body fluids shift, leading to temporary unconsciousness. This exposure can be compared with a blackout occuring when the analogue space suit's heat regulation fails. At the same time the hormonal stress level was determined during this experiment.

Besides experiments based on natural sciences, Mars Desert Research Station offered a unique environment to test new technological developments under controlled conditions. Considering the rapid technological development of the recent decades nobody can anticipate how, for example, a space suit will look like in 30 years. But research in analogue stations makes it possible to "ask the right questions" at least, that means the definition of the hardware's specification. At the same time the AustroMars experiments yielded a high degree of real-life relevance for terrestrial applications. For instance, the Famos hardware tested during the simulation can be used to detect symptoms of fatigue with fraught-with-risk occupational groups early enough.

AM21 Habitability

Within the framework of AustroMars, we understood the meaning of habitability as activities which increase the crew's well-being by adept architectural changes on / in the habitat and thereby optimising their coherence and efficiency. That is, e.g., an appropriate concept of lighting, evaluation of the existing contents of the habitat etc.

AM22 MDRS Rover

The Mars Desert Research Station Rover has been built by the Austrian Institute of Technology School in Vienna (TGM) on behalf of ÖWF. It was controlled by MCC via a satellite link or by the analogue astronauts via radio link. Besides a GPS-logger, inclination sensors and cameras, the rover also carried a simulated scientific payload to support the crew when on EVA.

AM23 Exploration Management

Beside the crew, also the Mission Control Centre (MCC) was part of this AustroMars experiment. It was the intention to optimize the cooperation among the scientific teams, simulated satellite data, pictures and measurements of the aerobot and the rover as well as the crew. In this regard exploration science means first simple tasks like the testing of the construction of an anti-radiation wall built with sandbags in Mars-like conditions.

AM24 Aerobot

The "Flying Eye" of AustroMars: Prior to sending the crew to a geological sample collection location, an aerial robot with an onboard camera performs long-range reconnaissance of the area of interest.

AM25 Object Tracker

This experiment tested the tracking of persons in the habitat to study their movement pattern by using automated cameras. The data were used on one hand to optimize the work patterns inside the habitat, on the other hand for psychological tests. At the same time they offer MCC a minimal invasive way to monitor the crew. The video stream was automatically interpreted by specialized software and permitted a quantification of duration times in predefined zones in the habitat.

AM26 Famos

Tiredness and exhaustion are two of the major risks for human failure. The fatigue monitory system (FAMOS) developed by Sowoon Technologies s.r.l. is a headset-based system monitoring eye-movements of the crew members. After the simulation the video tapes are analyzed in the laboratory and indicators for tiredness are determined.

Flight crew selection and training

Since September 2005, a crew selection process took place which originally involved 182 applicants who had to be down-selected to a flight crew of 6 highly skilled, motivated and well-trained individuals as well as a 3-person back-up crew. Modeled after training principles of astronauts and pilots, in a nutshell, the crew underwent a detailed training including education in science and engineering skills as well as physical and mental training, plus many manual skills such as applying a cast for a broken leg, driving an all-terrain vehicle in an off-road environment, giving presentations and media interviews, working with physiotherapeutical practices and knowing the main European and global space players.

Mission Control Center

The Mission Control Centre (MCC) for AustroMars was the headquarters of all technical and administrative activities in Austria during the actual simulation phase. The MCC was responsible for the contact to the „Mars“ base and the crew, the on-site support team in Hanksville, Mars Society’s mission support in Denver and the science teams. It was also responsible for outreach, media and sponsoring activities. The MCC Salzburg was manned 24 hours a day. During the day two shifts worked in the MCC, consisting of approximately 10 people. In the night shift and in periods of reduced activity, a core team of at least 3 people was available.

In addition, the regular Mission Support infrastructure of the Mars Society Headquarters in Denver/Colorado was used. MDRS operations were monitored by ground-based operators. However, in order to ensure that the AustroMars team had a clear and concise picture of events, a Flight Control Team (FCT) consisting of Flight Director, Technical Support and CapCom performed a number of operations support activities, using data from both the down linked telemetry (habitat environmental conditions), dumps of the various on-board system logs and on-site measurements. These activities occurred both in real-time and non real-time (off-line). The FCT was also the core team that was on duty 24 hours a day, for the whole 2 week simulation phase. The FCT depended on data supplied by the Flight Engineer as well as the on-site technical support team – in the form of daily Engineering Reports as well as direct communication via Skype.

The Simulation 1st - 23rd of April 2006

(Excerpts from the Commanders personal logbook)

Flight Crew and the On-Site Support Team left Austria early on Friday 31 March 2006, then spent a day in Salt Lake City acquiring the remaining equipment and supplies. The crew arrived at the Hab on Saturday 1 April 2006 and took over the station from Crew 47's Commander, Jan Osburg, around 10:00 the following day, after we had received an excellent MDRS training by crew 47. The rest of Sunday was spent with the unpacking of stuff, fixing of the ATVs and a successful test-flying of the Aerobot.

On Monday the unpacking of specific gear continued and Wendy got fixed again (exchange of broken starter). MSL and MSP went to Salt Lake City to retrieve the AustroMars Rover, while the rest of the crew did some photo and video shooting together with the Austrian Broadcasting Corporation.

Tuesday saw the execution of a successful Search and Rescue dress rehearsal. Also the Aerobot was finally outfitted with a "Black Widow" Webcam, which was tested successfully. Unfortunately we could not test-fly the Aerobot because of very strong winds. Both the PsychoMars and MedMars experiment were initiated to have a base line sample.

On Wednesday, the AustroMars Rover "Sisi" was successfully started up (at least partially); the MedMars Monitoring experiment and a dress rehearsal of the EVA suit donning procedure were held.

Thursday featured a public outreach activity in the morning during a live telecon with the Austrian Secretary of State Mr. Eduard Mainoni while he was visiting the MCC Salzburg. 30 guests and several media representatives from TV and print media attended the event. Inside the MDRS, the preparation of the laboratory area continued, the EVA room was cleaned up and an airlock light installed. We finalised the sealing of the window and installed a battery terminal. Alexander, our First Officer, celebrated his 28th birthday and stated that this was for sure the most peculiar one in his life (so far). On Friday, we did the final preparation of the Hab for the start-up of the simulation. The rover preparation was successfully finished, hardware and software are running and the rover made its first movements outside. Our "part-time crew" (TV team, newspaper contest winners, artist) left early afternoon, leaving just Crew and OSS at MDRS site. OSS procedures during Simulation were finalised together with Mission Control in Denver and MCC Salzburg. There was also a public outreach activity in the morning during a second live telecon, this time with the Governor of the Federal State of Salzburg, Ms. Gabriele Burgstaller, during the MCC-organised "Mars Party" in Salzburg, involving dozens of guests, families of the crew, VIP, etc.

We entered full simulation mode as planned on Saturday morning, immediately before sunrise. The AustroMars mission was then officially started at 0500 with EVA crew #1 (Frischauf, Groemer, Soucek) being deployed northerly of WPT 359. After a walk through the dawning of the day, the crew reached Repeater Hill just in time to see a magnificent sunrise behind the Hab. Following some minutes of calm and enjoyment, the crew inspected the outside of the hab and then entered the main airlock for a 10min re-pressurization. After the EVA was completed, EVA Crew #2 was cleared to leave the descent vehicle at landing site and approach the Hab, where the crew (Spiss, Kandler, Hutsteiner) arrived shortly after 10 a.m. The rest of the day was extremely busy with establishing power and communication, storing equipment, declaring Hab ground safe, etc. Various experiments started today already, including: Myograph, fluid balancing, installing of Object tracker experiment, medical routine measurements (weight, blood pressure, body fat and body water), saliva sample, skin probe sample.

During the first official night on the Red Planet, everyone recovered from the previous day's early morning landing. Sunday chased the crew out of beds at 0600. After breakfast and power check, N. Frischauf (CDR) and Christian Hutsteiner (FE) prepared for the first regular EVA, which served as engineering EVA checking the outside of the Hab, the ATVs, the Greenhab (outside), etc., leading to ground operational declaration.

No anomalies reported. During this EVA, Frischauf and Hutsteiner also took a camera with them, and the real-time videos received were stunning. A second EVA afterwards was conducted to take Geology emergency samples, preparing for an eventual emergency return to Earth. Other activities of the day included Rover testing and work, the Pupillomyograph experiment, the PsychoMars questionnaires and saliva samples, and more.

Monday was marked by two EVAs, the first one for BioMars sample return, the second one for WLAN installation and operation testing. The BioMars EVA resulted in six samples taken and brought back under sterile conditions; all samples were procured in the AustroMars Glovebox during the afternoon. Other activities of the day included saliva sampling, reports, work on broken PLSS #3, and the first test batteries for the Fatigue Monitoring System (FAMOS) experiment.

The power issue of the first few days had finally been solved.

Tuesday's main activities during the morning included the second BioMars EVA covering a total distance of 16km and collecting 10 samples, media activities (switch-x videoconference system in superior quality), another Rover test (the crew does not give up and chases two electronic problems, one in the power distribution system, another in the Telecommand Unit) and EVA planning for tomorrow. The afternoon was intensively packed with diverse tests, including, as every day, the Pupillomyograph, FAMOS, Object Tracker, urine samples and others, as well as a new psychological test (CogHealth). Furthermore, primary cultures were procured from today’s biological samples in the GloveBox.

Power issues have stabilised. Everything was on track.

The crew shot a Yuri’s Night video to greet all participants of the next day's world space parties. Wednesday started with the third LiMa (Life on Mars) EVA in three days, again collecting samples from two WPTs, and, filling the last 30min, trying to fly the Aerobot, a flying device with mounted optical MiniCam for local area reconnaissance. Due to heavy winds, however, this testing had to be postponed. Breakfast and lunch were framed like every day by various tests (FAMOS, Pupillomyograph, medical measurements).

In the afternoon, the second EVA crew of the day prepared for a novelty in the history of the MDRS: For the first time, sterile suits were used on top of the EVA suits to quantify contamination during an EVA, in general and locally on different areas of the suit (also, micro spherules were applied on one normal EVA suit to quantify cross-contamination). This extensive experiment required two hours for suit-donning, including two assistants in sterile TYVEK suits. Difficulties were discovered only from a technical point of view (attachment of sample bags and fragility of sterile silver-gold suits). Nevertheless this first AustroMars Track and Trace EVA added a unique new feature to the list of MDRS experiments and discoveries; the sample patches will be procured and examined in the coming days, and the crew eagerly awaited the second attempt the next day, combined with a MedMars rescue operation simulation - a challenge, that's for sure. After a new round of skin and saliva samples early evening, the crew prepared for the first relaxing evening of the mission: to celebrate Yuri's night on this very special 12th April 2006, 45 years after the door to human endeavours in space was first opened.

Thursday saw a mission feedback and wrap-up session in the morning and a medical rescue operation EVA in the afternoon. The EVA was originally intended as a geological excursion to take more samples from a site where white piles indicated gypsum abundances south of Phobo's Peak. After taking that sample, XO Soucek in an "intended" mission anomaly- fell down and injured his right ankle. A level 3 emergency (means: abort EVA; secure equipment and crew, return to station) was declared and telemedical support initiated by the Habcom to the Flight surgeon team at Mission Control.

Two additional Crewmembers donned their suits in an emergency procedure which allows for a suit-up in about 20 minutes (instead of 60 minutes). The medevac team arrived about 30 minutes later on-scene, bringing a) equipment to stabilize the injured leg and b) to administer a liquid "analgesic" (lemon juice) into the drinking water system of the patient.

In an exhausting exercise, two EVA-team members carried the patient back to the hab, cycling him through the airlock and provide further medical treatment including the application of a cast.

Friday was a day of relaxation for the crew as no EVA was conducted. Activities concentrated on an extensive documentation of samples and data collected so far. Housekeeping procedures and daily tests (FAMOS, Pupillograph, Object Tracker, saliva and urine, medical basic data) were undertaken as well as the third part of the PsychoMars questionnaire battery. GreenHab work concentrated on fixing of the grey water sump pump and of the Webcams.

Saturday saw three EVAs involving five crew members. The first EVA was devoted for radiation shelter management (filling of sandbags, medical measurements), the second EVA for GeoMars (sample collection), the third EVA for repairing and testing Repeater Hill station and testing Aerobot. Various Hab activities including the bi-weekly safety check (smoke and CO detectors, fire extinguishers, airlocks), greenhab and housekeeping were undertaken. A successful test of the Aerobot took place in the afternoon, as well as a Crew feedback session with the MCC in the evening.

Sunday three crew members attempted the first long-range GeoMars EVA to White Rock Canyon. They collected various important geological samples and applied drilling techniques. Meanwhile the remaining crew had to fight against the storm and was forced for a short moment to break simulation in order to climb to the roof and fix a part destroyed by the wind. The operation was successful, images and a report on this event had been sent by MSL M. Spiss. The day ended with a simulated radiation warning and the crew spending two hours in the airlocks, our radiation shelter.

With Sol 9, the crew of AustroMars added another aspect to its intensive program: From now on until the end of the mission, we have switched to "exploration mode", based on a simulated discovery of traces of methane and water vapour at Factory Butte. Various scenarios and activities were being worked out together with MCC Salzburg, including establishment of long-range communication. Due to the high workload of the entire team, the crew's day started at 0500 sharply and included a long-range scouting EVA to Coal Mine Wash and an Engineering EVA to establish a new WLAN network. All scientific test series were continuing as usual, on top of the new scenario. The crew was extremely motivated and therefore had no problems with the prolonged daily schedules to come. Very strong winds in the entire area required careful work, especially during EVAs. The long-range scouting EVA had marked about six new waypoints which were detailed in the respective EVA report, and two new names for formations discovered on the way.

Tuesday was a calm sunny day, and the Hab did not disintegrate any more because of storm. Everything was in good status, except the nominal internet connection. From that time on until the end of the mission we were relying on WildBlue sat connection and it proved to be reliable. Nevertheless the normal connection disabled by yesterday's storm will have to be re-established. ATV3 - suffering from a flat tire when an old tire patch failed - was running again and in perfect shape after repairs.

Generator was down most of the day, at 1800 we were still running on battery, but work was going on to fix the problem. Tuesday's main activity was a five hour emergency rescue operation EVA to train the rescue of an astronaut out of a (small) canyon under sim conditions. For this, AustroMars brought extensive equipment from Austria's Mountain Rescue Services and MSL M. Spiss, a trained mountain rescuer and expert, conducted the test.

Everything worked well and we proved, both from a medical, engineering and logistics side, that such rescue operations are feasible and, given the right equipment (in this case specially designed by Austria's Mountain rescue association, patented and worldwide in use), safe and effective. The afternoon saw another engineering EVA to Repeater Hill in order to work on the WLAN network as well as to test the Aerobot. Besides, all scientific tests were successfully performed as usual.

Wednesday featured a one long-range combined BioMars and GeoMars EVA, performed by the XO, the HSO and the FE, led to interesting areas around the waypoints 235 and 239. The EVA crew took a dozen new waypoints and samples. A sterile external suit was in use again, as well as micro spherules applied to special patches on a normal suit, to measure cross-contamination. While the three person EVA crew was on mission, Mission Control surprised the remaining analogue astronauts with a medical anomaly (CDR was seriously burned by a small explosion in the lab), which they mastered without major difficulties (even though HSO was on EVA) - thankfully the crew had an extensive first aid training beforehand. The day concluded with reporting and science test cycles.

On Thursday we found out that the 12 V bilge pump was not strong enough to pump the water from the greywater tank into the Greenhab - FE and MSL found an interim solution with a bucket at ground level, where one pumps the greywater from the tank in, afterwards the 12 V pump can take it from there. In the morning Mission Control injected a medical anomaly - at 09:30, our Health and Safety Officer "fell off a ladder" and got a deep, strongly bleeding wound on his left lower arm, which had to be treated immediately.

As also the second medical expert of the team, our Mission Scientist for Life Sciences, was not available (GreenHab duty), two "greenhorns", CDR and XO, had to help, and XO performed a two-hour surgery stitching the wound in a sterile environment, demonstrating that such proceedings can be undertaken in the confined environment like the MDRS Hab. The afternoon featured another long-range EVA (CDR, MSL, MSP), combining engineering tasks and geological sample collection, and leading to Skyline Rim on foot. From there, direct Vox contact could be established with the Hab without Repeater Hill's help.

Friday, the last day of the AustroMars Mission saw a finale that was absolutely in alignment with this remarkable mission. Besides the usual communication issues with our primary satellite connection, which is constantly interrupted for very long periods and then starts to work surprisingly again, our Mission Control Center in Salzburg had organised the flight plan in such a way that two teams would explore Skyline Rim in alignment with Operation Edelweiss.

As on the day before, we were again able to establish direct radio communication with the MDRS from the edge of Skyline Rim. But as the quality of the signal was today only bearable and sometimes communication could not be continued at all, any crew that intends to follow our footsteps, continuing the exploration of

Skyline Rim, should make sure the radio repeater at Repeater Hill is fixed and operational again.

Once we had left Skyline Rim, HSO, XO and CDR wanted to go to a specific point at the Tank Wash to obtain some geological samples. Unfortunately this EVA had to be aborted on the way to the geological site because of radio communication problems. In the evening the whole crew gathered in the MDRS again, packing stuff and preparing for the flight home to mother Earth. This last evening was of course something special and we intended to celebrate it in a way that none of us will ever forget it.

On Saturday morning the door of the MDRS was again opened and immediately thereafter we met our On-Site-Support team, Johannes Nendwich, René Vidalli and Johannes Gross, as well as Andreas Koehler, our photographer – the simulation phase of AustroMars was successfully finished after 2 years of intensive preparation and execution.

Out of the 20 AustroMars experiments, 17 were finished successfully as planned, further analysis is still pending. For two of the remaining ones (FoodMars and TeleMars), the scientific return is less than expected because of events that were not anticipated, hampering certain aspects of these experiments. The Rover was partially successful as it proved its functionality in the Martian terrain, but could not be further tested due to a technical defect, which could not be repaired with the limited resources available at the MDRS.

Outreach and media activities

The wealth of information about Mars exploration and Mars mission preparation passed to the public during the months of AustroMars clearly showed that this topic is not a remote idea, but a matured undertaking. Even though a real flight will depend on a firm political decision, we are in the midst of preparation: Why delay things that can be done today? **Reaction of the public:** The AustroMars team was faced with curiosity as well as surprise, when people started to realise how much has already been done and how broad and elaborated current Mars exploration and mission preparation is. This “look behind the scenes", made possible by the numerous science and engineering partners of AustroMars, helped the topic to be perceived as something tangible by the broad public.

Perhaps the most important message of all: AustroMars made clear to the broad public as well as to more than 140 volunteers engaged in this project that any personal commitment counts. AustroMars showed that space exploration is not a domain of NASA employees or TV series, but a true "hands-on" experience, as long as someone is willing. Also, there is a great deal of questions still to be answered, and it does not need world-class experts for each and every problem. For many of the project team, AustroMars was the first close contact with the field of spaceflight and a unique opportunity to contribute to one of humankind's most fascinating endeavours.
The outreach work of AustroMars did not avoid the discussion with critics. Naturally, a reflected dialogue was given preference to an empty repetition of polemics (on both sides of the "Mars front", by the way). Crucial in this respect were (and still are) the contacts with the public during or after *presentations and lectures*. This allows for a dialogue and exchange of views. AustroMars therefore tried not to cocoon, but to be open.

Overall, the outreach can be grouped in four big waves of interest:

1. First wave: Kick-off and crew casting (September / October 2005)
2. Second wave: Announcement of crew, science teams and experiments (January 2006)
3. Third wave: The simulation in Utah (March / April 2006)
4. Fourth wave: Shut-down with science conference and large event (September 2006)

AustroMars also included an art project labelled "The Fields Of Mars" including the installation of balloons at the MDRS prior to the hot phase of the mission by the Austrian artist Helene Keller.

Acknowledgement

AustroMars was made possible by a major grant from the Austrian Ministry for Transportation, Innovation and Technology, allocated by the Austrian Research Promotion Agency as well as the considerate cooperation of the Mars Society and a group of industrial sponsors.
Above all, the mission was a success due to the dedication, conviction and tireless efforts of 145 volunteer scientists, engineers, medical doctors, students and space enthusiasts. This is the kind of people which might one day take us to Mars. – The right stuff for a new world.

Chapter 3
Forewords

Eduard Mainoni, Secretary of State

Austrian researchers and scientists have a long tradition in contributing to international space endeavours. This started at the dawn of the space age with pioneers like Guido von Pirquet, who calculated the trajectories to planet Venus used by the first soviet probes and was continued by Hermann Oberth, the mentor of Wernher von Braun and men like Friedrich Schmiedl, who created the first solid state boosters for rocket mailing services. Nowadays, Mars Express, Europe's success story in Mars exploration, has Austrian hardware on board and top-notch magnetospheric science research on the Red Planet is being carried out at the Institute for Space Research in Graz. Dispatching unmanned probes to Mars is only the first step in preparing for a much bigger endeavour: the first human mission. Sending man and woman on this great voyage is one of the most fascinating and challenging projects facing today's scientists and engineers but it also offers unprecedented opportunities in technology development. Countries investing in the early research for such a mission benefit in the long run through the development of a highly skilled workforce and an ever advancing knowledge in materials, engineering techniques and scientific research.

The Austrian Federal Ministry for Transport, Innovation and Technology, through the Austrian Research Promotion Agency, decided therefore to support the AustroMars project of the Austrian Space Forum. About half of the mission costs were covered by the Austrian Space Applications Programme, which annually invests approximately 6 million Euros in the national space industry and research institutions in addition to the national contributions to the European Space Agency's programmes. Compared with many other space projects, AustroMars was an outstanding achievement. In addition, there was a tremendous public response to the mission and the people behind the simulation, as demonstrated by the surprisingly high level of media coverage and the number of presentations which have taken place in schools, universities and other educational institutions all over the country. This encourages us to support the development of further projects like AustroMars in the future.

I would like, therefore, to congratulate the project team of the Austrian Space Forum and its many partners to a wonderful and inspiring project, which I had both the joy and privilege to witness. The pathway to a human Mars mission now has another small but significant paving stone in red-white-red.

Eduard Mainoni
Secretary of State for Research and Technology Development,
Austrian Federal Ministry for Transport, Innovation and Technology

Dr. A. M. Wordon,

Apollo-Astronaut

Dear fellow explorers,

In a few decades, humans will set foot on the Red Planet. It is very likely that the first person to step into the red dust of planet Mars is already born somewhere. To ensure, that this grand journey will be a safe and fruitful one, many preparatory activities are a necessity: AustroMars is one of many small paving stones marking the road to our planetary neighbour, exemplifying an increased international interest in space exploration and expanding human frontiers.

I second this ambitious project involving numerous experiments ranging from life and planetary sciences to human factors as well as testing exploratory strategies. Unifying so many volunteers, engaging the public and creating the necessary political impetus for such a project under the common banner of space research is an impressive accomplishment I would like to congratulate the AustroMars team.

Alfred Merill Worden,
Apollo 15 Command Module Pilot

Project management's foreword

"The inspirational value of the space program is probably of far greater importance to education than any input of dollars. A whole generation is growing up which has been attracted to the hard disciplines of science and engineering by the romance of space."
A.C. Clarke

For each team member, AustroMars meant something different. For some of us, it was a wonderful scientific experience, getting hands dirty in a simulated spaceflight environment, for others it meant being part of a marvellous project and making an own contribution to the advancement of technology paving the way to the Red Planet, for others – including the project management and executive team – it meant countless hours in meetings, teleconferences and personal encounters, a lot of sweat and hard work. For others, then, it was a unique opportunity for networking and career building – there is a number of success stories of people, e.g. students being involved in AustroMars first and now having started their career to become a professional in their field.

Like all new projects, the subject had to pass through three stages, which may be summed up by these reactions: 1)"*It's crazy - don't waste my time*"; 2)"*It's possible, but it's not worth doing*"; 3)"*I always said it was a good idea*."

For all of us, these two weeks in April were the galvanisation of both the space enthusiasm of 145 people, the necessary political will as well as the technological and scientific stimuli paving the next small steps towards a first crewed expedition to the Red Planet. For all of us, it was an immensely rewarding project in a field defined by looking beyond the horizon. Hermann Oberth once said "This is the goal: To make available for life every place where life is possible. To make inhabitable all worlds as yet uninhabitable and all life purposeful." There were times, when many of us felt like explorers.

In a long standing tradition of books and reports of Mars-related research and popularization which involve a substantial amount of emotion and work, this report is dedicated to the first child to be born on Mars.

Norbert Frischauf   Gernot Groemer   Alexander Soucek

Chapter 4

Mission Description, Context & Rationale

Background

The major European and US space entities have both initiated ambitious exploration programmes culminating in a crewed expedition to planet Mars. Regardless of the decision whether to send humans to the Red Planet within the next decade or the next 40 years, technologies and strategies have first to be developed to make such an endeavour a safe and affordable undertaking.

Mars is the next logical step in our exploration programmes[1]. In order to stimulate the necessary technology developments, the US-based Mars Society[2] operates a Mars-analogue station in the desert of southern Utah since 2000, where short-duration surface missions[3] are simulated.

Between 9th and 22nd of April 2006 (including a one-week preparatory phase on-site), the „AustroMars“ expedition carried out such a simulation: the crew, the support personnel as well as the majority of experiments came from Austria. The project is to be understood as a technology testbed for Mars analogue sciences, and, at the same time, a showcase of national research capabilities.

Besides scientific stimuli, AustroMars enhances – in connection with a plethora of media and outreach activities – the public perception of space activities and presents a vivid Austrian research landscape as a small, but significant European player in exploration activities.

Previous Situation

Various field experiments in the high Arctic/Antarctic, in laboratories, underwater-simulations or the desert mostly focus on classical geosciences or “isolated” technology demonstrations, while the Mars Desert Research Station is a first attempt to integrate planetary field sciences and exploration programmes to gain an in-depth understanding of space research beyond Earth-orbit.

In this context, AustroMars offered a solid science case with interdisciplinary character dealing with the following questions:

+ Planetary- and Geosciences

Can we do field sciences the same way as we know it from Earth? Most geologists agree. If so – what kind of tools and procedures need to be developed? What kind of non-geological activities are possible (e.g. astronomical research at no extra weight-cost with a small telescope)?

[1] Mars is the planet which is most similar to Earth; it has all resources to support life and it might be the place where we can find out if life is prevalent in the cosmos or exclusively on Earth.

[2] The Mars Society, founded in 1998, is a private non-profit space advocacy group which is also conducting research with regard to the human exploration of Mars.

[3] A typical simulation lasts 2 weeks, as this is being considered the shortest surface stay period for missions using contemporary propulsion techniques: staying more than 4 weeks would mean missing a launch window and staying another year, which would drastically change the mission scenario.

+ Life Sciences (Medicine, Psychology, Biology)

What are the main risk drivers for a safe passage of the crew? What kind of telemedical technologies need to be developed, and what can be used as a spin-off for terrestrial applications? What are the relevant human factors to be considered for such a long-duration journey?

+ Operative Sciences

The main research questions focus on the „modus operandi“: how can humans and robots work together in an effective manner? How can intrinsic scientific insights of analogue biology and geology be applied to human spaceflight?

The AustroMars Science Programme

Based upon literature, current and past experiments from analogue environments and laboratory experience - combined with information from expert talks and conferences - a science rationale was formulated. Non-scientific aspects, such as the technical feasibility, cost, short term feasibility etc. led to the definition of the AustroMars Science Programme, which has been divided into individual experiments.

Besides the individual experiments carried out during the mission itself, the crew selection processes and training sessions also served as a research platform.

The principal scientific objectives for Mars exploration include the search for evidence of ancient or extant life, the evolution of climate, the geological evolution of the planet, and the resulting inventory of its natural resources. These four principal science objectives have been recognized as essential elements in the current Mars exploration strategy, with a major emphasis on the search for ancient life.

This was carried out through orbital remote sensing, in situ analysis, and the return of samples to Earth for detailed study. The leading scientific disciplines involved include geology, geophysics, climate, meteorology, and exobiology. Others, like medicine or psychology are essential to keep the crew operational. Engineering and operational aspects were focussed on maximising the scientific range and output.

The Mars Desert Research Station

The US-based Mars Society – a non-profit space advocacy group doing research in the field of human Mars Exploration activities – operates the Mars Desert Research Station (MDRS), an analogue Station which is located in the desert of southern Utah, USA, near Hanksville (GPS coordinates **N**38°24, **W**110°47, see figure 1). The Austrian Space Forum as project lead organisation conducted a simulated surface sojourn on Mars between April 8 and 22, 2006.

The Mars Desert Research Station's central Habitat with Crew.

The purpose of such analogue stations is learning how to live and conduct science on another planet. Such habitats present a key element in current human Mars mission planning. The station's centerpiece is an 8m-diameter "Habitat", a two-deck structure mounted on landing struts, peripheral external structures, such as a small greenhouse and a small telescope facility. The MDRS serves 6 carefully selected "Analogue-Astronauts" as base for research activities, exploratory excursions in analogue EVA-spacesuits which simulate the hindrance real planetary spacesuits will impose on the crewmembers. All this is being done in strict isolation, including the time delay between Mars and Earth by inserting a 10min lag in all communications to a Mission Control Center (MCC) based in Austria under patronage of the Mars Society's Mission Support Center in Denver/Colorado.

Such analogue stations offer unprecedented opportunities to carry out Mars analogue field research in a variety of scientific and engineering disciplines that will help humans carry out a real Mars mission in the decades to come. Therefore, the station shall serve as a testbed for field operation studies helping to define key habitat design features, field exploration strategies, tools & technologies and crew selection protocols that

Upper (Command) deck (note the entrance to the sleep bunks in the back-ground) and Lower Deck of the MDRS.

will help to maximise the scientific output of a real human Mars mission. The facility has been operational since January 2002 and has served 40 expeditions in 4 field seasons so far, cumulating in roughly 70.000 man-hours of analogue experience, more than any other analogue station in the world.

+ MDRS Climate and Illumination

Average external temperatures vary typically between 16°C (record: 24°C, 1992) and 0°C (record: -19°C, 1975), with an average precipitation of 2,7 cm. The sun was above the horizon between 06:45 and 20:15 local time, but night time operations were also possible - provided that crew safety were guaranteed.

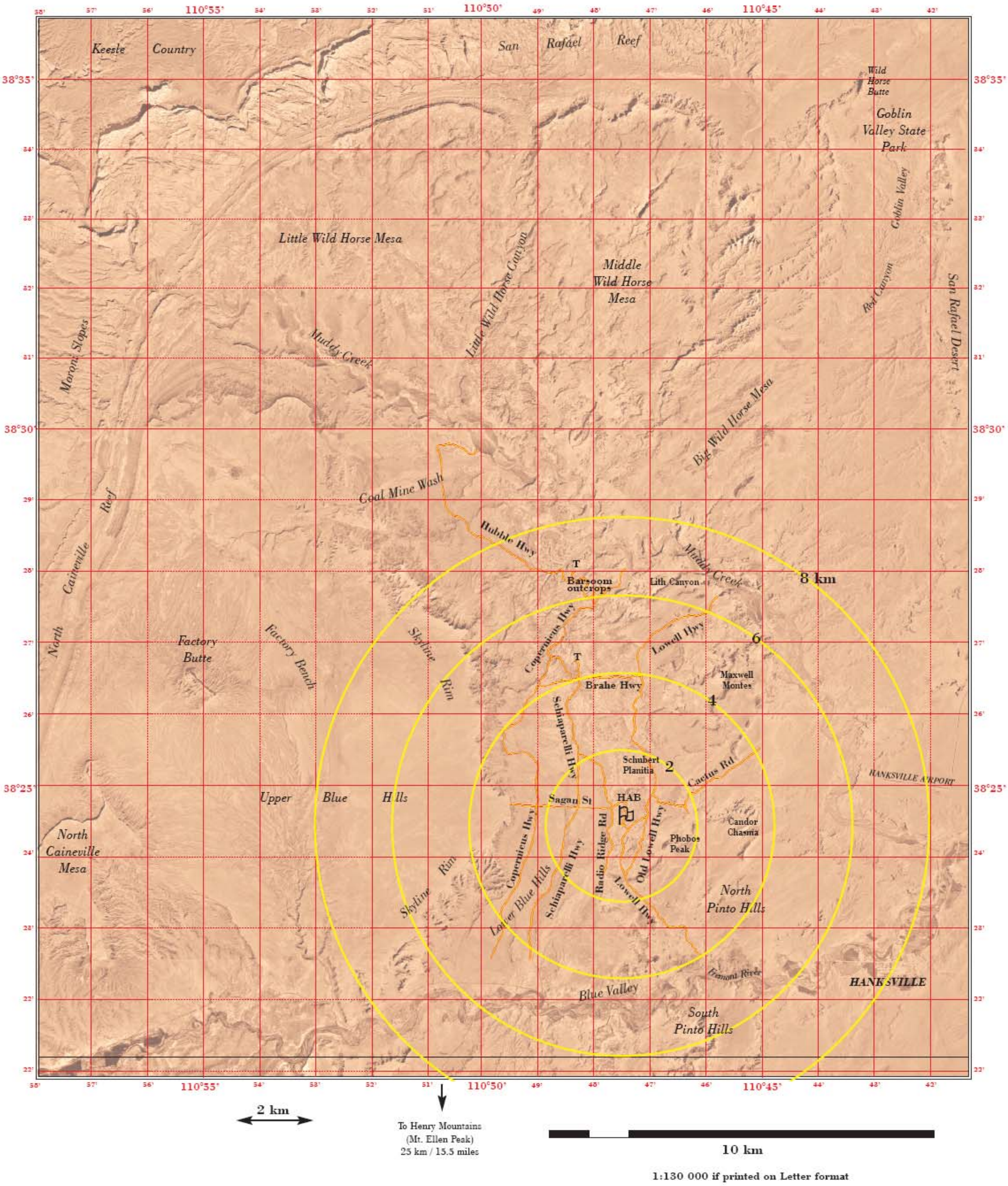
+ Habitat Setup

The habitat has a diameter of 8m and has two floors. The lower deck includes a laboratory area, 2 airlocks, hygiene facilities/toilets, EVA-suit storage and a small workshop. The upper deck (command deck) comprises sleep bunks, the kitchen area and the stations computers (including the satellite communication equipment, the remote operation computers for the telescope, etc…), a small library and medical supplies. A fictional satellite provided direct communication with "Earth" including a 10min time delay and reduced bandwidth.

Location of the MDRS

REGIONAL MAP OF THE MDRS HAB AREA

Wayne County, Utah, USA



MARS DESERT RESEARCH STATION
2006. 01.

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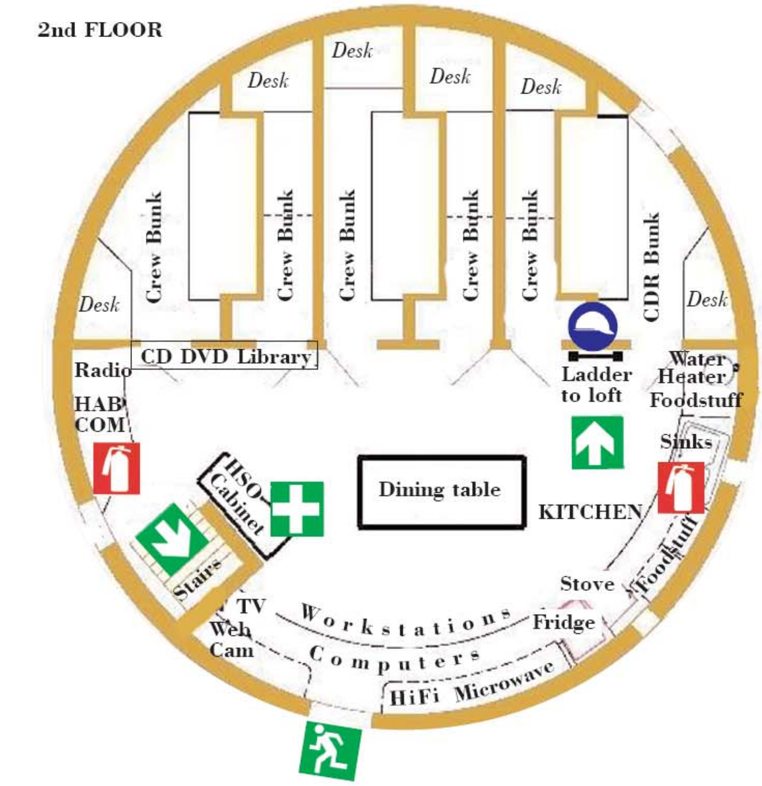

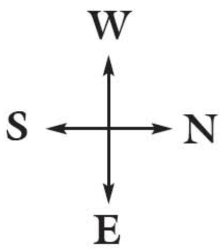

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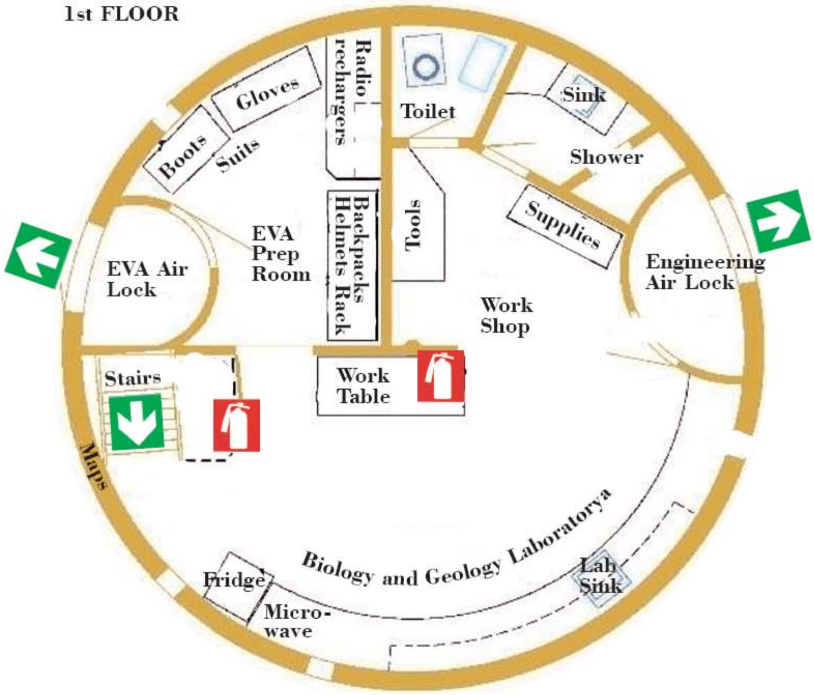

AustroMars Reference Scenario

As a human mission to Mars (HMM) is not likely to take place before 2030, only preliminary mission scenarios have yet been developed. In the recent years, ESA has performed mission analysis and design tasks which have been presented in the 2nd Aurora Working Meeting[4]. Another framework for the human exploration of Mars was given by NASA's Reference Mission, which has been developed by the Mars Exploration Study Team[5]. Some mission elements are common to all reference scenarios and are thus very likely to be effected. The reference scenario presented here is based on the following assumptions:

- **Launch Date:** around 2030
- **Major Objective:** Exploration of Mars
- **Highest Priority:** Safety of Crew

  ⇒ 1st Mission(s) to be conducted with fast transfer / short surface sojourn approach

  ⇒ Later missions feature longer surface stays while trying to minimise transfer time

  ⇒ Moon to be used as a test bed to validate technologies and procedures

- **Implementation:** International Collaboration
- **Facility on Mars:** Permanent Outpost, with location being driven by the abundance and availability of resources such as water to enable In-Situ Resource Utilisation (ISRU) and In-Situ Propellant Production (ISPP)

  ⇒ Energy-rich (high power) permanent Outpost to enable ISRU and ISPP

- **Launcher Availability:** ARIANE 5 Evolution Class only (no heavy lift launch vehicle development assumd)

  ⇒ Assembly in low Earth Orbit (possibly using ISS or a similar orbiting platform)

  ⇒ Split Mission (high mass transfer performance for cargo, short transfer for crew)

A manned mission to Mars might be carried out as follows:

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[4] The information presented at this meeting is publicly available and can be downloaded at ftp://ftp.estec.esa.nl/pub/aurora/WM2_14-15_05_2003/Presentations.

[5] The NASA Mars Exploration Study Team's Reference Mission is available at http://exploration.jsc.nasa.gov/Marsref/contents.html

- A series of unmanned missions will be conducted before humans are launched towards Mars. These unmanned missions will transport equipment to the surface and orbit of Mars. A Mars Decent/Ascent Module (MDAM) will be deployed in Mars orbit while a second, identical MDAM will automatically land on the surface along with additional equipment: A habitation module, a surface vehicle (rover), a power source (such as a nuclear reactor), an in-situ resource utilization (ISRU) facility and an in-situ propellant production (ISPP) plant will most likely be needed. Furthermore, scientific equipment and consumables will be transported. As the duration of the Earth-Mars transfer is not thought to be critical for cargo mission applications, an energy efficient trajectory and an engine with high specific impulse to minimize transport cost may be chosen.

- Upon arrival of the automated equipment described above on the surface of Mars, in-situ propellant production will start. As soon as enough propellant has been generated on Mars to fully fuel the MDAM on the surface to ensure a safe return of the crew, a manned craft (the Crew Re-Entry and Transfer Vehicle CRTV) will be launched from Earth. Some scenarios foresee a docking with an earlier assembled second spacecraft in earth orbit, others foresee a direct launch towards Mars. In any case, the crew will transfer towards Mars. The trajectory of this crewed flight will be such to minimize radiation exposure and microgravity time. This will increase the transfer's energy demand but enhance crew safety. Crew transfer from Earth to Mars will take between 150 and 200 days.

- The CRTV is inserted into Mars orbit, where it docks with the MDAM. The crew transfers into the MDAM and descends to the surface of Mars, subsequently transferring into the habitat The crew stays on the surface for at least 30 days and will conduct activities to progress with the exploration of Mars and to prepare for follow-on missions. Extravehicular activities (EVAs) will be conducted as well as excursions in a surface vehicle. A large number of scientific experiments will be carried out.

- At the end of the surface stay, the crew launches to Mars Orbit with the MDAM which has been positioned on Mars' surface before their arrival. This ensures that the crew can leave the surface in case of emergency without having to await the MDAM being refuelled. The MDAM docks with the CRTV. Some scenarios foresee refuelling of the CRTV with propellant brought from Mars, other scenarios assume that a fully fuelled transfer stage has been brought from Earth.

- The CRTV accelerates towards Earth and leaves the MDAM in Mars orbit, where it might be used for the next human mission. Upon arrival at Earth, the crew transfers into a descent capsule and performs re-entry into the atmosphere. The CRTV will either be parked in an Earth orbit, where it might be used for the next mission or will be discarded and sent into an interplanetary course towards the Sun.

Several key issues have not yet been decided upon. These key issues comprise the method of propulsion for the CRTV (chemical, thermo-nuclear or electrical propulsion systems), the method of orbit insertion (aero-braking or propulsive orbit insertion), the extent of hardware re-use and the decision whether a permanent outpost will be built, which can be used by several successive manned exploration missions.

Crew safety will certainly play a major role in a human mission to Mars. On the one hand, this is due to ethical considerations, on the other hand public support is likely to vanish in case of fatalities. Exploration is – and has always been - an adventure involving considerable risk, which is generally accepted by partaking people. Nevertheless, spaceflight is subjected to very high standards, which are often exaggerated and negatively influence efficiency.

A scenario featuring nuclear thermal propulsion (NTP) is outlined below. This NTP scenario is closely related to NASA's reference mission. It is based on the assumption assumes that the entire mission will be based on utilizing nuclear thermal propulsion only. Thrust is high (several kN), specific impulse is moderate (900 – 1000s) hence a fast transfer ($\leq$ 150 - 200 days) at the expense of moderate amounts of propellant seems feasible.

Mission Sequence

- Pre-requisite: Fully operational Martian Outpost
  Outpost on Mars is fully established, has been set-up by several robotic cargo missions beforehand. All outpost modules, including both the ISRU and ISPP facilities (based on either: H_2/O_2 – CH_4/O_2 – CO/O_2 cycles) are fully operational. Two fully tanked Mars Descent/Ascent Modules, which have been sent beforehand, are already waiting (one at the outpost, the other one in VHMO).
- Spaceship assembled in LEO
  Possibly by using ISS or a similar orbiting platform.
- Spaceship transferred from LEO to VHEO (close to escape)

The Spaceship is still unmanned. The transfer could either be done via an SEP-Tug, by the NTP engine itself or via on the spaceship installed electric engines, if the spaceship utilizes a bi-modal NTP system.

- Crew Re-Entry and Transfer Vehicle (CRTV) launched into VHEO

The CRTV could be an upgraded Sojus Capsule to perform the ascent as well as the descent and landing when returning from Mars.

> ***Safety first:***
> If CRTV is not placed into sufficient high orbit, crew returns with small correction maneuvers at apogee to Earth at next perigee.

- CRTV docks with Spaceship

> ***Safety first:***
> If docking fails, crew makes small correction maneuvers at apogee and re-enters at next perigee pass.

- Crew boards Spaceship

Crew performs extensive checkout of Spaceship.

CRTV stays attached to Spaceship, is hibernated to serve as Earth Re-entry Vehicle on return (can “re-boot” quickly to serve as safe haven if needed).

- Spaceship leaves VHEO
- Spaceship accelerates at Perigee

Hyperbolic Transfer to Mars (high Delta-V, $<$ 200d of transfer, short stay time)

Hohmann Transfer to Mars (low Delta-V, $\approx$ 200d of transfer, long stay time)

- Spaceship coasts to Mars
- Spaceship arrives at Mars

Aerobraking and a (as small as possible) propulsive maneuvers to stay in VHMO is performed

- Spaceship docks with Mars Descent/Ascent Module (MDAM) in VHMO

MDAM has been parked in VHMO beforehand.

Crew performs extensive checkout of Spaceship and MDAM.

- Crew descends to Mars with MDAM

The spaceship stays in VHMO. The MDAM lands via aeroentry nearby the Martian Outpost, where a similar fully tanked MDAM, which has been sent beforehand is already waiting.

Whether the whole crew or only part of it lands in the cause of the first mission needs to be further assessed.

Safety first:

Fuel production and storage at the Martian Outpost has to be sized such as to allow for the freshly landed MDAM to replenish its fuel tanks within a minimal duration of less than 30 days.

- Crew explores Mars for 14 days

  The crew checks out both MDAMs to ensure their full operational readiness.
- Crew ascends with "old" MDAM into VHEO

  "New" MDAM stays at surface for next crew.
- MDAM docks with Spaceship

  Safety first:

  If docking fails, crew makes small correction maneuvers at apoapsis and re-enters at next periapsis pass for a return to Martian Outpost.

- Crew boards Spaceship

  Crew performs extensive checkout of Spaceship. MDAM is either discarded or parked in VHMO to serve for follow-on mission.
- Spaceship leaves VHMO
- Spaceship accelerates at Apoapsis on:

  Hyperbolic Transfer to Earth (high Delta-V, $<$ 200d of transfer)

  Hohmann Transfer to Earth (low Delta-V, $\approx$ 200d of transfer)
- Spaceship coasts to and arrives at Earth

Aerobraking and (as small as possible) propulsive maneuvers to stay in VHEO are performed

Safety first:

It must be assumed that an aerobraking manoeuvre - although feasible - might not be undertaken due to the severe environmental implications that go along with the re-entry of a hot reactor in a catastrophic failure scenario.

- Crew Re-Entry and Transfer Vehicle (CRTV) is powered up

  Crew performs extensive checkout of Spaceship and CRTV.
- Crew descends to Earth with CRTV

  The spaceship stays in VHEO; the CRTV lands via aeroentry at a pre-selected place.

  Safety first:

  CRTV has to be designed such (Propulsion, Thermal Protection System, Life Support System) as to allow for a direct entry from interplanetary space (departure of CRTV before the spaceship has established VHEO – in case the spaceship's propulsion system fails).

Parking the spaceship in VHEO at the end of the mission assumes that it is feasible to re-use a big part or the complete spaceship for a later HMM. This is an important issue, especially in the case of an NTP system, with its associated high cost for the propulsion system. If the spaceship is to be discarded, the "Safety First" requirement becomes extremely important as the crew will have to depart several days before the encounter to allow for sufficient time to send the capsule on a re-entry course, while the spaceship will remain on a non-collision course with respect to Earth.

The mission scenario described above has been analyzed to identify all implications for a high-fidelity simulation such as AustroMars. The findings are discussed below:

- International Collaboration
  A mission to Mars will most likely be an international endeavour with participants from many countries and cultures. Some organizations participating in AustroMars are US-based (Mars Society, University of Texas in Galveston). Intercultural cooperation was thus a key element of AustroMars.

- Safety
  Crew safety will be the governing design driver for a human mission to Mars. For every human space mission, this is reflected both in hardware design (double failure tolerant design for systems critical to crew survival, redundancy) and operations/mission procedures. The AustroMars simulation applied the same standards to its procedures. Research on fatigue-induced human error were conducted in the framework of the FAMOS experiment.

- Split Mission Design
  A human mission to Mars will most likely rely on the "split-mission" concept, i.e. crew and equipment are transported to Mars on different trajectories. This means that the crew found operational equipment (habitat, rover, etc.) upon arrival. Extensive check-out activities will be necessary to assure a safe surface stay. The same was true for AustroMars.

- Science & Exploration

  Exploration of Mars is the main goal of a human mission. AustroMars contributed to exploration science by performing important experiments on planetary protection (BioMars), astronomy (TeleMars), geology (GeoMars), and robotic exploration (MDRS Rover, Aerobot). Furthermore, management issues were addressed in the experiment “Exploration Management”.

- Surface Time

  The time spent on the surface of Mars will typically be in the range of some tens of days. AustroMars simulated a mission with a somewhat similar duration. Results from AustroMars will help to design more realistic mission schedules with an appropriate number of tasks.

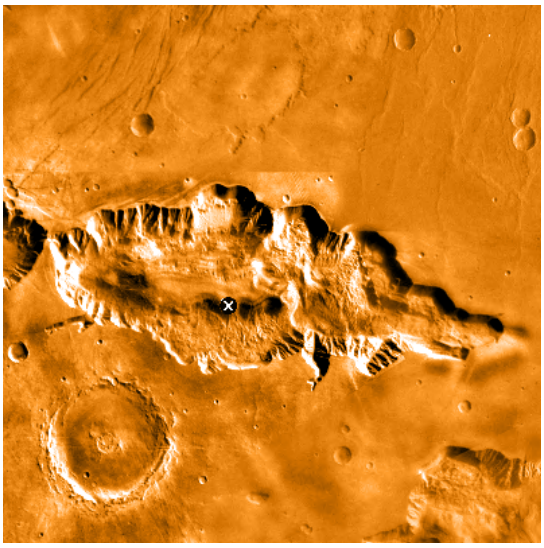
- Isolation & Communication

  A human crew on Mars will find itself in a highly isolated environment. Communication with Earth will only be possible during short intervals, with delays in message transfers of several minutes. The resulting deprivation of social stimuli and the need to make quick stand-alone decisions without the support from the Mission Control Center on Earth in times of danger will subject the crew to considerable psychological stress. This problem was addressed in the experimental suite “PsychoMars”. Furthermore, medical emergencies pose a great threat as contact to qualified medical personnel might not be possible. Medical problems thus were needed to be solved by the crew (MedMars, PhysioMars).

- Mass and Surface Equipment

  It is evident that the mass transported to the surface of Mars should be kept as low as possible to minimize cost. This is in direct contradiction to requirements imposed by human factors considerations, which call for large and comfortable habitats and transfer vehicles to avoid reduced crew performance. The results from the experiment “Habitability” advanced the knowledge about the optimum compromise between mass and comfort.

The AustroMars Reference Landing Site was Hebes Chasma



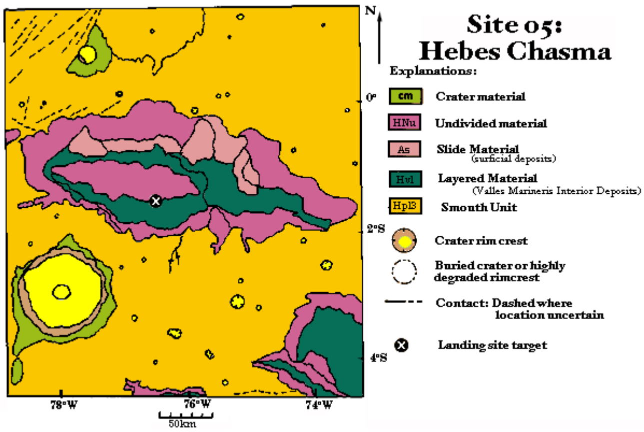
Latitude: 1.5°S

Longitude: 76.5°W

Elevation: 5 km

+ Geologic Setting

The site is located in Hebes Chasma, an elongated, closed canyon that is part of the great Valles Marineris system. The landing target is located in an area where layered rocks have been exposed, apparently sedimentary rock formations.



Within this Martian canyon there is a raised plateau (or "mesa") which dominates the landscape of this huge depression and is also made up of layered rock formations. The canyon floor is covered by deposits of the youngest period (Amazonian) which presumably lie on top of the older (Hesperian) bedrock that forms the valley bottom.

+ Scientific Rationale

The origin of the giant Valles Marineris system is thought to include episodes of massive crustal faulting and erosion by wind, water and landslide. Most of the vast quantities of water that flowed through the system evidently drained out to lower ground at the eastern end.

However, for some of the closed canyons, water would have been trapped to form vast lakes - environments that led to sedimentation and that may have favored complex chemical evolution. Thus, the layered deposits exposed in the walls of the Hebes mesa may well include water-laid sediments with preserved organics and, even, fossils.

+ Exobiology Significance

Spur and gully landforms characterize the sides of the mesa and, by Earth-based analogy, suggest erosion by water, perhaps episodic. The steep slopes that form the base of the mesa are interpreted to be rock falls and debris avalanches from the rim and walls of this plateau. Landslides cover the basin floor in places.

The proposed landing site is on the basin floor, at the edge of a debris slope that rises steeply upward, towards the mesa rim. This will provide the rover with access to rocks that have broken off from the layered formations in the mesa walls and rolled down to the canyon floor.

Chapter 5
Management

5.1 Project organisation

AustroMars was operated by the Austrian Space Forum as legal entity[6]. All partner institutions (university institutes, companies, volunteers, etc.) are tied to the Austrian Space Forum as leading institution. Memoranda of understanding mutually signed cover this cooperation.

AustroMars can be conceived as research platform with interdisciplinary character. Hence, the wide variety of projects and scientific research under the umbrella of "AustroMars" requires decentralisation not only in project management, but also in financing. Financing of scientific projects led by partner institutions is covered by those institutions or sponsors acquired by them. There are no mutual obligations other than a commitment of cooperation for an optimal scientific output under the frame of AustroMars.

[6] The Austrian Space Forum is a registered non-profit association in Austria ("uneigennütziger Verein"). The executive board is its outside representation.

AustroMars is based on a flexible management system allowing for decentralised task management and execution. The project is split into a horizontal as well as a vertical organisation. Vertically, the hierarchy descends from the project lead, to the management team, to the unit and team leaders down to single project participants. Horizontally, AustroMars is split in five units, coded 10 to 50, or with colour code (see below). These five units represent the thematic structure of the project.

Project Lead

The project lead was spilt within a team of three project leaders constituting the **final point of responsibilities**. These were: Gernot Groemer, Norbert Frischauf and Alexander Soucek, all at the same time members of the Executive Board of the Austrian Space Forum. Each of the three was allowed to take project decisions; this normally followed a mutual consultation process. However, if the need arouse, the project leaders were entitled to decide in one person.

Decisions of the project lead were binding for all members. However, as AustroMars followed the Austrian Space Forum's tradition of project execution, every team member was invited to articulate any issues of importance at any time to the project lead, or a respective hierarchical level below. Decisions of fundamental importance for the success or image of the project were first discussed in the Management Team Meeting (MTM, see below).

Inward communication to the project lead, in all general matters, and beyond thereof in any case it deems reasonable, used the general email leitung@AustroMars.at. This significantly eased the cross-management communication in the project.

Outward communication: The project lead informed the entire AustroMars team on a regular basis about proceedings of the project. This information, called "Montagsmail" (Monday mailing), is described below. Furthermore, the project lead secured optimal case-to-case communication.

Executive Staff ("Stabsgruppe")

During the preparatory week and the simulation itself, N. Frischauf, A. Soucek and G. Groemer were part of the Utah crew and as such not available for day-to-day operations in Austria. Therefore, an executive staff team was established having all authorities to conduct and manage the AustroMars project. This executive staff group consisted of the following individuals:

- **Willibald Stumptner** (Lead)
- Florian Selch
- Daniela Scheer
- Katja Bedenik

This team made decisions, including financial, media and staffing decisions necessary to ensure a smooth project. This included dealing with media and VIP-visit requests at the Mission Control Center.

The Units

AustroMars was split in *five thematic units*, which allowed for a decentralised, more effective management:

- Science (CC[7] blue, NC[8] 10)
- Engineering (CC green, NC 20)
- Humanities (CC red, NC 30)
- Logistics and Support (CC yellow, NC 40)
- Mission Control Centre (CC black, NC 50)

Each unit had, as focal managerial point, a unit leader. The unit leader assumed all responsibilities for the entire unit, as he/she had the final decision power for the entire unit. The unit leader had, furthermore, the duty of immediate and effective communication towards the project lead. He / she delegated as much duties as reasonable within the unit and the teams (sub-splitting the units). For all activities within the unit (except where not deemed reasonable) the unit leader provided for a constant updating.

AustroMars Unit leaders:

Science:	Gernot Grömer
Engineering:	Norbert Frischauf
Humanities:	Alexander Soucek
Mission Control Center:	Willibald Stumpner
Logistic & Support:	Gernot Grömer

[7] Colour Code
[8] Numerical Code

For communication from the Unit Leader to the entire unit, a special email was be used: [unit name]@AustroMars.at. In the following, each unit is described including a managerial breakdown in teams. Unit leaders as well as team leaders (in brackets) are identified.

AM10 SCIENCE UNIT

For a detailed description of the teams, please refer to the science and team sections of this document.

AM11 BioMars (Birgit Sattler)
AM12 TeleMars (Paul Beck)
AM13 PhysioMars (Sandra Lengauer)
AM14 GeoMars (Iris Lenauer)
AM15 MedMars (Berthold Moser)
AM16 PsychoMars (Florian Juen)

AM20 ENGINEERING UNIT

For a detailed description of the teams, please refer to the engineering and team sections of this document.

AM21 Habitability (Barbara Imhof)
AM22 Crew Management (Willibald Stumptner)
AM23 MDRS Rover (Robert Klotzner)
AM24 Aerobot (Norbert Frischauf)
AM25 Object Tracker (Luzian Wolf)
AM26 Famos (Luzian Wolf)

AM30 HUMANITIES UNIT

The third unit of AustroMars was special both in terms of content and positioning within the overall project. “Humanities” was not more than a compromise term allowing for quick comprehension of what can be called a very inhomogeneous accumulation of several important duties / work profiles. In short, all what cannot be described under (natural) science or engineering (the latter ones building the nucleus of AustroMars) fell within unit 3000. This included sociological sciences, law, philosophy (hence the unit name “Humanities”) and art as *material aspects*, project documentation, media relations and event organisation as *administrative aspects*. Note: Only these administrative aspects were governed outside the unit 4000 Logistic and Support! All other admin issues fell into the fourth unit.

The third unit was sub-split in three teams, headed by the following personnel:

AM 31: Documentation and Media

Team leader**:** Gerhard Groemer (documentation), Daniela Scheer (Media)

Content**:** This team had of two key activities, directed inwards and outwards of the project. Documentation (inward) included the chronicle project documentation with means of recording and collecting, i.e. photography, video recording, texts, collections of key items (articles, interviews, etc.). Emphasis layed on the photographic documentation. The Media relations (outward) included proper processing and preparation of media-relevant texts, i.e. press releases and information notes. Both parts of this team were strongly interlinked. Additional tasks: assistance in the website editorial work, updating of the AustroMars press review, conducting interviews with project members, maintaining the photo archive and selecting images for media release.

AM 32 Social Sciences, Law & Philosophy, Art

Team leader: Alexander Soucek

Content:This team comprised all material aspects of the AustroMars project beside natural and life sciences or engineering. The work within this team was split on a case to case basis, and input had been received on the basis of various little projects. One key goal of the team lead in team 32 was to communicate AustroMars to a scientific audience usually not dealing with space. Diploma thesis's or small projects / workshops in such environments were desirable, as is the comprehension of artistic work.

AM33 Public Outreach & Education, Event Organisation

Team leader: Alexander Soucek (Education), Katja Bedenik (Events)

Content: Team 33 managed any outreach and education activities, as well as – in close cooperation with the Logistic and Support Unit – all administrative issues dealing with the organisation of AustroMars events. Such events shall not be confused with AustroMars-internal meetings or team events. Rather, this denominated outreach events with informal or entertaining character addressing the public.

AM41 Administration (LSU-ADM)

Team Leader: Gernot Groemer

Content: The AM41 team was responsible for the following items:

- Legal Issues, Contracting (Alexander Soucek)
- Finances (Bettina Frischauf), incl. Payrolls
- Archive (incl. Document tracking) (Oliver Hauser)
- Science Archive (Kerstin Zimmermann)
- Transportation (Oliver Hauser, Rene Kolb)
- Quality Management (Walter Schuster)
- Property Master (Inventory, etc.)

AM42 IT-Services (LSU-ITS)

Team Leader: Olivia Haider

Content: The AM42 team was responsible for the following elements:

- Programming and maintenance of website (Olivia Haider)
- Database programming & technical maintenance (Markus Keller, Oliver Hauser, Nikolei Haider)
- Corporate Design management
- Logbook (Maria Pflug-Hofmeier, Humanities-Unit)

AM43 Personnel (LSU-PER)

Team Leader: Markus Haider

Content: The AM43 team was responsible for the following items:

- Flight Crew Selection process

  - automated psychological screening (Dietmar Kratzer)
  - psychological interviews (Doris Peham)
  - Medical testing (Mischa Todeschini)
  - Lower-Body Negativ Pressure testing (Helmut Hinghofer)

- Flight Crew Training
  - ATV Training & Media Training (Hermann Brunner)
  - Theory training

- Flight Crew Safety (ensured, that Crew safety is properly ensured at all times during selection, training and simulation phases)

- Volunteer Coordination
  - Recruitement, Introduction & Transfer to Units (Markus Keller)
  - maintainance of Volunteer database (David Gschließer)

  Checked, if volunteers wanted additional responsibilities, maintained overview over volunteers workload and utilization

AM50 MISSION CONTROL CENTRE UNIT (Willibald Stumptner)

AM51 Mission Control Center (MCC)
AM52 Procedures & Flight Plan (Boris Wilthan)
AM53 On-site Support (OSS) (Back-up Flight Crew)

Decentralised Management within the Units

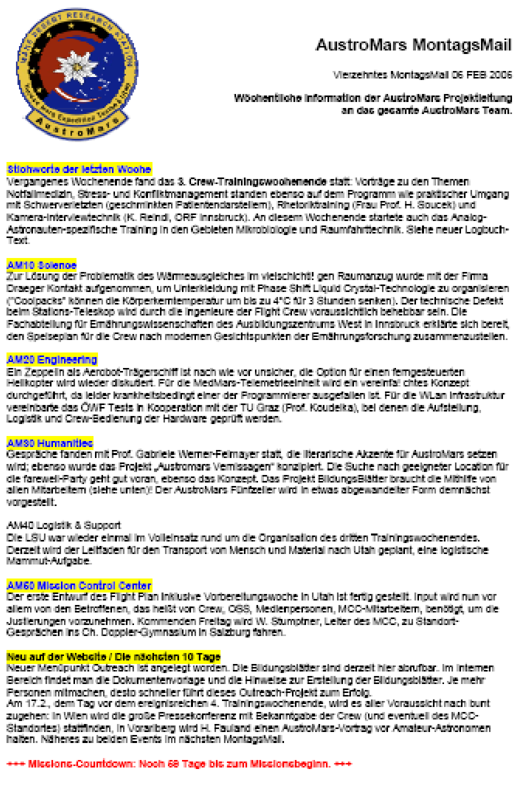
The complexity of AustroMars required a decentralised management. The latter one worked well based on a) good and fast communication and b) a thorough sub-split of activities. The unit leaders implemented these preconditions; thereafter, all members of each team worked with most autonomy possible, keeping themselves updated through study of the website and the weekly Monday Mailing, approaching actively the unit leaders for proposals, activities or questions, and trying to organise themselves for concrete tasks (including organisation of possible assistance / helpers, replacements, etc.). The better this decentralised and partially autonomous chain of work functions, was, the more resources were freed for additional or in-depth activities throughout the whole project.

Team Member Duties: Information & Communication (IC)

As mentioned several times above, exhaustive **information** and **communication** was a key element for AustroMars. This was – despite the project leaders duty to inform and communicate properly at any time – also achieved with an active and self-organised involvement of each member of AustroMars. The project lead asked all members to be put in copy of any communication possible relevant or interesting for the project lead, as often as possible (leitung@AustroMars.at). Only if the loop was closed, the management worked most efficiently and, hence, effectively.

The Monday Mailing

With the weekly, standardised mailing – comprising very short, easy to access information on a nevertheless exhaustive basis – every project member of AustroMars received regular top-level information. Every reader was invited to comment or ask for further clarification, in case of need. The Monday Mailing has been sent to everyone involved in the AustroMars project. It could also be accessed at any time on the internal website space.



AustroMars MontagsMail

Vierzehntes MontagsMail 06 FEB 2006

Wöchentliche Information der AustroMars Projektleitung an das gesamte AustroMars Team.

Stichworte der letzten Woche
Vergangenes Wochenende fand das 3. **Crew-Trainingswochenende** statt: Vorträge zu den Themen Notfallmedizin, Stress- und Konfliktmanagement standen ebenso auf dem Programm wie praktischer Umgang mit Schwerverletzten (geschminkten Patientendarstellern), Rhetoriktraining (Frau Prof. H. Soucek) und Kamera-Interviewtechnik (K. Reindl, ORF Innsbruck). An diesem Wochenende startete auch das Analog-Astronauten-spezifische Training in den Gebieten Mikrobiologie und Raumfahrttechnik. Siehe neuer Logbuch-Text.

AM10 Science
Zur Lösung der Problematik des Wärmeausgleiches im vielschichti! gen Raumanzug wurde mit der Firma Draeger Kontakt aufgenommen, um Unterkleidung mit Phase Shift Liquid Crystal-Technologie zu organisieren ("Coolpacks" können die Körperkerntemperatur um bis zu 4°C für 3 Stunden senken). Der technische Defekt beim Stations-Teleskop wird durch die Ingenieure der Flight Crew voraussichtlich behebbar sein. Die Fachabteilung für Ernährungswissenschaften des Ausbildungszentrums West in Innsbruck erklärte sich bereit, den Speiseplan für die Crew nach modernen Gesichtspunkten der Ernährungsforschung zusammenzustellen.

AM20 Engineering
Ein Zeppelin als Aerobot-Trägerschiff ist nach wie vor unsicher, die Option für einen ferngesteuerten Helikopter wird wieder diskutiert. Für die MedMars-Telemetrieeinheit wird ein vereinfa! chtes Konzept durchgeführt, da leider krankheitsbedingt einer der Programmierer ausgefallen ist. Für die WLan Infrastruktur vereinbarte das ÖWF Tests in Kooperation mit der TU Graz (Prof. Koudelka), bei denen die Aufstellung, Logistik und Crew-Bedienung der Hardware geprüft werden.

AM30 Humanities
Gespräche fanden mit Prof. Gabriele Werner-Felmayer statt, die literarische Akzente für AustroMars setzen wird; ebenso wurde das Projekt „Austromars Vernissagen" konzipiert. Die Suche nach geeigneter Location für die farewell-Party geht gut voran, ebenso das Konzept. Das Projekt BildungsBlätter braucht die Mithilfe von allen Mitarbeitern (siehe unten)! Der AustroMars Fünfzeiler wird in etwas abgewandelter Form demnächst vorgestellt.

AM40 Logistik & Support
Die LSU war wieder einmal im Volleinsatz rund um die Organisation des dritten Trainingswochenendes. Derzeit wird der Leitfaden für den Transport von Mensch und Material nach Utah geplant, eine logistische Mammut-Aufgabe.

AM60 Mission Control Center
Der erste Entwurf des Flight Plan inklusive Vorbereitungswoche in Utah ist fertig gestellt. Input wird nun vor allem von den Betroffenen, das heißt von Crew, OSS, Medienpersonen, MCC-Mitarbeitern, benötigt, um die Justierungen vorzunehmen. Kommenden Freitag wird W. Stumptner, Leiter des MCC, zu Standort-Gesprächen ins Ch. Doppler-Gymnasium in Salzburg fahren.

Neu auf der Website / Die nächsten 10 Tage
Neuer Menüpunkt Outreach ist angelegt worden. Die Bildungsblätter sind derzeit hier abrufbar. Im internen Bereich findet man die Dokumentenvorlage und die Hinweise zur Erstellung der Bildungsblätter. Je mehr Personen mitmachen, desto schneller führt dieses Outreach-Projekt zum Erfolg.
Am 17.2., dem Tag vor dem ereignisreichen 4. Trainingswochenende, wird es aller Voraussicht nach bunt zugehen: In Wien wird die große Pressekonferenz mit Bekanntgabe der Crew (und eventuell des MCC-Standortes) stattfinden, in Vorarlberg wird H. Pauland einen AustroMars-Vortrag vor Amateur-Astronomen halten. Näheres zu beiden Events im nächsten MontagsMail.

+++ Missions-Countdown: Noch 69 Tage bis zum Missionsbeginn. +++

5.2 Document management

It was to be expected that a large number of documents with different formats, such as images, audio files, maps, text documents etc... would be created during the project, such an online archiving system has been created by the projects IT-team which allowed for a password-protected access to all this information.

Each document was assigned a **unique document tracking number**, a master reference file has been put online to enable users to browse quickly through the plethora of material. In addition to the uniquie tracking number, a color code –where appropriate- was put on the first page of the document to allow an easier visual allocation to a certain unit. The color codes were used in the same manner as directed by the general AustroMars management scheme.

Science (10)
Technology (20)
Humanities (30)
Logistics and Support Unit (40)
Mission Control Center (50)

In each project track, sub-teams were established with a responsible co-ordinator for each group. The tracking numbers were designated by the unit-leader, who would send a digital copy to the logistics and support unit. This unit would put it on to the server for general use.

Syntax for the Document Tracking Number

e.g. **AM41.03B** means:

AM = AustroMars
4 = Unit (here: “Logistics & Support Unit”)
1 = Group (here: „Administration“)
.
03 = the third document in this group
B = version number.

- Within the document there is a reference to its own number, the color code (if appropriate) and the date of the most recent version and an acronym of the author or full name.

The material was stored at a server of the Austrian Space Forum at the University of Innsbruck, and, in addition as backup on other hard drives. The AustroMars website itself was located in Innsbruck as well as on a server farm in Germany for redundancy reasons.

A more detailed description of the archiving strategy for the scientific data is presented in the Science Archive section.

5.3 Logistics & Transportation

Organization of Equipment Transport to Utah

The majority of all equipment to be transported to Utah was gathered at a common point in Austria (University of Innsbruck) before being shipped to Utah. The transport was scheduled to take app. two weeks, with customs formalities not expected to exceed two days, if all would go well. A margin of one week was foreseen in case something went wrong. In Utah, the equipment was graciously stored at the place of the Utah chapter of the Mars Society (William Fung-Schwarz, 3949 South 300 East, Salt Lake City, UT 84107-1601, USA) and then transported with rental cars to Hanksville.
Other options, such as hiring a school bus, air transportation and others were abandoned due to cost reasons.

Packing

All equipment was to be transported by air. The maximum package dimensions were 160cm (Height) x 317cm (Length) x 244cm (Width). Wooden boxes were not used due to flight regulations as they are more expensive and require a certified thermal treatment. Instead, aluminium or cardboard boxes were suggested.

Customs Formalities

Customs Formalities were not expected to exceed two days. To avoid problems, each team was requested to provide a detailed list with the contents of each box. The company “Gebrueder Weiss Transport & Logistik” provided as much support as possible in dealing with customs formalities, taking a heavy work load from the AustroMars project management. In particular, the project lead would like to thank Mr. Rene Kolb (Mars Society Austria and working at Gebrueder Weiss), who’s continuous work for the mission certainly reduced the stress.

In order to minimize customs costs, a carnet was obtained to confirm the shipment back to Austria.

Transportation to Utah

Except for the rover, the majority of the hardware was shipped from the University of Innsbruck to Los Angeles and carried further on to Salt Lake City/Utah by ground transportation. The material arrived on time and in good shape. The rover, however, as last minute engineering work had to be performed on the machine, had to stay in Austria beyond the shipping deadline. Therefore, in order not to jeopardize the entire delivery in time, the shipping was split. The rover was packed in Lower Austria and picked up by ground transportation, flown to Los Angeles via Vienna and then brought to Salt Lake City. This was a major uncertainty, as the customs delay was an unknown and the rover did not arrive upon the landing of the flight crew in Utah.
During the second last day of the preparation week, the equipment finally arrived in Salt Lake and was brought down by the On-Site Support team.

In addition, the FAMOS, OT and Actimeter watch-equipment as well as the saliva sampling devices from the University of Texas were brought directly to Hanksville via UPS. Given the generous transportation weight limits the airline operator Delta offered, it was decided that most of the small items would be transported by the flight crew themselves, splitting up the respective luggage. These items included the 2-leg rescue equipment from the Austrian Mountain Rescue Services, medical supplies, the aerobot, EVA-gloves, a limited supply of workbench equipment which was hardware-specific, etc.

Local transportation between Salt Lake City and Hanksville, the village next to the Mars Desert Research Station, was arranged by using rental cars and driving a Minivan from Denver Colorado to Hanksville which would replace the old Air Force truck which had served the station crews the previous years. However, the rough terrain is certainly not suited for normal cars.

The following people were flown to the USA:

- 6 + 3 Flight Crew and OSS
- 1 photographer (Andreas Köhler)
- 1 journalist from the national newspaper “Kronenzeitung” (Tobias Micke)
- 2 winners of a “Kronenzeitung”-Mars contest (Ingrid Köhrer and Stefan Stanger)
- 2 people fliming crew of the Austrian Broadcasting Cooperation ORF (Alexander Tomsits and Günther Löffelmann)

In addition, a local contact was present next to the outgoing crew under the command of Dr. Jan Osburg (Georgia Tech University), which was Don Foutz, the operator of the Whispering Sands Motel and the local contact for the Mars Society. The Austrian artist Helene Keller joined the team as well. So, in total, there were 17 people present at the station during the preparatory week, most of them staying at the Whispering Sands Motel, in order to avoid an overload on the bioregenerative systems.

Transportation from Utah

The workload for shipping the hardware back to Austria was clearly underestimated. It took 2 days for the flight crew to pack and relabel the several hundred kilos of hardware. Some items had to be cooled, such as the biological samples and the saliva samples. In addition, the Utah team had to ask the Whispering Sands Motel for storage space until the shipping company would pick it up.
The saliva sampling back to Houston was done by UPS ground shipping. The rest of the (micro-) biological samples were put into a freezer in Hanksville, using an isolation box and crushed ice. However, due to a miscommunication, the ground shipping company did not receive the order to keep the samples frozen, which resulted in a melted sample upon arrival.

Another problem was that the hardware had been unpacked by US Mars Society staff to relocate the FAMOS-hardware which had to be shipped back to Switzerland directly for customs reasons. During this repacking, some of the non-critical hardware was lost and had to be re-ordered from the suppliers, as this also affected clinical hardware for the Pupillograph device.

5.4 Science and technology partners

This section gives an overview of all institutions involved in the AustroMars mission and focal points for the respective organization. The listing represents only the main cooperating entities.

[1] Mars Society, Dr. Tony Muscatello, (Pioneer Astronautics)

P.O. Box 273, Indian Hills, Colorado, 80454, USA, Tel.: +1 303 980 0759
Email: Tony.Muscatello@PioneerAstro.com

[2] Leopold Franzens University Innsbruck, Austria

- **Institute for Psychology, Ao. Univ.-Prof. Dr. Barbara Juen**
  Innrain 52, 6020 Innsbruck, Tel.: +43 512 507 5559, Fax: +43 512 507 2835
  Email: Barbara.Juen@uibk.ac.at
- **Institute of Limnology, Dr. Birgit Sattler**
  Technikerstr. 25/5, 6020 Innsbruck, Tel.: +43 (0)512 507 6124, Fax: +43 (0)512 507 2930, Email: Birgit.Sattler@uibk.ac.at
- **Institute for Astro- and Particle Physics, OR Dr. Herbert Hartl**
  Technikerstr. 25/8, 6020 Innsbruck, Tel. +43 (0)512 507 6033, Fax: +43 (0)512 507 2923, Email: herbert.hartl@uibk.ac.at
- **Institute for Geology and Paleontology, Univ.-Prof. Dr. Christoph Spötl**
  Innrain 52, A-6020 Innsbruck, Tel. +43 (512) 507-5593
  Email: Christoph.Spoetl@uibk.ac.at

[3] Medical University of Innsbruck, Austria

- **Institute for Sports- and Cardiovascular Medicine, Prof. Prim. Helmut Hörtnagl,**
  Anichstraße 35, 6020 Innsbruck, Tel.: +43 512 504 3450, Fax: +43 512 504 3469
- **Department for Anesthesiology and Intensive Care, Dr. Rosmarie Oberhammer**
  Anichstraße 35, 6020 Innsbruck, Tel.: +43 512 504 0, Fax: +43 512 504 3469, Email: rosmarie.oberhammer@AustroMars.at
- **Institute for Neurology, Sleep research , Univ.-Prof. Birgit Högl**

Anichstraße 35, 6020 Innsbruck, Tel.: +43 512 504 0, Fax: +43 512 504 3469, Email: birgit. hoegl@uibk.ac.at

[4] Medical University of Graz, Austria

- **Institute for Adaptive and Spaceflight Physiology**, Univ.-Prof. Dr. Helmut Hinghofer

  Wormgasse 9/1, 8010 Graz, Tel.: +43 316 683380, Fax: +43 316 383638
  Email: helmut.hinghofer@meduni-graz.at
- **Department for Traumatology, Dr. Renate Mauschitz**

  Email: renate.mauschitz@AustroMars.at

[5] University of Texas at Galveston, Medical Branch, Ass.-Prof. Dr. Sheryl Bishop

301 University Boulevard, Galveston TX 77555, Tel.: +1 409 747 6027
Email: sbishop@utmb.edu

[6] Tiroler Landeskrankenanstalten GmbH (TILAK)

- **Public Affairs Department, Dr. Klaus Lottersberger**

  Anichstraße 35, A-6020 Innsbruck, Tel.: +43 512 504 28612, Fax: +43 512 504 28617, Email: nikolaus.lottersberger@tilak.at

- **Ausbildungszentrum West für Gesundheitsberufe (Training facility of the University Hospital Innsbruck, AZW)**

  Innrain 98, 6020 Innsbruck, Tel: +43 508648, Fax: +43 508648 2200
  - **Department for Dietology**, Mrs. Lina Kathan
  - **Department for Physiotherapy**, Mrs. Sandra Lengauer

[7] Technical University of Vienna, Institute for Architecture and Design, Dipl.-Ing. Barbara Imhof

Karlsplatz 13 / 253, A-1040 Wien, Tel. +43-1-58801 27024, Email: barbara.imhof@AustroMars.at

[8]TGM Vienna (Vienna Technical School), Dipl.-Ing. Uwe Kraus

Wexstraße 19-23, 1200 Wien, Tel. +43 1 33 126-0, Fax: +43 1 33126-204
Email: uwe.kraus@AustroMars.at

[9] Medical University Basel, Centre for Chronobiology, Univ.-Prof. Dr. Christian Cajochen

Wilhelm Kleinstr. 27, CH-4025 Basel, christian.cajochen@pukbasel.ch

[10] Object Tracker, Dipl.-Ing. Luzian Wolf

Elisabethstraße 4, 2380 Perchtoldsdorf, Tel: 01/8655404 Fax: 01/8655404 Email: luzian.wolf@object-tracker.com

[11] Testzentrum Schuhfried, Dr. Gerhard Schuhfried, Dr. Ludwig Pilsz

Hyrtlstraße 45 2340 Mödling Tel.: 02236/ 423 315- 20, Email : ludwig.pilsz@AustroMars.at

[12] Univ of Vienna, Institue für Geochemistry, Univ.-Doz. Dr. Christian Köberl

1090 Vienna, Althanstraße 14, Tel: 31336/1714 / Fax: 31336/781
Email: christian.koeberl@univie.ac.at

[13] Elektronikdesign.at, Mr. Schinner Andreas

Grillhofweg 15, 6080 Innsbruck-Igls, Telefon: +43 (660) 760 69 57, E-Mail: andreas.schinner@electronicdesign.at

[14] Institute for Austrian, European and Comparative Public Law, Political Sciences and Public Administration University of Graz, Univ.-Prof. Dr. Christian Brünner

Universitaetsstrasse 15 C/3, 8010 Graz, Austria, Tel: +43/(0)316/380-3388 , Fax: +43/(0)316/380-9450, E-mail: christian.bruenner@uni-graz.at

[15] Geodesy Austria, Trimble Instruments, Dr. Ekkehart Grillmayer

Ennserstr. 83, 4407 Steyr-Gleink, Tel.:, Tel.: +43 676 3372165, +43 7252 87165 20, Email: e.grillmayer@geodaesie.at

[16] SOWOON Technologies, Dr. Ninoslav Marina

Sowoon Technologies S.a.r.l, PSE Technology Park, CH-1015 Lausanne, Tel. +41-21-693 9160, Fax: +41-21-693 9160, Email.: ninoslav.marina@sowoon.com

In addition, approximately 100 companies, ranging from major electronics component supplier to local catering services for the Mission Control Center in Salzburg, from rental car companies to video conversion specialist companies have been involved in AustroMars. The majority of these firms were located in Austria.

Chapter 6
Experiments

This section reflects the science programme of the AustroMars Mission. It should be pointed out, however, that the results of the individual experiments are **not** being discussed here as most of them are work in progress. Some of the research carried out during the simulation will take months to come and maybe sometimes even years to be processed. The findings of these experiments are published either in the Mars 2030 Workshop publication and/or in scientific and engineering journals.

MSL Markus Spiss and HSO Gernot Groemer during the microbiological training.

6.1 Life Sciences

6.1.1 Experiment AM 11 BioMars

Discipline: Microbiology, PI: Birgit Sattler, Univ. of Innsbruck

If there was or is life on Mars, contamination issues play a crucial role in identifying substrata with biological origins and mitigating risks of backward contamination of the crew, the habitat and, eventually, the Earth's biosphere. No satisfying contamination control protocols have been developed so far.
BioMars adresses exactly this question by formulating procedures to minimize the crosscontamination of samples and crew. In order to measure the contamination, a drilling experiment will be carried out to take a subsurface sample at a depth of 20-50m and quantify the amount of material transferred in both directions by either means of marked bacteria or, alternatively, by chemicals (e.g. flourescent substances) or granulous substrates.

Output: quantification of cross-contamination in an analogue environment under high fidelity conditions and protocols to minimize the transfer of biological material.

<u>BioMars Module 1: Track & Trace</u>

A) Fluorescently Labelled Microspheres

Premission

- **Optimizing methods** regarding handling with microspheres on tissue were (mode of application, recovery etc.)
    - Check of various tissues (i.e. pore sizes, wash out)
    - Distribution of spheres: How far do they go? Recovery method?
    - Freeze –Thaw – Recovery: test with spheres on tissue; still fluorescent?
    - Fixation of tissues on suits: Velcro
    - Determination of tissues to be fixed on AA body and colour-tracking (knees, hands, arms, legs, front, back, bottom)

Preparation for mission

- Preparation of various tissues with known numbers of microspheres in sterile packing (Whirlpack), transport to MarsHab

Mission Setup

- Application onto transferable tissues (velcro) on 3 candidates following certain protocols and on suggested body parts: knee, chest, legs, hands, bottom
- EVA of analogue astronaut with sample tissues, retrieval of tissue after arrival to MarsHab, sterile packing, transportation
- Taking environmental samples, which will be examined for microspheres?
- Issues which had to be clarified included:
    - Which EVA? When? How many EVAs (depending on amount of microspheres/tissues)? Dust after EVA collected; check for microspheres?
    - Freezing/Storage of samples in hab? Labeling of tubes?
    - Check of “life signs” samples for microspheres? Check of equipment for microsphere?
- Steps to be taken by crew:
    - 3 EVAs (for 3 cleaning methods) each 3 analogue astronauts (for statistics).
    - Dust collected after 3 EVAs and frozen, Samples stored in sterile Falcon tubes in freezer, Labeling: date, EVA, astronaut, tissue position

Postflight

- Further processing either at Montana State University (MSU) or University of Innsbruck (LFU)
- Recovery and counting of Microspheres
- Determination
    - Which “colour” is found where, crosscontamination *on* the suit.
    - Between suit and samples, Which suit-parts are highest risk of “planetary contamination”, Suggestions for better protection on future missions

B) Biological Contamination

Premission

- Which cleaning methods to be tested: Alcohol and taken to hab!
- Preparation of various tissues, (preferably autoclavable)
- Fixation method on suit (similar to A)

Preparation of various tissues = autoclave; sterial packaging, labeling (for EVAs) and transport to hab

BioMars Module 2: LiMa (Life on Mars)

Preflight

Sterile sets of petridishes with applied nutrient agar will be brought to MarsHab

Mission Setup

- Sampling during EVAs: sampling locations were suggested by the BioMars-Team after evaluation of photomaterial of the first EVAs (looking for possible niches for life)
  - Check with MCC, Photomaterial after first EVAs needed
  - After analysis of biology team, new directions for crew

- Spreading of samples onto petriplates in MarsHab
  - Sterile sampling (i.e. sterile falcon tubes, spatula), Sample on agarplate and into incubator (temp?), Dealing with extraterrestrial life forms (protocol)
  - Dealing with waste (old plates)

- Biological analysis by crew in hab:
  - Microscope (description, counting chamber, photo)

At the end of the simulation, the following activities had been performed by the crew, especially the Mission Specialist Life Sciences (MSL) Markus Spiss.

Sterile covers fort he EVA-suits

LiMa:

- 3 LiMa EVA's with 6 waypoints (all successful) and 6 extra soil samples (all archived with co-ordinates and photos)
- 1 Scouting-EVA to Factory Butt with one extra LiMa soil sample
- 12 primary cultures, 10 of which were positive
- 16 pure cultures from the 10 pos. primary cultures
- From all LiMa samples, primary material is available, processing of all samples
- LiMa Night-EVA which was scheduled according to the original flight plan fort he 21st of April has been cancelled due to housekeeping and life support maintenance activities.

Typical LiMa pure culture sample

HAB-Samples:

- Hab-samples (air sterility) in 9 locations, 8 of which were positive;
- from these, 5 pure cultures could be acquired.

Crew-Hygiene:

- 99 Crew-skin samples have been taken and cultivated
- 3 pure cultures from positive skin samples from XO
- 45 samples have been frozen for germ flora determination
- germ flora quantification on the 13th mission day (before and 1h after personal hygiene from all 6 crewmembers on 4 different body locations each)

Pure cultures:

- 23 pure cultures
- 20 cultures have been analysed in the MDRS laboratory macroscopically and microscopically and frozen.

Backward-contamination:

- 4 Track & Trace EVA's with 6 EVA-suits
- The suits have been improved after the first EVA which resulted in a nearly complete loss of all patches; from the 2nd suit onwards, all patches were collected successfully.

Forward-contamination:

- 4 Track & Trace EVA's with 5 suits
- All patches collected successfully

6.1.2 AM 15 MedMars

Discipline: Medicine, Intensive Care Medicine, PI: Dr. Rosmarie Oberhammer

During the simulation phase of AustroMars, medical experiments and tests were carried out. In addition, the MCC-related medical operations were managed by the MedMars team including the medical supervision of the flight crew and the on-site support personnel. This section describes both components of the activities.

CDR Frischauf being rescued by HSO Groemer, FE Hutsteiner and XO Soucek during a medical evacuation simulation during the preparatory week.

For the development of the AustroMars Telemetry Unit, the engineering team was lead by Andreas Schinner.

<u>Experiments Overview</u>

- **[AM15-A = AM 17] Lower Body Negative Pressure** (Helmut Hinghofer)
  During the crew selection process, tests have been conducted to select-out candidates with a high susceptibility to syncope.

- **[AM15-B] Emergency Medicine** (Renate Mauschitz, Dominik Pfeiffer)

  - **Search & Rescue:** conducting a rescue operation in steep and difficult terrain involving the application of state-of-the-art mountain rescue techniques in sim
  - **Minor trauma treatment:** during the sim, one of the medical anomalies envisaged are minor traumas including e.g. a minor concussion with a VLC cap., and/or a peripheral fracture (frac. uln./rad. or similar…) involving minor treatments such as surgically closing wounds and applying a cast.
  - **(planned) drug administration in the EVA suit:** due to long duration times during rescue ops, the provision of drugs before the patient arrives

at the Hab –that means in the EVA-suit- are desirable. This test would release an aerosol (e.g. a certain smell) into the airstream of the analog astronauts suit and hence simulate the application of inhalative analgesics.

- **[AM15-D] Fluid balancing** (Rosmarie Oberhammer)
  The total fluid balance of all six crew members will be analysed by measuring the total intake and output of fluids including taking measurements of the bladder before and after EVA's with an ultrasounding device.

- **[AM15-E] Microbiological tests (planned) (**Rosmarie Oberhammer)
  As the crew lives under reduced hygienic conditions in a confined space, the development of microbiological communities on the human skin will be tested.

Operative Component

Team:

- Dr. Renate Mauschitz (lead)
- Dr. Goetz Nordmeyer
- Dr. Rosmarie Oberhammer
- Dominik Stumpf, medical student and paramedic
- OA Dr. Nikolaus Steinhoff

If there was a flight surgeon without right of practise (jus practicandi) on duty at the MCC, a doctor with the right of practise was available on-call and prepared to be physically present at the MCC within less than 3 hours anytime of the day.
The main responsibilities of the flight surgeon during the operative phase included:

- **Making sure that the medical telemetry was being properly archived by the SATS flight operator at MCC**. This includes EVA-activities (signal from the personal life support backpacks (PLSS) and the Habitat.
- **In case of real emergencies, the flight surgeon**
  - provided medical advise and councelling to the Crew-HSO including medical, situational and hazard assessment as well as advice on drug administration

- organized the medical evacuation, transportation and delivery of the patient to the appropriate medical facilities in the United States and if necessary, the safe re-patriation transport back to Austria.

- **Being physically present 24-hours per day at the MCC, operate the FS-console and observe the requirements set forth by the AustroMars definition document and Mars Society requirements.** This included

  - monitoring crew health: Vital signs during EVA's, Sleep cycle: duration & quality, Hydration & Nutrition
  - advising on Medical matters
    - Monitors potential hazardous substances (incl. aerosols, fumes, allergic substances)
    - Organizes MCC support in case of real emergencies
    - Coordinates physiotherapy-counter measures
    - Advises on medication
  - making recommendations with respect to Greenhab-Operations/Hygiene

- **Observing and assisting** in all matters related to the health and well being of the flight crew, on-site support personnel and staff at the MCC including back-seat teams and if necessary for the Back-up Mission Control Center in Denver/Colorado until the Mars Society Chief Flight Surgeon (Dr. Tam Czarnik, Houston/Texas) takes over responsibility.

- **Supervision of all medical activities related to ongoing MedMars and PhysioMars experiments**

LBNP-Tests (Experiment AM 17)

Cardiovascular and hormonal reactions on presyncopal cardiovascular stress

This experiment investigated hormonal reactions of the final 15 Flight Crew candidates as part of the pre-flight tests to determine high susceptibilities to orthostatic intolerances during critical in-flight situations when the air supply of the PLSS might fail.

Summary, Background and Preliminary Studies

This experimnet studied effects about presyncopal circulation effects through combination of two orthostatic stimulations (HUT, LBNP) on the human circulation in combination with different hormonal systems: HUT („Head Up Tilt“, vertical orientation of the human body) and LBNP („Lower Body Negative Pressure“, under-inflation on the lower body) were used in combination to create an extrem stress situation to circulation regulation systems, so that it will be possible to study cardiovascular and humorale compensation mechanisms. (Evans et al. 2004).

HUT: By usage of an automated tilting table the researchers tilted a male test person from a horizontal position until he has reached a 70° angle, which means that he will nearly move to a vertical position. As a result his blood moved from the upper regions to the lower regions of his body. This creates a nearly daily psychological stress for his loop regulation.

LBNP: A glass container was put around the legs of the test person (i.e. from the hip downwards). A neopren seal which attaches at the hips ensured that the glassdome was airthight. Inside the glassdome underpressure was to be generated. As a result the blood moved to the legs similar when a person is standing in a vertical position.

It's a goal of this experiment to recognize circulation regulation trends under extrem situations. Therefore the team analyzed noninvasive "beat to beat" files and will correlate them with hormonal files.

FE Christian Hutsteiner during the LBNP tests in Graz

The team could prove that Galanin, a very short Neuropeptid, is produced 100 times more intensively under presynkopal situationes (Hinghofer-Szalkay et al 2006). This was unknown up to this day, but proves that there exist unknown hormonell mechanisms in the cardiovaskular regulation.

Experiment Design

These studies was performed openly and randomised. To take into account the zircadian rhytm of hormonal systems, all experiments began between 9 and 11 am. A total of 15 candidates, who are familiar with the experiment, were used for the tests. Before the beginning of the experiments a candidate moved to a horizontal position so that he could reach a Basis-Steady-State. During this time an iv access was established (17G-1.4x40mm Teflon-Catheder) and a noninvasive Monitoring-Device (Task Force Monitor) with electrodes, upperarm-bloodpressurewristband and sensors for Finapress connected to a Candidate. As a result the team got simultaneous indication about more than one cardiodynamic state variable.

Shortly before HUT the researchers took a bloodsample (before the candidate had to do some physical activity), after that they moved the candidate in a sloping position HUT (around 20 seconds and 70°). After 5 minutes in this position they brought the lower half of his body to an under-inflation (-20 mmHg). The scientists increased this every 3 minutes by around 10mmHg. The end of the protocol was signalled by a presynkope. This moment is the end of the so called stressphase and this is also the end of HUT and LBNP. The candidate was brought from a sloping position to a normal position and a second bloodsample was drawn.

Emergency Medicine Protocols

In addition to the regular surveillance of the v´crew with respect to their fluid balance, weight, blood pressure, heart rate, body fat and total body water, a series of emergency medicine experiments were conducted. As an example of one of these experiments, a typical post-incident report from the in-flight archive is shown here:

```
Medical incident Report
20.4.2006

Gernot Groemer, HSO

Incident: at 10:00 the HSO climbed a ladder to put up supplies into the storage board in the EVA preparation room. He fell down the ladder, cutting his left forearm with a 6 cm long and 1 cm deep VLC, remaining conscious all times with no additional obvious injuries, no vomiting, no nausea, no backpain.
```

HSO Groemer applying surgical stitches on an “injured” FE Hutsteiner with a sterile stapler on the command deck (not during the simulation described in the text.

As the MSL Markus Spiss, the second trained EMT of the Crew was on IVA in the low-pressurized tunnel to the Greenhab, he was not available for treatment, so the CDR and XO provided first aid by applying a pressure bandage to the wound, lying the HSO down and putting his arm into the air. The original idea was to call back the MSL, but as this exercise was meant to test the ability to direct medical actions, hence the XO who had been trained in surgical stitching was providing further treatment.

Treatment: the pt. was brought to the upper deck which had been used previously for closing a VLC, dressed in sterile clothing (coat, facemask, gloves), put a sterile cover on the table, the pt. forearm on it with a surgical cover (with a punched hole) on the wound, having an assistant (the MSP, who was also filming) open the sterile scissor, forceps and surgical clamp and preparing the surgical needle and sew.
He applied eight stitches which were filmed and then covered with an OP-site cover and put into the incubator at 37°C (that's the incubator temperature for all microbiological samples).

Lessons learned / First impressions

- Directing a sparsely trained crewmember in a basic surgical technique is a challenge, especially as this is not an everyday action for the HSO as well, but is certainly doable if one takes his time and the expected standards w.r.t. stitching techniques are not too high.
- We believe that a sterile enough surrounding in the station is a challenge, but can be done.
- The stapler is naturally much easier to handle than the needle, but after 2 or 3 stitches there was a minimum routine coming back, as the surgical training was exactly two months old. This might be different during a 6 months flight to Mars, but still doable and can be trained during the en-route phase of the mission.
- Finding material is a challenge in an emergency situation: making sure, that each crewmember is very much aware of where to find the medical supplies is a must. When opening a medical jump kit, there is a plethora of small, similar looking items available at one glance, with difficult to read technical words printed on similar looking packages ("What is an OP-site foil? What is etc…? The medical packages are all in plain white with a pale label which has a bigger company label than whats in it"). Therefore the arrangement, color, texting etc. of the equipment shall reflect the procedures, e.g. having a red kit labeled "strong bleeding", green kit "poisoning" etc… taking into account that it might not be the HSO who is providing the healthcare.
- Theoretical training, practical training, and repeated drill training: the last medical training finished 2 months ago: a re-cap of the most important procedures as a regular drill might be an option and could eventually be included in the flight plan as a weekly routine. (Where is which material?)

- "Make it easy and comfortable for the layman to help" (Quote from the XO)

Footage: Camcorder video of First Aid and stitching; static images with digicam.

In addition to these tests, a broken leg was simulated including the application of a cast and a steep terrain rescue attempt using a 2-leg carbon-fibre construction developed by the Tyrolean mountain rescue services. Details about these activities can be found in the section including the daily reports and the scientific papers.

6.1.3 PsychoMars

Discipline: Psychology, PI: Dr. Florian (Univ.Innsbruck) and Dr. Sheryl Bishop (Univ. of Texas at Galveston)

Research Area A: Selection Process

Output: definition of selection criteria and procedures for conflict management training, psychological select-out of unfit crew-applicants

It was a goal of this project to study the psychological selection process, which lead to the selection of at least six candidates, who were needed for a perfect working team under extreme isolation conditions. The long term goal was to find scientific selection criterias for future isolation studies and also to find solutions which are necessary for a perfect working team under extrem conditions. The researchers used the same selection criterias as NASA and ESA use when they select Astronauts and other individuals which will work under extrem conditions (Polar Expeditions, Underwater Expeditions). In a three stage selection process the PsychoMars team tried to find psychical parameters like efficiency, Multi-Tasking capabilities, Intelligence, to be a good team player and so on. A more detailed description is given in the section about the selection process in general.

Reseach Area B: Stress preception and group dynamics

This suite of tests focussed on the devellopement of sociological structures within the flight crew in the hab. The following dimensions were looked at:

Mars Habitat II (45 min.): test suite

- Personal and group functioning survey
- group goals and goal accomplishment
- group processes like motivation, commitment, prosocial behaviour,
- strength of cohesion, relations in a sub-group;
- self categorization
- polarisation in a group and sub-groups
- ostracism and pressure to fulfil group norms
- „Personal functioning“ e.g. tiredness, stress, well being
- Sheldon´s perceived Stress (measuring the state of anxiety)
- Brief Coping Questionnaire

Neurocognitive parameters:

- Salivary assays (Cortisol), SLgA
- Subjective assessement
- Coghealth

Mars-Habitat I: psychological interviews

Psychological Protocol Time Line

Test	source	pre	Day 1	Day 6	Day 10	Day 13	Post
Hab 1	1 hr	X					X
Hab 2 em	1 hr		X	X	X	X	
Salivary	15 m		X	X	X	X	
Cog he.	15 m		X	X	X	X	
tonprot	15min		X	X	X	X	
interview	45 min						X
		1 hr	1,45 h	1,45h	1,45h	1,45h	1, 45h

During the mission, the researchers required 4 times 1.45 hours per crewmember.

Inflight, in addition to the questionnaires, a standardized test battery had to be done by the flight crew which makes the simulation comparable to other teams which have performed at the Mars Desert Research Station. This suite of tests includes the CogHealth battery used by Prof. Sheryl Bishop on MDRS crews as well as at the Flashline Mars Arctic Research Station for comparison.
To validate these questionnaires against hard physiological data, salivary samples were taken each day on each crew member and, at the same time, also by the On-Site-Support team to have a comparison.

The following parameters were tested:

In-flight:

- Emoint interview protocols
- Coghealth data sets: Flight Crew and OSS
    - Reaction time, Accuracy, Memory/Recall
- Salivary assays: Flight Crew and OSS
    - cortisol, secretory SigA, testosterone, 17-Hydroxyprogesterone, DHEA, fasting Insulin
- Sheldon’s Subjective Stress Inventory - Flight Crew and OSS
- Coping Styles - Flight Crew and OSS
- Personality and Motivation - Flight Crew and OSS
    - AstroPCI, NEOPI, SFPQ, Jenkins Revised Activity Scale
- Group Functioning and Identity (experimental scale) - Flight Crew and OSS
- Mood scales - Flight Crew and OSS

6.1.4 FAMOS

Discipline: Human Factors, PI: Luzian Wolf

The success of long duration space missions, such as manned missions to Mars, depends on high and sustained levels of vigilance and performance of astronauts working in the technology rich environment of a spacecraft. We applied an early prototype of the FAMOS Fatigue Monitoring System headset to assess the performance status of selected AustroMars crewmembers on a daily basis. The FAMOS system is currently being developed by Sowoon Technologies. The device recorded videos of eye movements and eye lid activity while monitored subjects engage in their routine working program. After completion of the two-week experiment campaign, video recordings will be analyzed in the lab of the company and fatigue indicators and trends will be calculated.

Experiment Description and Scientific Context

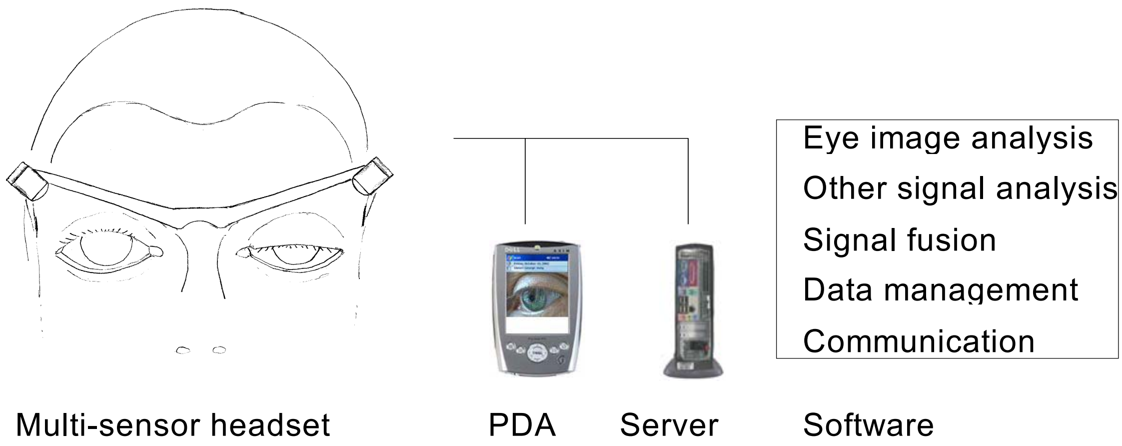
Vigilance and performance of astronauts can be impaired because the conditions of space flight appear incompatible with adequate sleep duration and sleep quality and result in cumulative sleep loss. Ground-based research has demonstrated that sleep loss is associated with neurobehavioral performance decrements. These detrimental effects of inadequate and non-restorative sleep on neurobehavioral performance may be exacerbated by other conditions of space flight, such as the low illuminance in habitable compartments of the spacecraft. Subjective self-assessments of such decrements are unreliable. Therefore, objective methods that can continuously monitor on-line the status of the sleep-homeostat and neurobehavioral performance capability in individuals are needed.

Data indicated that slow eye movements (measured via the electro-oculogram, EOG) as well as low frequency EEG components from frontal brain areas are associated with neurobehavioral performance decrements in laboratory studies and in a large field study in medical interns. Although these data indicated that ocular and EEG parameters could be used to monitor and predict performance, further validation of these methods is required under conditions that more closely resemble those of long duration space flight. The electroencephalogram EEG and electro-oculogram EOG are associated with a significant instrumentation effort of the subject, and are therefore not practical for field measurements.

New techniques other than the EEG and EOG were required, which can be applied with minimal preparation / instrumentation effort of the test subject. Such a new instrument is currently being developed by Sowoon Technologies, and is described in the next chapters.

FAMOS System Concept

Sowoon Technologies (CH) is currently developing a field instrument suitable to measure and record head accelerations, gaze direction, eye closure frequency, eye closure pattern, electrical surface potentials, voice (option), and optionally additional variables. This baseline FAMOS system consists of 1) a lightweight multi-sensor headset, 2) a small portable electronics box (a commercial PDA personal digital assistant), 3) a base station PC and 4) dedicated software for the headset, the electronic box, and the PC.



The headset acquires real-time images of the left and right eye regions, the acceleration of the head, several electric surface potentials, and voice. It consists of an anatomical interface that rests on the nose and contact points on the temporal sides of the head. It carries two miniature CMOS cameras that image left and right eye regions from a close distance, IR-illumination for gaze analysis, miniature accelerometers and gyros, several other sensors, signal conditioning and low-level data processing circuitry, and a communication interface. The headset connects to the electronics box via a cable.

The electronics box provides power to the headset and receives its data. It includes utilities to configure and test the headset and to preview headset camera images, provides data storage for off-line operation, and relays real-time headset data via a wireless link to the base station PC.

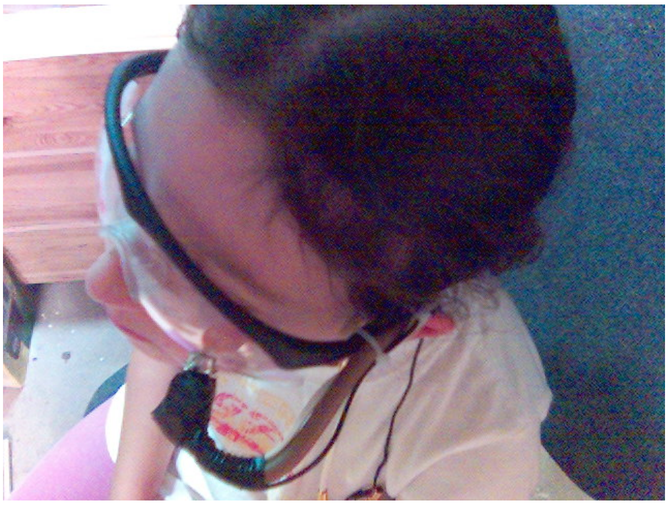
The base station PC is the computing platform of the system, dedicated to data analysis, display, archiving, system management, performance evaluation, and reporting. Dedicated software unpacks the data stream originating from the headset into its components. It analyzes the image sequences of left and right eyes and derives variables that are relevant for performance / fatigue monitoring: Eye closure frequency, eye closure pattern (PERCLOS), gaze direction, gaze variability, pupil size, differences between left and right eye, and others. Eye-related variables, head acceleration data, electrical potentials and data from additional sensors are combined in a dedicated data fusion software module to yield a fatigue metric.

Objectives

The objective of this experiment was to obtain operational experience with an early prototype of the FAMOS device, and to apply this prototype to obtain good quality video-recordings of eye movements and eyelid activity of selected crewmembers on a daily basis. The prototype will be used in off-line mode: Data will only be recorded, and data analysis is being performed in the lab of the experimenter after the end of the experiment campaign.

Hardware description

For the AustroMars Experiment, the FAMOS System consisted of an early prototype of the FAMOS headset with one camera, and a recording device. The headset could be easily mounted on the subject’s head and may be used for 1 hour or longer without causing discomfort to the subject. The picture below shows one of the first working models of this device.



The headset connects to the recording device with a cable. Three recording device alternatives wer being considered (Mini DV camera, Tablet-PC, or Laptop PC), the final selection was comprised of a handheld video recording device with solid state memory.

The base station PC and data analysis software were not a part of the AustroMars hardware in the Habitat, but remained in the lab of the experimenter. After the end of the experiment campaign, all recorded data were transported to the lab of the experimenter, where data were analyzed.

6.1.5 Object Tracker

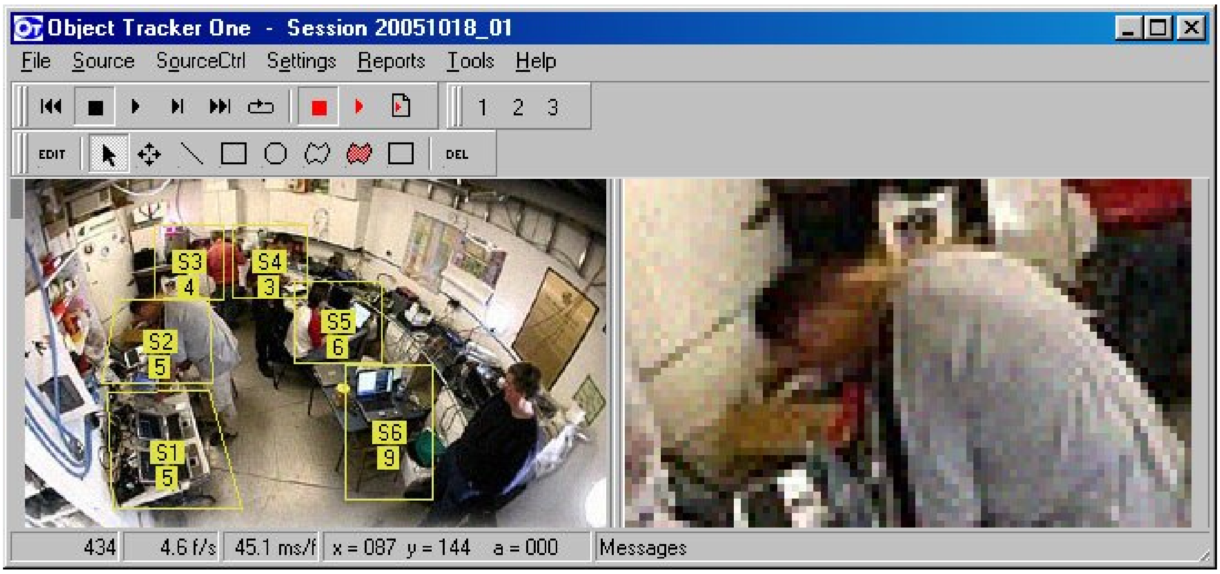
Discpline: Human Factors, PI: Luzian Wolf

The experiment 'Crew Activity Monitoring with Object-Tracker' monitored the apparent physical activity of the AustroMars crew inside the Habitat with a video based technique. A camera acquired a video stream of the Habitat work deck and fed the stream to the Object-Tracker system, which is a PC-based platform for motion analysis and target tracking, developed by Object-Tracker in Austria. The system analyzed the video stream in real-time and calculated activity measures for each of several regions of interest, which corresponded to locations where crew members regularly performed activities. Activity date, images, and video sequences were stored in a database. After completion of the two-week experiment, activity data were analyzed and plotted in various ways to determine activity patterns and trends.

Objectives

The objective of this experiment was to monitor the physical activity of the AustroMars crew inside the Habitat with a video based technique.

A camera acquired a video stream of the Habitat work deck and fed the stream to the Object-Tracker program. The program processed the video stream in real-time and calculated activity measures for each of several regions of interest (S1-S6 in the picture below). These regions of interest were defined on day 1 of the experiment remained unchanged during the course of the experiment. Regions of interest were defined in a way so that they corresponded to locations where crew members regularly performed activities.



Activity analysis within a region of interest was based on a technique that calculates the ‘optical flow’ in this region, which is the velocity field of the apparent motion in the image sequence. Other types of analysis within regions of interest are possible.
Every day at 00:00, the system created a new monitoring session (create a new directory, a new database file, and others). At 5:00, it activated the camera and started processing the video stream. For each region of interest, it wrote data records containing the activity vector, a time stamp, and other relevant data to the database, at a rate of one record per second (t.b.c.). It recorded an image of the scene in intervals

of approx. 30 seconds. Occasionally, it created a video record of the scene with a frame rate of approx. 1 frame per second and stored it on hard disk. At the end of the working day at 23:00, it will de-activated the camera and stopped video processing.

Data analysis will be performed in the lab of the experimenter. Motion data will be normalized to compensate for the distance between a region of interest in the scene and the camera. Resulting activity data will be plotted in various ways (activity vs. time of day, day of experiment, region of interest, and others) to determine activity patterns and trends. We will then attempt to link individual activity records to crew members. This will be achieved by inspecting the images that have been stored in the database and to visually identify the crew member that is visible in the particular region of interest. This task is expected to be time-consuming and would be simplified in crew members would wear visible tags (e.g., circular bar code tags, numbers, letters, color tags, or similar) that can be easily identified in video images.

Hardware description

The experiment hardware consisted of the following items:

Item	*Amount*	*Description*
1	1	PC Laptop
2	1	PC Laptop power supply with cable
3	1	Ethernet PC card
4	1	Network camera, Panasonic
5	1	Network camera power supply with cable
6	1	Ethernet cable, cross-over
7	1	USB camera + USB extension cable
8	1	Mains adaptor US male – European female
9	1	4-way socket with cable, European
10	1	CD with OT-program and drivers

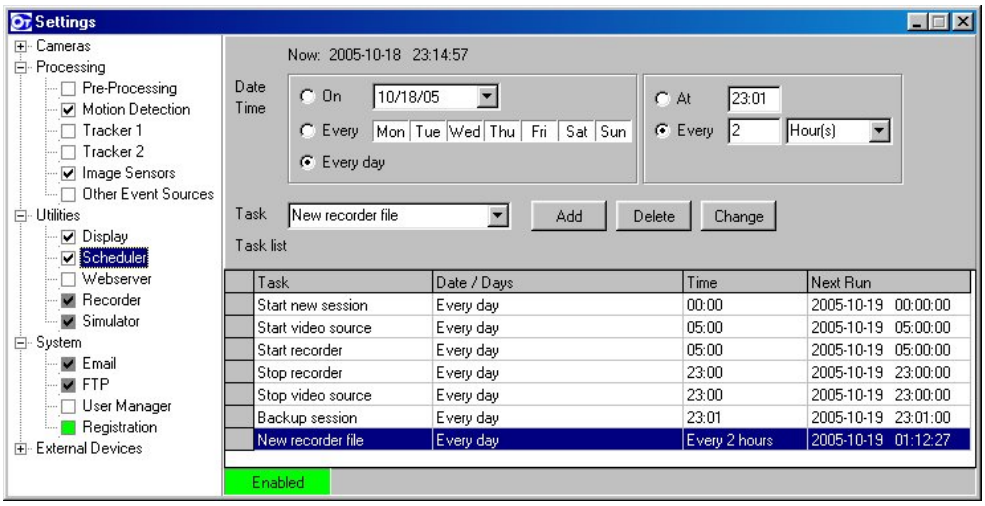
The photos below shows hardware items 1-7.

Software description

For the AustroMars experiment, the Object-Tracker One software has been used, which is a modular and extensible software system for motion analysis and target tracking. The following paragraphs present a brief describe of the core functions of this program.

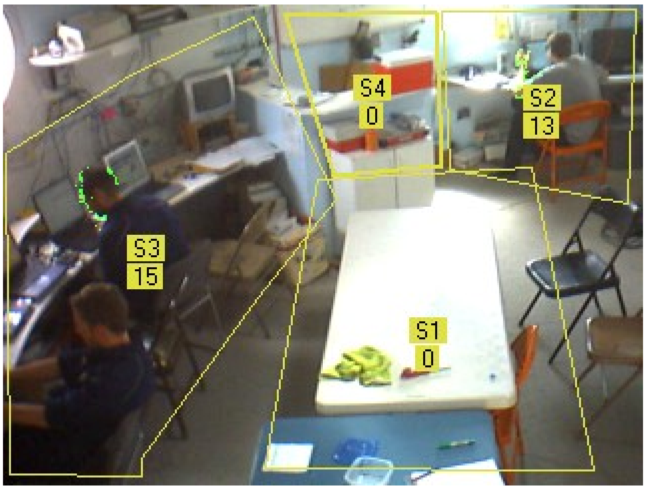
Automatic Procedures

The Object-Tracker System was equipped with an integrated scheduler, which automated repetitive tasks such as starting and stopping the video source, starting and stopping the recording function, creating new sessions, or performing back-ups.



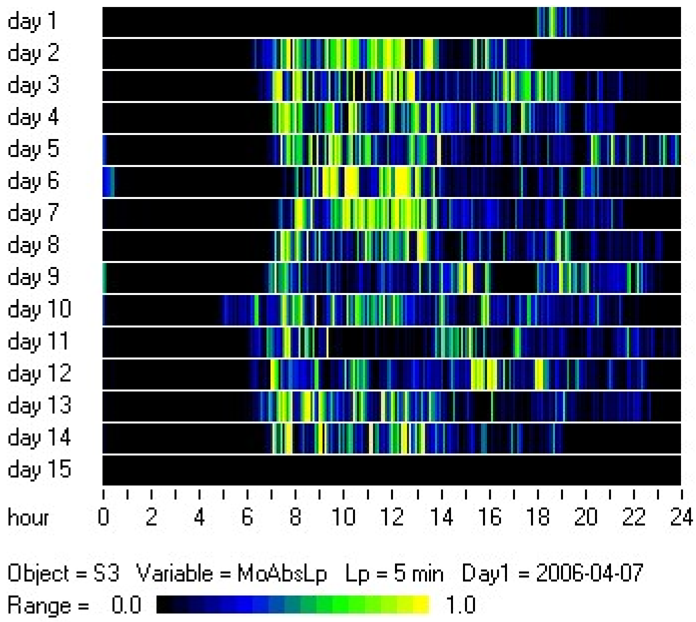
Preliminary Results:

The Object Tracker experiment was set-up and configured successfully by the AustroMars crew. Adjustments of the set-up were implemented successfully, based on instructions provided via email. The OT system worked without interruption for 14 x 24 h. All recorded data could be retrieved. The experiment yielded 7 GByte of motion data (MS-Access format) and 9 GByte of video data (.avi format, 1 frame/sec., 320 x 240, DivX compression). Data analysis is currently in progress.



The picture on the right shows four regions of interest (S1-S4) that were continuously monitored.

Motion data were plotted to visualize activity trends throughout the experiment duration. The picture on the right shows such an activity plot for region S3. Activity peaks are clearly visible, with an appearent accumulation in the period between 7:00 - 14:00.



Actimeter watch dataset for one of the test subjects provide objective data on the duration and sleep quality.

6.2 Physical Sciences

6.2.1 GeoMars

Introduction

One of the most important direct sources for reconstructing the history and the current state of a planet can be deduced from the surface material. This is the reason why taking samples will be a major activity on any future human mission to Mars. Every sample taken will greatly increase our current knowledge of the planet, but due to constraints regarding travelling distance and time, it is vital that each sample is taken correctly the first time and that the process of sample acquirement is optimized. The expirements conducted by the GeoMars part of the AustroMars project aim at further refining the circumstances of optimal geologic sampling.

Experiment description

In the GeoMars experiments the effectiveness of sampling of rocks and soil is analysed. This includes both quantitative and qualitative aspects. The amount of samples taken is determined by the equipment and logistics. For taking rock and soil samples members of the AustroMars crew were equipped with basic geology hand tools. This included hammers and soil penetrators. For storage samples were placed in easiliy sealable bags which were labelled on site. Sampling actvities were seriously impeded by limited agility in the space suits which had to be worn be the team members whilst away from the habitat. It is of interest to assess the amount of limitation this aspect has in regard of the quantity of samples obtained.

Members of the AustroMars team taking subsurface soil samples on a GeoMars EVA.

The quality of the samples is determined by the choice of EVA routes, by the amount of time allotted to geology-related activities and by the

Taking a soil sample on EVA

geological experience of those taking the samples. The retrieved samples are compared to the already existing geological descriptions of the area. The proportion of different lithologies covered will give us an idea of the scope of information that can be obtained by taking a small number of samples in a limited amount of time.

Extra-vehicular activities

The time which crew member spent "in the field" is determined by the amount of time they spent outside the habitat. During the 15 days of simulation, the flight crew went on seven EVAs which were at least partially devoted to geological investigation. On the first EVA a contingency sample was taken, to secure that at least some material can be taken back, should circumstances prevent any activities outside the protection of the habitat. The following excursions can be divided into short- and long-range EVAs. On the short-range EVAs crew members were required to scout the area surrounding the habitat on foot. On the long-range EVAs ATVs (all-terrain vehicles) were used to enable the members of the AustroMars crew to reach points of interest out of range of walking distance. Where possible areas on geologic interest might be was deduced by analysis of pre-existing satellite data or topographic maps and accounts and observations of crew members previously on EVA. The routes of the EVAs were then chosen taking into account the topographic situation (flat areas imply that they might be easily covered on ATVs, whereas steeper areas are more likely to contain an outcrop) and the aim of attempting to cover as many different areas as possible.

AustroMars crew taking soil samples on a GeoMars EVA.

Altogether this amounted to approximately 32 hours in which 3 crew members studied the natural surroundings, documented this by photographs and rock and soil samples.

Samples obtained

A total of 44 samples were obtained, mostly loose rocks and soil from the surface. A lesser amount of subsurface sample was acquired by hammering (solid rock sample) or using a soil penetrator (loose samples). Samples were photographed in situ then bagged and sealed. More detailed

Gypsum crystal found on EVA.

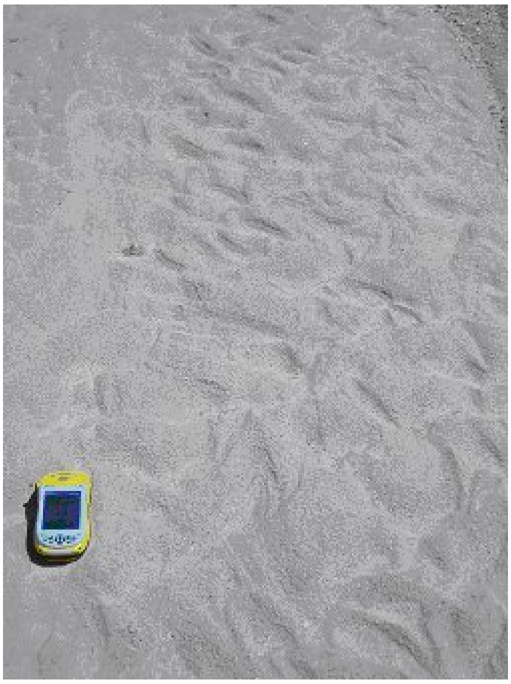
observations of the samples taken were made back at the habitat.

Lithologies described in literature[9][10]

The area around the Mars Desert Research Station characterized mesozoic sediments. The morphological features of cliffs, rims and canyon were formed by persistant erosion.

Triassic: The only formation of Triassic age in the MDRS area is the **Navajo Sandstone**. The pale-coloured sandstone shows cross-bedding which represents ancient aeolian sand dunes. Buff-coloured knobs and cliffs are typical weathering features of the Navajo Sandstone.

Jurassic: The **Carmel Formation** is usually of green red or gray colour and consists of limestones, shale and gypsum. White to red sandstone interspersed by thin beds of muddy siltstone make up the **Entrada Formation**. While the sandstone were deposited in an arid environment (much of Utah was a desert during this time), the siltstone is a product of marine reworking of aeolian sands during high tide. A possible combination of these two environments could be a sabkha-like facies, which occurs at the transition between a desert environment and a shallow sea. Over the Entrada-Formation lies the **Curtis Formation**, which consists of pale green sand, silt and limestone deposited in a shallow sea. The next formation in this sequence is called Summerville and is made up of thin continuous beds of orange and brown mud- and siltstones. Occasionally white layers of gypsum can be found. Gypsum is a product of evaporation and thus signifies a fall in the sea level. Gypsum veins which are not parallel to the layering were produced later on through mineral-rich groundwater flowing through rock fractures. Additionally, ripple marks and mud cracks can be found in this formation.



Ripples made by flowing water preserved in a dried creek bed.

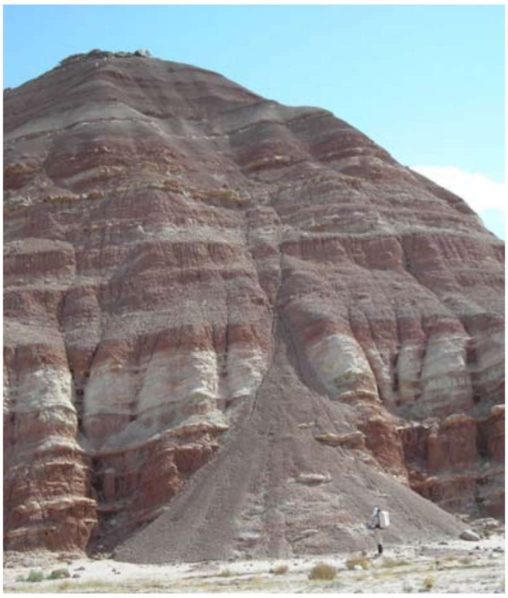
The overlying strata of the **Morrisson Formation** can be subdivided into the Tidwell Unit at its base, the Salt Wash Unit in the middle, and the Brushy Basin Unit in the upper part. The gypsum-rich silt- and sandstones of the Tidwell unit are often eroded. Sometimes a greenish layer on the tops of vertical cliffs of the Summerville Formation can be observed. The transition to the Salt Wash Unit is marked by a change in environmental conditions. Fluvial sandstones and

[9] Francis, S., A Brief Geological History of the Area Surrounding the MDRS Hab, 2003.
[10] Hargitai, H.I., Geomorphologic investigations and Mars analogs at Mars Desert Research Station, 2006.

Different weathering properties produce mushroom-like shapes. The lower-lying sediments are more easily eroded than the top layers.

conglomerates, deposited in channels of an ancient river system, mark a much wetter climate. Between the river channels red and green siltstones were deposited. The Brushy Basin Unit is made up of deep red, green and white mud- to siltstones, occasionally limestone ledges can be found. These sediments, rich in clay minerals and volcanic ash, are easily eroded and form low rounded hummocks.

Cretaceous: The oldest strata in the Cretaceous stratigraphy are represented be the **Dakota Formation**, which is further subdivide into three units marking different environments. The lowest-lying unit consists of massive conglomerate deposits with rounded pebbles and ochre-coloured cross-bedded sandstone, typical for rapidly flowing rivers. The next unit in sequence is made up of sandy coal, deposited in a swamp environment. Sandstone from a shallow sea makes up the top unit and stands for a rise in the sea level. Oyster shells and fossil burrowing-marks are wide-spread in this unit. Altogether the Dakota Formation is much more resistant to erosion than the underlying Morrison Formation. This means that the Dakota Formation is often undercut, sometimes to such an extent that large blocks of Dakota Formation fall down from the tops of cliffs.



Alluvial fan (crew member in front for scale) in which the layers less resistant to weathering are washed away.

The **Mancos Formation** lies over the Dakota Formation and consists of Tununk Shale, Ferron Sandstone, Blue Gate Shale, and Emery Sandstone units. The Tununk Shale is dark brown in colour and easily eroded. The deep sea anoxic muds rich in organic material bear witness to the continuing fall in sea level. The Ferron Sandstone marks an ends of the marine regression. The rocks of this unit were deposited in a large delta environment, in which sand eroded from an orogenic sedimented over the deep-sea muds. This sandstone is relatively resistant to erosion and provides protection to the underlying softer Tununk Shale. The Blue Gate Shale is also soft and easily erodes into rills and ridges. The shale of this unit marks another rise in the sea level. The uppermost member of the Mancos Formation, the Emery Sandstone, is a pale yellow sandstone which once again marks the return to a shallower marine environment. It is also more resistant to erosion than the shales of the underlying unit.

Results

A wide range of the different lithologies present in the MDRS area were covered by the samples taken on the extra-vehicular activities. For a more detailed analysis of the effectiveness of the sampling procedures, the great amount of data collected during the simulation still needs to be processed.

Loose rock found on Skyline Rim (23_3)

6.2.2 TeleMars

Team: Dr. Rudolf Albrecht, Paul Beck, Katharina Bischof, Gernot Groemer

Rationale

The presence of a small (robotic) telescope unit offers a series of unprecedented advantages based upon the position of the system relative to Earth, e.g. for observing objects in the solar system from different viewing angles (such as the sun), allowing for a rapid orbit determination for comets and asteroids, and even offering a research opportunity for deep space astronomy, such as (hypothetical – the details have to be studied) interoferometry synchronized by an external signal (such as pulsar signals), giving a baseline of up to 380 million kilometers. Such a telescope would be mostly remotely controlled from Earth, but for the set-up and calibration, a human operator would offer a significant benefit. Besides astronomical advantages, a telescope would enable the crew to target e.g. radio-communication dishes precisely to Earth or would allow for a relatively precise position determination in case other systems fail.

Hence, one of the objectives was to study operational aspects of a small telescope under simulated Martian conditions. The Mars Desert Research Station offers the opportunity to do amateur astronomical observations with a Meade LX200 system which can be controlled from the working station on the upper deck.

Test planning

However, the first procedures, such as opening and closing the dome for acclimatisation, rotating the dome and being available for manual interventions requires a human presence at the site. Therefore, the AustroMars mission planners had allocated appropriate crew time to operate the telescope in evening EVA's. The potential hazards of such a nightly EVA-mode were minimal, as all pathways to the telescope were illuminated by LED-lights and the terrain was well-known to crew.

A small astronomical observation programme had been designed by Paul Beck and Katharina Bischof from the Institute for Astronomy at the University of Vienna which could be done with such a small instrument without science grade filter systems, namely to search for minor planets and small solar system bodies and refine orbital parameters.

TeleMars situation on-site

Unfortunately it turned out, that Mars Society mission directives ruled out the usage of EVA-Suits in sim when operating the telescope for safety reasons. The dome is so small, that it can only be used by a single analogue astronaut at a given time – abrupt movements might damage the telescope, e.g. with the PLSS. Mission Control therefore advised the On-Site Support Team to act as “automated assistants” to perform tasks which otherwise probably would have been made possible by robotic assistance on Mars during a real mission.

However, each time when there was a scheduled slot for astronomical observations, there were either technical problems with the power supply and data link to the Habitat and/or bad weather conditions.

Therefore it has been decided –also given the apparent lack of sleep of the flight crew – to abandon this experiment for the reasons given above.

6.3 Engineering

6.3.1 Rover

Within the two weeks of the mission, 20 experiments were conducted, one of which was the technology demonstration of the AustroMars rover, nicknamed “Sisi”. The rover had been designed and built by a Technical College – the TGM – in Vienna, Austria, supported by the expertise of space professionals. Even though Sisi passed its performance tests in Vienna, due to unknown reasons the rover proved to behave rather buggy during the mission, requiring an intense repair activity at the MDRS.

Roving Utah: Sisi during a test run (above image) and the cover page (below) of one of the first thesis within AustroMars, dealing with the power design of the rover.

Comparable to the Apollo 13 incident(s), we had to set up an expert group, collaborating with the astronaut conducting the repair. However, in contrast to today’s space missions, it was the astronaut, who was driving the repair activities, as he was the man in place and in possession of an information monopoly. Especially because of this unique set-up, the related activities are likely a good example how similar tasks might be best set-up for a future manned Mars mission. Technical papers outside this report presents key lessons learned, compare the repair task performance with terrestrial efforts and provide recommendations for future missions how the balance between autonomy and interactivity is best maintained.

6.3.2 Habitability

When planning long duration human space missions, the human element has often been described as mission critical. The extreme environment and long term exposure to sensory deprivation makes it unpredictable how the crew will behave under nominal and non-nominal situations. The few isolation studies performed so far reveal the lack of knowledge about the crew behaviour in such missions. Current and past simulators often focus on a specific topic and rarely simulate the integration and symbiotic interdependence of the space environment, the spacecraft, its ECLSS systems, its crew, mission control and the family, friends and values left behind on Earth by the crew.

This research presents an overview of past and present terrestrial simulators. As a review document, it serves as a resource for drawing requirements and background information for the development of simulation facilities, however there are limitations to the review process undertaken. The main limitation relates to the timely access of information, with past simulators releasing large volumes of detailed information 25-40 years following the studies; others to language of the country of origin or little technical and operational information on relating websites.

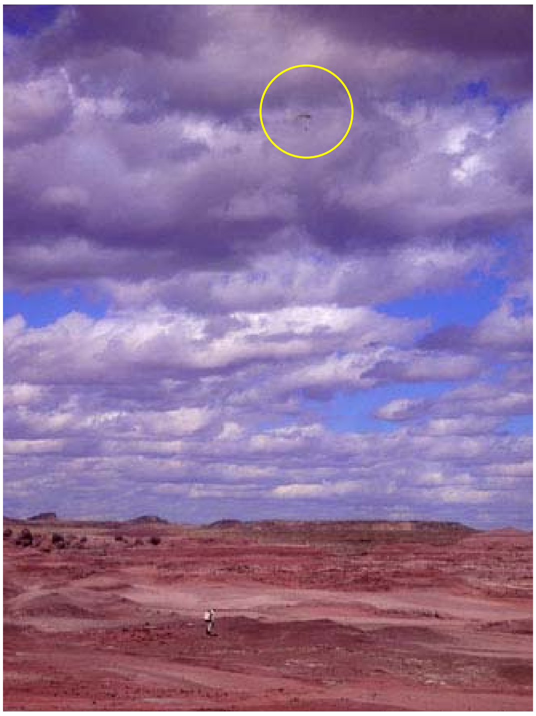
The research outcome provides summary highlights and major medical/scientific investigations and technological functions for all of the simulators featured. A comparative analysis of the various key technical data for the simulation facilities as well as the integration of the information to help clarify lessons learnt and lessons not learnt has been assembled.

Simulations have never been performed under realistic technological, architectural and psychological conditions and their interlocking effects. Spacecrafts operate in a non-forgiving environment. ECLSS systems are loud and noisy. The interior of a space habitat is likely to be hot, humid and smelly. Real-time communication with Earth is not possible. Food will be repetitive after a while, as well as daily procedures. The scientific results may seem repetitive after a couple of months. Escape is not possible. The critical manoeuvres of rover docking and daily EVA's have never been combined with long-term isolation and its potential effects on the human being.

When heading for a human Mars mission in 2030 it is time to progress towards integrated knowledge and mission development. High-fidelity simulators are therefore needed and shall have the possibilities to evaluate the human response under realistic conditions. Further they shall serve as a test-bed for the study of habitable volume, as it contributes to a range of physiological and psychological variables key to understanding the challenges and benefits of manned-missions. The development of a scalable facility, where living volumes can be modified as required for specific mission requirements, can contribute much needed knowledge of the effect of habitable volume on crew performance, satisfaction and mission success.

During the AustroMars mission, a detailed questionnaire was filled out by the flight crew post-flight. The questions included various issues such as waste management, lightening situation, personal space, coloring and many more. These data will be compared to other isolation studies within the European Space Agency's FIPES study. This project shall culminate in the establishment of a (permanent?) simulation facility for spaceflight incorporating the lessons learned from many exploration mission simulations.

6.3.3 Aerobot



In addition to simulated remote sensing data, the exploration cascade was completed by an aerial recoinnaissance system. There were several attempts in field trials in Austria which system to use best, but most of them had the problem that they needed excessive crew training time (e.g. a helicopter), were not realistic for a Martian environment (again, helicopter), or technically too complex (like a large airship that was tested in Tyrol).

The AutroMars engineers then tried B-wing aeroplanes which combined low airspeed with easy navigation and realistic weight allowance for a radio-controlled video system. However, these systems (two units were built and tested) were impossible to use with a simulated spacesuit. Hence, the decision was made to go for a glider system which was nearly selft stabilizing, easy to use and still had enough payload allowance to allow a Black Widow AV-System (a commercial off-the shelf-component) to be put on board which had a radio range of about 600 m.

The system was based on a Graupner G-con Sky Surfer chassis combined with a Black Widow AV system using a wide angle lensing system, a platine camera and a 200 mW transceiver. The receiving system was a laptop with a video-in signal which was connected to a 30 dB omnidirectional antenna and a video-converter.

Unfortunately, this system turned out to have a big disadvantage when it came to power consumption and the problem of difficult take-off procedures. In the end, the aerobot only flew a few times during the simulation. However, during the hot phase of AustroMars, the video system was then also used for medical videos taken during various extra vehicular activities.

Avionics compartment of the Aerobot.

6.3.4 Exploration Management

An important part of a simulated space mission is the development and testing of procedures to be used in a real mission. While some things look good on paper, the harsh reality of a high fidelity simulation helps in determining the proper course of action in various activities necessary for a human mission to Mars and Mars on-planet exploration.

The AustroMars project wanted to test several operational procedures (»How to ..« and »What to do if ..«) during the two week simulation phase:

Crew productivity and daily schedule planning

It is a known fact that the time available for payload operations, experiments and EVA activities is a comparable low percentage of the available crew time. Station and spaceship maintenance, sleeping cycles, crew hygiene, cooking, physical work-out to combat zero-g effects, eating and writing reports, space-ground communication take up the bulk of an astronauts time in space. Based on the baseline mission scenario with only 2 weeks on the surface of mars, every hour counts.

The AustroMars team planned to increase crew productivity by producing a detailed pre-mission schedule for every crew member in 15 min intervalls throughout the day. This schedule was then modified every day for the next work day, taking into account every non-nominal event or delay that resulted in a deviation from the baseline schedule. This revised daily activity plan was then transmitted to the crew (and on-site support) shortly before or during their rest period. The commander had to right to further modify the plan when unexpected events made the execution of the planned schedule not possible. It was clear to all involved that this strong external influence on even minute details of an astronaut's activities requires a very disciplined crew and creates stress. Time for relaxation or recreational activities was planned in to compensate.

The MCC staff estimated a +10 % increased crew productivity (over normal schedule planning done by commander and his XO at the end of a work day) during the first simulation week, mainly due numerous anomalies in the stations power systems and malfunction of the rover hardware. The second week showed a slight increase to +15 % crew productivity, despite increased stress levels due to heavy workload, time lost from repairing damage to station structure during a storm and continued power and data connection problems. With less anomalies the MCC planning staff estimated the potential for a + 20 % increase in crew productivity, with especially the commander having more productive work hours per day, which accounts for a significant portion of the productivity increase.

Due to several problems with the station, the schedule was not followed as accurately as MCC wished in the first days, even taking anomalies into account. Then the commander had seen to it that his crew more closely followed the schedule, anomalies permitting. It was also obvious that the crew used the time planned for relaxation or recreational activities during week 2 to catch up on any remaining backlog. It also needs to be taken into account for future projects that the time spent writing daily reports (both the standard reports for the Mars Society as well as the reports and documentation for the AustroMars experiments and outreach activities) is non-trivial and was underestimated in our baseline planning. The same can be said for planning an even work distribution amongst the crew for repetitive tasks (like cooking, greenhouse duty, video messages to public, cleaning, certain medical and psychological experiments). It is of great importance that the daily schedule is sent to crew and on site support as soon as possible, especially when on site support has to prepare for a long distance EVA of the crew.

It has been shown that detailed schedule planning can improve crew productivity during short term missions, if it is constantly modified by the MCC and commander to adapt to on-site conditions. However, adequate crew selection and training as well as psychological monitoring is a must to avoid »burning out« your crew with such a tight schedule.

Anomalies

The AustroMars project planning team – in coordination with the PIs and flight surgeon - had prepared a second version of the baseline mission schedule not available to the crew. This version included several planned anomalies to test crew response in non-standard and emergency situations. The crew was trained to handle such situations. This included :

- Problems with power supply
- Problems with communication and telemetry
- Medical emergencies
- Fire alarm
- Solar Storm / radiation hazard
- Pressure leak
- Scientific opportunities and »positive« anomalies deviating from the planned daily schedule
- Problems with the exploration vehicles (rover,aerobot)

Not many of these anomalies had to be simulated, as the crew had to face and overcome numerous challenges with the MDRS equipment and the exploration vehicles. Power and rover problems dominated the preparation week and Simulation Week 1. Communication problems (antenna dealigned by desert storm) and problems with the waste water system dominated Simulation week 2. Structural damage to the station (wind/storm damage) was repaired out-of-sim due to the danger of losing a significant portion of the MDRS roof. However, afterwards this was used to simulate a pressure leak, with the crew putting on EVA suits in a very short time (according to prepared emergency procedures) and a simulated repair of the leak.

A fire alarm was combined with a medical emergency. This and other medical emergencies was handled by the flight director and flight surgeon mailing a selected crew-member that he should simulate an injury (and raise the alarm). The other crew members were not aware of when it would happen or to whom. One of the medical anomalies was scheduled to occur when the crew medical expert was on a long distance EVA and not immediately available.

An anomaly with psychological effects was the solar storm event. First the MCC simulated a drop in communication quality and issued a solar storm warning to the crew, which was ambigous (due to simulated signal degredation) concerning the arrival time of the storm Mars. Part of the crew being on an EVA also increased tension as they had to be recalled as soon as possible while the rest of the crew preparing the simulated radiation storm shelter. They later found out by repeatedly requesting from CapCom the resending of the warning and combining the non-scrambled parts of the message that they had time to prepare. During the simulated radiation hazard/solar storm the crew spent several hours in cramped conditions in the airlocks (=simulated storm shelters). The change of pace from heavy workload to forced inactivity also affected the crew.

4 Crewmembers staying in the primary airlock for several hours – catching up with some reading.´´ during the solar storm. The other 2 are in the engineering airlock.

»Positive« anomalies were interesting scientific discoveries to be found by EVA teams during their exploration activities. The on-site support team – under instructions by the PIs - prepared these anomalies (e.g. signs of active volcanism) and the flight director ensured during the daily planning that the EVA team passed through this area.

Exploration cascade

The AustroMars project wanted to test the »exploration cascade« principle : a satellite discovers a scientifically interesting site, a flying vehicle explores it in more detail, a rover sends pictures up close and personal and then the crew visits the most interesting places for in-situ work. The vehicles can be controlled both from MCC and the habitat. Although we have simulated this »cascade« during several EVAs (which included »positive« anomalies), the hardware problems with the exploration vehicles (rover, aerobot) did not allow a full simulation as planned, especially not the steering of the rover from a MCC work station.

In situ resource utilization

The use of local materials instead of transporting everything from Earth is one of the most important evolutionary steps mission planners can take on their road from single shot »stick your flag in« missions to a permanent exploration and base occupation strategy. Within the framework of AustroMars we have chosen the task of filling sandbags as an example for ISRU. Besides the use of sandbags as building material and radiation protection, it also served as a way to physically exhaust some of our crew (which was important for certain medical experiments) and test the limits of the maneuverability of the EVA suits during hard labor.

Crewmembers filling sandbags for radiation shielding.

Although simulation astronauts are perfectly capable of performing this duty, it is definitely a strenuous and time consuming activity, with the flexibility of the suits being a major factor.

Filling a sandbag consumed roughly 5-10 minutes. If someone wants to shield a larger surface, virtually dozens to hundreds of sandbags have to be filled leading to a wall building time of approximately 1-2 weeks for the size of a 1 m high wall sourrounding the MDRS hab. – Therefore this seems to be an unrealistic option for short term stays.

It is recommended that earth controlled semi-automated vehicles are used to save astronaut time. MDRS simulation crews doing any kind of digging and building away from the habitat also have to take into account that they have to undo all their work at the end of the exercise and leave the workplace in the condition they found it as much as possible.

Chapter 7

Crew Selection and Training

7.1 Public announcement and response

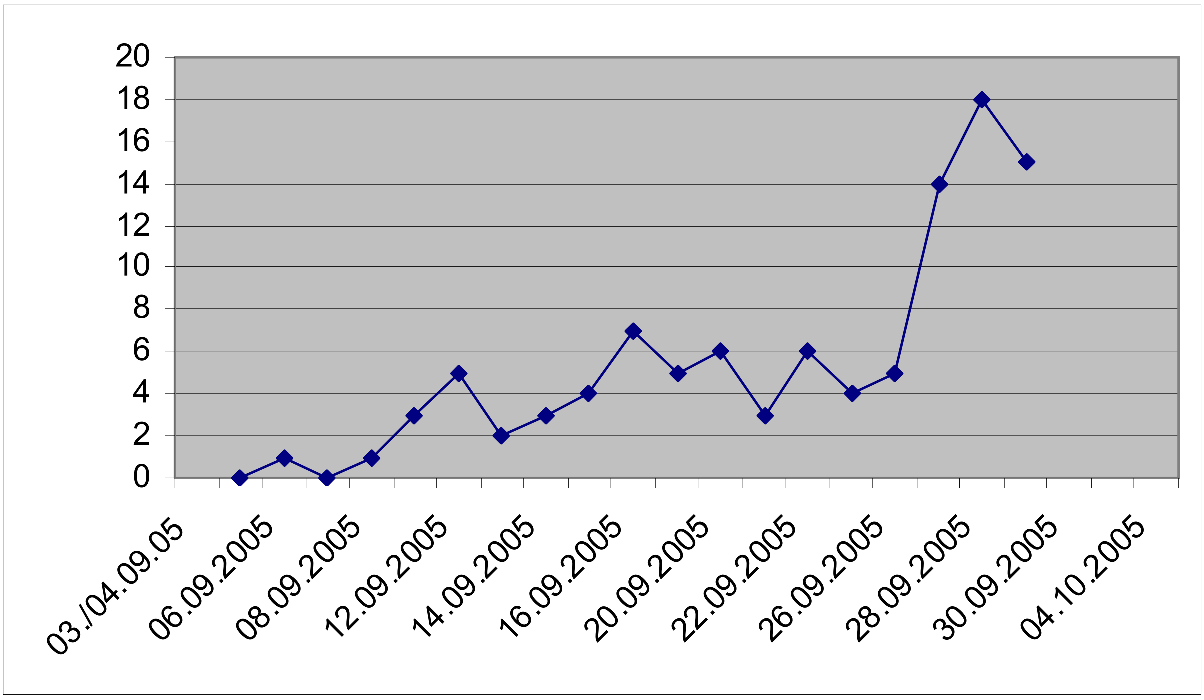
Screenshot from one of the major announcements of the crew selection opportunity.

In the end of August / beginning of September 2005 a call for flight crew applicants was made public, resulting in 182 serious responses. 172 of those went into the first, formal selection process. This number is surprisingly high, as it was made clear in the announcement that the time and efforts required for a participation in AustroMars were significant. In comparison: For the first and so far only Austrian cosmonaut selection in 1988, 220 people applied, 20 women amongst them. 198 of those complied with the formal requirements.

The opportunity was announced via mass media, such as national television stations, all major daily newspapers in Austria and regional magazines. There was a live show in the Austrian Broadcasting Cooperation (ORF) which had an audience of estimated 360.000 viewers on that particular day. Numerous radio and TV interviews were given, there were even reports about people applying for the "Mars mission".

Three of the applicants who made it into the flight crew were also part of the project management team (Norbert Frischauf, Alexander Soucek and Gernot Groemer). The reason why core people from the project organization were included into the flight crew team was, that at the time of the "hot phase" in Utah, most of the major management decisions were already made and during these critical 2 weeks a highly qualified and trained executive team under the lead of flight director Willibald Stumptner was able to make short-term decisions.

The number of applications received per day can be clearly correlated to certain media announcements. Details are given in the following table:



The geographical distribution of applications is described in the table below:

Province	B	K	NOE	OOE	S	ST	T	V	W	other	
# of applicants	2	6	16	21	6	43	22	4	45	6	**171**
formally rejected	0	3	6	6	1	12	9	1	11	0	**49**
formally accepted	2	3	10	15	5	31	13	3	34	6	**122**

Gender	m	f	total
# of applicants	142	29	**171**
formally rejected	38	11	**49**
formally accepted	104	18	**122**

regional distribution	West	Mid	East	
# of applicants	38	27	106	**171**
formally rejected	11	9	29	**49**
formally accepted	27	18	77	**122**

West...	V, T, S, plus others
Mid...	OOE, K
East...	NOE, B, ST, W

Where the following abbreviations were used:
W: Vienna (Capital City), B: Burgenland, NOE: Lower Austria, OOE: Upper Austria, St: Styria, K: Carynthia, S: Salzburg, T: Tyrol, V: Vorarlberg, others: Austrians and german speaking applicants living abroad (Switzerland, Germany, Italy and United States).

7.2 Flight crew selection process

The complete application papers had to include a detailed curriculum vitae, a passport photo of the applicant, a hand written motivation letter, a form including all vital data (contact coordinates, height, weight, etc.) and a signed legal document through which the applicant agreed to participate in the crew selection and training process if she or he would be selected.
The selection committee was composed of representatives from the Institute of Psychology at the University of Innsbruck, medical doctors from the Medical Universities of Graz and Innsbruck and delegates from the Logistics and Support Unit (which was also handling the training process). No members from the project management were included in that committee to ensure an objective selection.

The psychological selection process

Psychological Selection was done by the research group „Emotion-Kognition-Interaktion“ (EMKONT) of the Institute for Psychology at the University of Innsbruck in the period from November 2005 – January 2006 and comprised three steps. Selection steps were based on a multimodale upheaval, objective tests, qualitative interviews and last but not least the actual behaviour in a group. It was the job of these studies to find 9 candidates. Three of these 9 candidates formed the so called backup group.[11] The following table shows a summary of this process.

Phases	Period	Place	Persons	Selection criteria
Preselection	10/05	Institute f. Psychology of the Univ. Innsbruck	172	complete application papers; Compliance of the so called basic criterions
Selection 1	05./06. 11. 05	Tests Vienna/Innsbruck	104	Performance parameter; Personality tests.
Selection 2	14.–25. 11. 05	Institute f. Psychology of the Univ. Innsbruck	33	Psychological Interview
Selection 3	End 01/06	unknown	15	Team-Parsing
Result			6 (+3)	

Overview about phases and parameters of the psychological selection

172 Applications (1.10.2005, date of postmark) from all over Austria: After a first Selection (complete application papers, age between 25 und 40 und body height between 160cm -195cm) the researchers invited 104 candidates to a first selection; 20 persons went to an on-hold position. Psychological Tests (Step 1), between 5 and 6 November 2005 were conducted with the assistance of the company *Schuhfried* in Vienna and Innsbruck, they got parameters about power and common personage. The researchers analysed all results of these exams, reducing the number of applicants down to 50. Afterwards they analysed the results of the personal inventory test sheet (“Persönlichkeitsfragebogen” 16PF) based upon dimensions like – emotional durability,

[11] Three Candidates were quasi-fix from the beginning of the process, but participated in all qualification tests as normal candidates.

self-confidence, inner silence and high power strength. This yielded 33 candidates (4 women and 28 men). The psychologists sent these 33 persons to a psychological interview to Innsbruck (14 to 25 Nov 2005) (Step 2). During these interviews they tested all candidates in 16 dimensions, like self- and foreign-sense, selfregulation, teamplaying capabilities, reflexivity and affectual regulation. Upon this basis they selected at least 15 of the best candidates. At the end of January 2006 they came together for a final test selecting the final 6 + 3 flight crew members.

Selections	Period	#	Methods of Tests
Selection 1	Nov 2005	104	Questions • AMT, LVT, DT, COG, 2HAND, SIMKAP
Selection 2	Nov 2005	30	Videos of psychological Interviews; Analysis of mimisch-affective Behaviour • Ratings to self- and foreign sense, Teamcapabilities & affect regulation • Questions about emotions belonging to the Interview (DAS) • Questions belonging to Stress-manipulation (SVF) • Questions belonging to Emotion-regulation (EER) • Questions belonging to psychical Problems (BSI) Questions belonging to stress Reactions and Goals (AERZ)
Selection 3	Jan 2006	15	Videos belonging to exercises that will be done in Groups to see how eill the Candidates work together.
Online	April 2006	6	Self-Assessment of power and working together in groups; • Foreign-Assessment of power and working together in groups;
Medical Examins	April/ May 2006	6	Interview about stress during the simulation; • Self-Assessment of power and working together in groups; • Foreign-assessment of power and working together in groups;

Table : Sequence of events for obtaining psychological selection data

Applied Tests:

- AMT – Adaptive matrices test (Hornke, Etzel & Rettig, 2000)
- LVT – line following test (Wagner, 1996)
- DT – Wiener Determinationstest (Schuhfried, 1996)
- COG – Cognitrone (Schuhfried, 1994)
- 2HAND – Two-handed coordination (Schuhfried, 1994)
- SIMKAP – Simultanous capacity/multitasking (Bratfisch & Hagman, 2000)
- 16PF – 16 Personality factors test (Schneewind, Schröder & Cattell, 1986)
- DAS – Differential affect scale (Merten & Krause 1993)
- SVF 120 – Stress copying questionnaire (Janke, Erdmann, Kallus & Boucsein, 1997)
- BSI - Brief Symptom Inventory (Franke 2000)
- EER – Questionnaire for emotional regulation (Benecke & Vogt, in Vorbereitung):
- AERZ – Questionnaire w.r.t. nuissance copying (Weber & Titzmann, 2003).
- INTREX (german version, Tress 1993)

During the psychologial interviews: 2 highly trained psychologists and a representative from the projects Logistcs and Support Unit plus a technician monitor the interview.

Psychological Interview

The psychological Interview was done by a team of two highly trained interviewers. Its main goal was to find intrapsychical structures which are responsible for stress and negative emotions and also between conflicts between persons. It was carried out in main parts by the Operationalisierte Psychodynamische Diagnostik (OPD; Arbeitskreis OPD 1998). Die OPD is a reliable and validated system for the evaluation of psychological disorders based on illness, conflict, relation and structure on a structurized clinical Interview. For this interview the psychologsits have used elements of structural diagnostic and also conflict diagnostic. In addition, they also enlarged the tests with a few extra dimensions, which seemed to be relevant for the selection of crewmembers: „Capability to work in a Team“, „Living in Isolation“, „Reflexions on strengh and weakness“ and the capability to solve „Conflicts“. Both interviewers were certified users of the scientific OPD; one of the interviewers is also a OPD-Trainer. All interviews were conducted in a split-screen-procedure. The studies tried to find out the capability of a candidate with stress, isolation and conflicts during the situation. (Time around 60 min.)

Self- and foreign evaluation of the power of a group

To get criteria about the evaluation of strengths, the psychologists used tests with questions about self- and foreign-evaluation to study the effectiveness of living together in a group during and after the simulation. Each crewmember had to estimate his/her output about how he/she believed the other members of the group would estimate him/her. Also the 5 other crewmembers estimated the effectiveness of each person. All in all there were 7 independent evaluations. The examinations were based upon a rating scale developed from McFadden et al. (1994) und Rose et al. (1994) to get results on empirically tested scales w.r.t. leadership, working together in a team, living together in a group, teamwork, job performance, efficiency under stress, personage and also personal wishes about working together. The evaluation was based on a scale which is divided into seven steps „extraordinarily applicable“ to „not applicable“.

Interview about subjective experience and critical load during the simulation

One week after the simulation the psychologists obtained a qualitative interview with each crewmember about the subjective stress he had experienced during the simulation. Also each crewmember expanded on his experiences with conflict situations and solutions.

All data files were obtained between November 2005 and April 2006. After the end of the simulation in Utah, the psychologists analysed all data files, which is a fairly complex task including raw material for another 1-2 years of research.

Medical selection process

In parallel to the psychological selection process, a detailed medical examination of all 30 finalists was carried out in close cooperation with the Medical Universities of Graz (Institute for Physiology), the Institute for Adaptive and Spaceflight Physiology (IAP, Graz) and the Institute for Cardiovascular Medicine at the Medical University of Innsbruck.

The main task was to select-out candidates with a high risk of not being able to meet the physical requirements of the mission. 30 finalists were thoroughly examined by assessing the fitness and physical status via the following tests:

- detailed medical interview
- detailed physical examination
- spirometry
- ergometry under stress
- cardio-echography
- blood analysis (with big lab)

Norbert Frischauf performing ergometry tests. During the assessement, lactat measures were taken.

In cases of ambiguities, follow-up tests were carried out. For several candidates this was the first time they underwent such a scrutinizing examination. Hence, in a few cases e.g. the blood analysis revealed potentially risky patterns, such as high cholesterine levels etc.

The medical interviews were focusing on examinations of family anamnesis, general reactions to various noxes, allergies, myogelosis, para-vertebral muscular hardenings, joint abnormalities, abdominal, pulmonal and cardiac history, tonsillary status, jaw & teeth status.

The laboratory analysis included checks on the following parameters:
Glucose, HbA1C, urea nitrogen, creatinine, glomulary filtration rate, proteins, total bilirubin, urinary acid, cholesterine, hdl cholesterine, ldl cholesterine, non-hdl cholesterine, triglycerides, natrium, potassium, magnesium, GOT (ASAT), GPT (ASAT), Gamma-gt,

creatinkineasis, alkalic phosphatase, cholinesterase, lactate-dehydrogenises, CRP, iron, transferrine, ferritine, transferritine saturation, PT quick, leucocytes, absolute neutrophile number, erythrocytes, hemoglobine, hematocrite, thrombocytes, MCH, MCHC, MCV, erythrocyte-spread, complete differential blood: segmented cells, lymphocytes, monocytes, eosinophiles, basophiles.

The urinary status included the following parameters: leucocytes, nitrite, pH, proteins, glucoses, keton bodies, urobilinogen, bilirubin, erythrocytes, and relative density.

All values were medically validated by a lab physician.

In addition, there was a detailed laboratory analysis on serum protein electrophoresis checking the various values of proteins in the serum, immunoglobines in the blood, infection markers, vitamins, thyroidal hormones (TSH, FT4, FT3), and a virus serological assessment (Anti-HAV, Anti-HAV-IgM), HEPA-interpretation, HBsAG, Anti-HBs, Anti-HBc, HEBP-interpretation, Anti-HCV, HEC-interpretation.

The stress ergometry included measurements on heart rate, RR, PER and AP-condition whilst checking the ECG for abnormalities (e.g. extra systoles etc…). In addition there was a detailed lactate monitoring which lead to a exercise recommendation for the individual candidates.

The echo-cardiography checked for RV-Index, various physiological parameters such as wall thicknesses, septum-diameter, aortal conditions, the various volumina of heart compartments, ventricular sizes, etc… mobility of the mitral valve, pulmonary valve and tricuspid valve. The assessment also included a Doppler sonography, circulatory times and carotis pulse curve.

One of the LBNP-test subjects shortly before fainting due to the pressure loss in the lower extremities.

In addition to this, 15 finalists had to undergo a Lower-Body Negative Pressure test at the Institute for Adaptive and Spaceflight Physiology in Graz which was combined with a small research project looking into the hormonal response to physiological stress induced during the experiment.

As a last, formal point, there was a background check performed by the Logistics and Support unit and an interview after the psychological test batteries checking for language abilities and asking various technical questions to get a better and complete understanding of the candidate’s ability to handle complex technical procedures.

7.3 Training activities (principles, chronology, topics)

The training for the AustroMars flight crew was modeled after the current training strategies for pilots and astronauts on a small level. The training included a mixture of theoretical lectures and a lot of hands-on training plus exams to make sure that all theoretical content was properly understood. In the following table, the complete training schedule is given:

1. module /Graz 17.-18.12.2005	theory	Mars ref. missions, ESA/FFG, Aurora/SEI-frameworks Who is Who in AustroMars, Mars Society geography: Utah, MDRS Environment Introduction to astronomy (solar system) field orientation, GPS system photograhpy training (theory) Mars planetology I
	hands-on	physiotherapeutical training field orientation using GPS photography training (practise)
2. module /Innsbruck 21.-22.01.2006	hands-on	psychological selection night sky orientation night sky orientation practise (Planetarium Schwaz) MDRS Hab Systems I microbiology I geology I
3. module /Innsbruck 4.-5.02.2006	theory	first aid micro biology II Mars planetology II
	hands-on	stress management training media training rethorical training I emergency medicine microbiology practise (Lab)
4. module /Graz 18.-19.02.2006	theory	on-going Mars activities microbiology practise (Lab) exam
	hands-on	acrobatic flight training (Punitz military airport) rhetorical training II (H.G. Heinke) procedures training with MCC-staff experiment training I (PhysioMars, BioMars, TeleMars, Aerobot)
5. module /Graz	theory	technology: habitat subsystems, s/c subsystems

4.-5.03.2006		electronics I Mars planetology III geology II
	hands-on	planning of pre-week activities electronic lab training experiment training III (MedMars, Habitat-Software, Habitability) exp. training II (PsychoMars, GeoMars, FAMOS, OT)
6. module /Tirol/Kühtai 18.-19.03.2006	theory	Mars planetology IV Mars & Humanities: philosophy and legal matters
	hands-on	medical training procedures training: Hab maintainance, GreenHab, lab work team building exercises ATV field training/ rough driving
7. module/Graz 25.-26.3.2006	theory	experiment-training IV Exam
	hands-on	emergency medicine farewell-ceremony with MCC-staff

In between these very intensive training modules (usually between early morning right into the night), there was time for personal study and physical training directed by the Institute for Cardiovascular Medicine of the Medical University of Innsbruck. In addition to this, each flight crew member responded to various interview requests and was assigned to various experiments, so that a personal connection to the experimenters was ensured. This was considered to be an excellent move, because the time slots allocated for the experimental trainings were rather short given he complexity of some tasks.
This turned out to be extremely useful, when anomalies would appear during the simulation itself and short-term decisions had to be taken.


XO A. Soucek obviously having fun in practising microbiology procedures with Florian Selch (Molecular biologist, University of Vienna).

The training programme was considered to be one of the most exciting parts of AustroMars during the preflight period, as it allowed detailed insights in various fields like how to apply a cast (and do it practically!), how to drive all-terrain-vehicles in rough terrain, how to respond to media inquiries, how to talk to youngsters of an elementary school and many more.
The acrobatic flight training at Punitz military airport was done to increase the trust of the crew in technology in a potentially hazardous environment.

In the laboratory kitchen of the University Hospital Innsbruck's training establishment, MSP Kandler discusses the dietary programme „FoodMars" with dietologists.

For most of the training activities, other team members were entitled to participate on a case-to-case basis to a) create a system of incentives and b) enhance the social bounds between the flight crew members and the rest of the team. For that very reason and to reduce project costs, during the training sessions the programme management made sure, that the flight crew members would be housed by team members in their private homes.

Flight crew finalist and later lead CapCom Raphaela Hechl during the first aid training.

Acrobatic flight training at Punitz airport: Please note that the cockpit is pointing downwards. The accelerations obtained were approx. +4/-2 g.

Flight engineer Christian Hutsteiner during off-road driving training at a quarry in Roppen which was generously offered as a training site for the crew for two days by a local company. The vehicles were rented from the Quad-Freax-Team in Tyrol, one of the leading off-road groups in the region, who also introduced the flight crew in basic maintenance and handling of the machines.

Dr. Rosmarie Oberhammer is teaching XO Soucek and BU/P Rene Vidalli how to handle the ultrasound bladder scan device which would be used during all EVA preparations in-flight. BU/L Johannes “Sandwich” Nendwich is the “patient”.

Group photo of the 15 crew finalists during the astronomical training at the Zeiss Planetarium Schwaz, on the left side: the managers of the planetarium, Axel and Gabi Krieger and their son. All uniforms including the flight overalls were sponsored by Fair Rescue International.

Prof. Spoettl from the Geology Department of the University of Innsbruck gives an introductory lecture on geology.

Chapter 8

Mission Control Center

The Mission Control Centre (MCC) for AustroMars was the headquarters of all technical and administrative activities in Austria during the actual simulation phase. The MCC was responsible for the contact to the „Mars“ base and the crew, the on-site support team in Hanksville, Mars Society’s mission support in Denver and the science teams. It was also responsible for outreach, media and sponsoring activities. The MCC Salzburg was manned 24 hours a day. During the day two shifts worked in the MCC,

Typical MCC setting: Flight Director Willibald Stumtpner discusses the upcoming flight plan with geologist Iris Lenauer, molecular biologist Florian Selch and psychologist Florian Juen.

consisting of approximately 10 people. In the night shift and in periods of reduced activity, a core team of at least 3 people were available, others on stand-by.

In addition, the regular Mission Support infrastructure of the Mars Society Headquarters in Denver/Colorado was used. Most of the time, the Mission Support members were based also in the city of Amsterdam/The Netherlands (Artemis Westerberg) and Houston/Texas (Tam Czarnik, Medical Director for MDRS operations of the Mars Society).

8.1 Set-up

The MCC consisted of the following positions:

- *Flight Director* – responsible for the whole simulation coordination
- *Technical Support / Rover Operator* – responsible for the technical equipment and controlling the rover
- *CapCom* – communications with the crew
- *Flight Surgeon* – crew health (physiological)
- *Crew Support* – crew health (psychological)
- *Documentation / MediaCom* – Coordination of press and documentation
- *Principal Investigators* – persons responsible for the scientific experiments
- *General Support* – persons responsible for the infrastructure of the MCC

CapCom Christian Makolm during a night shift around Easter Sunday.

Their areas of responsibility will be explained in more detail in the following paragraphs.

COMMUNICATION

The MCC used the internet as a means of communication, with special emphasis on the program “Skype” for instant messaging, voice contact and file transfer. This was supplemented by e-mail, cell phone and mail. On-site webcams both in the MDRS and the MCC allowed all teams as well as the public to observe the activities – with new pictures every few minutes. During the simulation phase all communication with the flight crew in the MDRS was conducted with a time delay to simulate the long distance between Mars and Earth. This was done at the MCC by waiting ten minutes before replying to messages from the MDRS. Video communication was also used, with support of the “switchX” software (in cooperation with the ORF – Austrian National Television Broadcasting Agency).

MDRS OPERATIONS

MDRS operations were monitored by ground-based operators. However, in order to ensure that the AustroMars team had a clear and concise picture of events, a Flight Control Team (FCT) consisting of Flight Director, Technical Support and CapCom performed a number of operations support activities, using data from both the down linked telemetry (habitat environmental conditions), dumps of the various on-board system logs and on-site measurements. These activities occurred both in real-time and non real-time (off-line). The FCT was also the core team that was on duty 24 hours a day, for the whole 2 week simulation phase. The FCT depended on data supplied by the Flight Engineer as well as the on-site technical support team – with daily Engineering Reports as well as direct communication via Skype.

These activities focussed on key areas where additional expertise and resources, beyond those necessary to support the basic and nominal steady-state operations, were needed. These areas are as follows:

- Activation/check-out, reconfiguration and deactivation of the MDRS systems;
- MDRS anomaly investigations;
- MDRS configuration control;
- MDRS inventories supervision;
- MDRS maintenance assessments;
- Dialogue on MDRS systems;
- Dialogue on payloads;
- Operations products maintenance.

Payload operations support was provided on-site at the MCC and off-site at Payload/Experiment locations/institutes, if necessary.

The MCC was run in three shifts during the two simulation weeks.

1. shift 7 a.m. – 3 p.m. (All positions)
2. shift 3 p.m. – 11 p.m. (All positions)
3. shift 11 p.m. – 7 a.m. (Flight, Engineering, CapCom)

The time refers to MCC time.

During the preparation week no official shift rotation was implemented, but nonetheless the MCC operated 24 hours a day even during this time.

The MCC was officially opened on 8th April 2006 and finished its operation on 22nd April 2006.

MCC PHYSICAL INFRASTRUCTURE

The MCC was accommodated in the Christian Doppler grammar school in Salzburg. This location provided a perfect mix of available technical infrastructure, 24 hour accessibility for team and public, central location in a major town, extremely motivated support by school staff and students at very low cost.

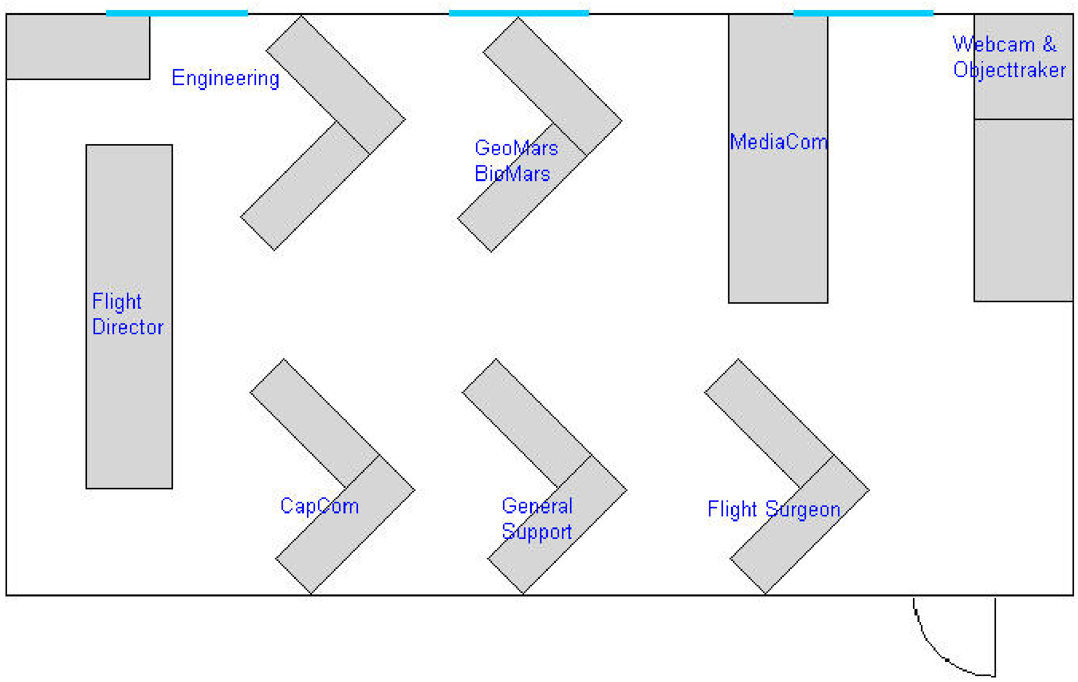
In the preparation phase other locations were suggested by various supporters of the AustroMars project. These included private company offices, barracks of the Austrian army or university facilities.

The MCC based in a school in Salzburg/Austria.

All had their merits, but were lacking in one area or the other, while the Salzburg location met all criteria. It has to be noted that every contact with the public during activities of the Austrian Space Forum often leads to important contributions from motivated space enthusiasts (like the Christian Doppler grammar school student Sebastian Sams) for future projects.

The MCC consisted of the Mission Control room, Conference room, General Purpose room, Kitchen and Library. The Mission Control room accommodated the flight operations control/coordination and ground operations functions, and provided office space.

A conference room was used during outreach activities, interviews, staff meetings and managerial and administrative functions, including visiting operations support personnel. The General Purpose room hosted the school servers and was used for storage and infrastructure management operations. The kitchen operated 24 hours a day. The library was used as a quiet location for rest, especially by the on-duty flight surgeon who was on call in 24 hour shifts.



MCC Room Sketch including operator stations

MCC Flight director work station (and part of the MCC crew)

AUSTROMARS MISSION CONTROL CENTER STAFFING PLAN

The detail of staffing description includes the General Staffing Concept, positional tasks and responsibilities according to the mission phases.

Objectives

A primary objective of the Staffing Plan is to provide a description of the MCC Flight Control Team (FCT) and support positions.

MCC STAFF

Flight Director	Willibald Stumptner, Dieter Maier, Michael Taraba, Simon Feigl
Engineering, Technical Support	Dieter Maier, Michael Taraba, Mario Lassnig, Johannes Wernig-Pichler, Harald Fauland, Wolfgang Jais, Harald Fuchs, Simon Feigl
CapCom	Raphaela Hechl, Georg Kaiser, Christian Makolm, Ernst Stelzmann
Flight Surgeon	Götz Nordmeyer, Rosmarie Oberhammer, Niki Steinhoff, Renate Mauschitz, Eva Maria Hartung
Crew Support	Florian Juen
MediaCom	Daniela Scheer, Katja Bedenik
Principal Investigators on site	Iris Lenauer, Florian Selch

General Support	Sebastian Sams, Christian Posselt, Oliver Hauser, Markus Haider, Markus Keller, Melanie Albiger, Sigi Schmuck, Gregor Krevs, Christian Egger, Bernhard Mitterwallner, Felix Härtnagl, Julian Härtnagl, Mag. Ludwig Bermoser, Mag. Helmut Friedl

Operations and Staffing Concept

An analysis of associated personnel interaction is included in the position description, which indicates the relevant positions tasks to support the AustroMars mission:

- MDRS Activation and Checkout Phase
- Payload/Experiment Operations Phase
- EVA Phases
- Other Phases

The AustroMars Flight Control Team included positions performing MDRS systems monitoring and control, user operations coordination and flight operations planning product generation. In addition, the Flight Control Team did coordinate and monitor the delivery of data, commands, voice, and video communications between the MDRS on-board source/destination and the MCC.

The Flight Control Team performed both on- and off-line tasks. The FCT positions and their responsibilities are described hereafter.

MCC Flight Director (FD or Flight)

The MCC Flight Director is responsible for the overall mission operation, safety and effective MDRS system and payload operations.

During mission/simulation preparation, the FD is responsible for ensuring (at a management-level) that the resources of the MCC and the supporting operational ground segment are adequate to conduct mission operations. This includes ensuring adherence to mission rules, and proper coordination of any necessary deviations.

The FD position was manned on a continuous, 24-hour per day basis. At most times FD and one back-up was available in the MCC. During the mission the active FD was always reachable via a special cell phone rented for the duration of the mission.

***Interactions*:**

MCC Team	During real-time operations, the **FD** acts as the main decision-taker and coordinator of the **Flight Control Team** at the MCC and approves all operations decisions with respect to the MDRS Element systems and payloads.
CAPCOM	The **FD** interfaces with **Capsule Communicator (CAPCOM)** for authorization and coordination of Space-to-Ground (S/G) communications for system and payloads operations and to transmit requests, decisions and/or changes of operational activities to the MDRS crew operations. The FD will coordinate with CAPCOM for official status announcements and operational discussions, GO/NO GO decisions, flight plan updates and problem reporting. Flight coordinated with CapCom for approval of all operations decisions and commitments with respect to the MDRS systems and/or payloads activities.
FCT	The FD coordinates with the **Flight Control Team (FCT)** for approval of all operations decisions and commitments with respect to MDRS system issues. The FD was notified by the FCT of MDRS anomalies affecting nominal operations and coordinated the impact of those anomalies on planned operations.
Principal Investigator (PI)	The FD coordinates with the **Principal Investigators (PI)** for approval of all operations decisions and commitments with respect to payload issues. The FD and PE notified each other of MDRS and payload anomalies affecting the other's operations and coordinated the impact of those anomalies on planned payload operations. The PI and FD coordinated the use of S/G link for payload issues. FD ensured enough time for payload operations in the daily schedule planning based on PI input.

Back up (Mars Society) Mission Support	The FD announced all decisions affecting MDRS mission operations and coordinated those issues with the Mars Society **Mission Support Center** in Denver **.** FD relayed Mars Society requests via CapCom to the crew.

In addition, the MCC Flight Director was responsible for modifying and revising the existing overall mission schedule so that it included any necessary changes based on the state of the MDRS and the health of the crew.

A daily flight plan product was generated every day to coordinate next day operations preparation activities. This schedule was transmitted to crew and on-site technical support personal during their rest periods.

The Flight Director was responsible for updating the RSS news feed of the AustroMars website as part of the outreach activities of the MCC.

MCC Flight Surgeon (SURGEON)

The Flight Surgeon had overall responsibility at MCC for crew health related issues. The Surgeon provided support for all issues relating to crew health and medical data management, including pre-flight preparation, real-time monitoring, real-time conferences, and post-flight rehabilitation. The Surgeon also provided support regarding medical or life science payloads, hazardous operations and medical policy making within the complete AustroMars program. Surgeon was available for several health related issues amongst the MCC staff.

The Surgeon position was online 24 hours per day, 7 days per week. Physicians are quite used to 24 hour duty days, so they rotated daily – in contrast to the three 8 hour shifts of the other MCC staff.

Flight Surgeon, Biomedical Engineer positions and medical support specialists such as psychologists and others were on console at their respective instititutes on a shift rotation basis.

***Interactions*:**

MDRS (Flight Crew)	During real-time operations, the **SURGEON** acts as the coordinator with the **Flight Crew** at the MDRS on physiotherapy-counter measures, advises on medication and makes recommendations with regard to Greenhab-Operations Hygiene. Surgeon organizes MCC support in case of real emergencies (this included contact with on-site medical staff near the MDRS).
FD	The ***Surgeon*** coordinated with Flight for official medical status announcements and crew health discussions. Surgeon coordinated with FD for approval of all crew health decisions and commitments with respect to the MDRS medical matters. Surgeon notified the FD if the PI should communicate with the crew for crew health related issues. Surgeon gave FD the necessary input for daily schedule planning changes as dictated by real or simulated crew injury.
CAPCOM	The Surgeon interfaces with **Capsule Communicator** (CAPCOM) for the coordination of crew health related issues and for making recommendations to the crew and advised on counter measurements in case of real emergencies.
Crew Support	Surgeon coordinates with Crew Support/psychologist about the psychological impact of health related issues.
Principal Investigator	The Surgeon coordinates with the **Principal Investigators** for approval of all hazardous operations decisions and commitments with respect to the payload issues. The Surgeon and PI notified each other of crew health problems affecting crew capabilities and coordinated the impact of system anomalies on planned payload operations. The Surgeon and FD coordinated with PI the use of S/G for payload issues.
Back up Mission	The Surgeon coordinated crew health related issues with the **Mission Support Center**.

Support (Denver/CO)	

Capsule Communicator (CAPCOM)

The Capsule Communicator or CAPCOM was responsible for coordinate the use and distribution (enabling/disabling) of Space-to-Ground communications and voice link with the Flight Crew for MDRS operations. The CAPCOM was online 24 hours per day, 7 days a week.

***Interactions*:**

MDRS (Flight Crew)	During real-time operations, the CAPCOM acts as exclusive counterpart to the **Flight Crew** at the MDRS and communicates all operations decisions with respect to the MDRS systems and payloads. Communication with flight crew regarding scheduled and unscheduled Mission Action Requests and MDRS daily status. Furthermore the CAPCOM interfaces to the flight crew to coordinate/conduct daily crew briefing sessions and coordinates family contacts.
FD	The CAPCOM interfaces with the **Flight Director** for authorization and coordination of Space-to-Ground voice communications for system and payload operations and to receive requests to communicate with the MDRS crew for system operations.
FCT/Engineering	He interfaces with the **FCT** for coordination of communications on MDRS system operations and to receive important information to communicate to the crew for system operations.

SURGEON	The CAPCOM interfaces with **Surgeon** for the coordination of communication with flight crew in case of crew health problems.
Principal Investigator	The CAPCOM interfaces with the **Principal Investigator** to coordinate communications for payload operations and to receive important information to communicate to the crew for payload operations and coordinate payload uplink messages.

The CapComs were chosen from amongst those crew applicants who trained longest with the flight crew, but had to drop out at the last selection step. This ensured a strong relationship between the crew and "their" (wo)man on the ground. It gave the space-to-ground communications a necessary comradely touch amongst all the pressures of mission schedule and payload operations duty. CapComs also excelled at explaining to crew or MCC staff the respective point of view of the other group. Cap Coms also acted as confidential channel between the crew and their families. That included looking after family members visiting the MCC.

CapComs have to be able to do extensive multi-tasking and often had to handle multiple requests from the MCC staff at the same time. CapComs need a high resistance to stress. Especially during situations of degraded communication quality (simulated solar storm or real life sandstorm or equipment malfunction) it is their job to communicate to the crew the most essential information clearly and quickly.

Technical Support and Rover operations

During mission preparation and real-time operations, technical support is responsible for solving any and all technical problems around the MCC as well as coming up with solutions for all kinds of problems and malfunctions at the MDRS. This involved an intimate knowledge of MDRS technical equipment and procedures, technical and media equipment used by the crew, communications technology and payload/experiment hardware. Exploration vehicle (rover, aerobot) malfunctions were solved in close cooperation with crew and on-site technical support.

Remote-controlled rover operations were planned, but could not be implemented beyond basic measures due to problems with rover hardware. The technical support also organized replacement part shipment to the MDRS site in the preparation week. Technical support was also responsible for data archiving and back-up data storage.

Interactions:

FD	The primary contact is the **FD** for planning daily systems or near-term re-planning activities. Discussions concerning inventory, stowage, consumables and re-supply planning for system and payload operations are conducted. The technical support also assisted the Flight Director and **PI**s with regard to payload malfunctions and operations re-planning.
MediaCom	The technical support assisted **MediaCom** with classroom interactions and Media interactions, acting as guides or hands-on experiment demonstrators (like water rockets etc.)
Back up Mission Support (Denver/CO)	Technological solutions were coordinated via FD with the **Mission Support Center**, based on their intimate knowledge of on-site equipment from previous MDRS expeditions.

Ground General Support (GGS)

The Ground General Support (GGS) was responsible for the management of all the MCC ground facilities necessary to support AustroMars mission operations.

The GGS provided support to both the real time and preparation activities for the MCC Operations, infrastructure services and partner communications support. The GGS provided 24 hours MCC facility control, communications support and data capture functions. The GGS supported the MediaCom in public outreach activities. The GGS was responsible for purchasing the necessary equipment, supplies and food to sustain the MCC for 3 weeks of continuous operations.

***Interactions*:**

FD and FCT	Contact with the **FCT** for resolving ground segment anomalies and ensuring the necessary data rate, network troubleshooting & coordinating with the school staff. Coordination of ground network data, video or voice communications including configuration changes, and troubleshooting. Coordination with **FD** about planning for daily schedule of MCC operations.
MediaCom	Coordination with MediaCom, supporting numerous guided tours, outreach activities, production of promotional material, hands-on experiments.

Media Communicator (MedCom)

The Media Communicator (MediaCom) was responsible for coordination of Media activities and for configuring AustroMars video conferencing and managing all preventative and corrective maintenance of the media equipment.

The MediaCom supported the Ground General Support in planning resource utilization and configuration of the media resources to support mission/simulations operations. This position was also responsible for the implementation of user video product requirements and supporting the distribution of video/video products for the purposes of public relations.

MediaCom was responsible for event planning, especially involving interaction with VIPs. Promotional activities were planned by MediaCom and executed with the help of GGS. MediaCom also was responsible for website content product generation.

The MedCom position was active during normal office hours, but provided extended support during periods of high activity.

Interactions:

All MCC positions	The MedCom interfaces with all MCC positions for planning media activities (especially interviews) and assists the FCT with coordination of interactions with the Public Community and Press.
Public and Press	Coordination of media activities, communication on updates and development of the AustroMars program to the Public Community and Press.

Crew Support (Psychological Crew Health)

Crew Support was responsible for assessing crew member's psychological health and directed psychological experiments. Crew Support monitored most communication with the crew and used it for determining the psychological situation of the crew during the simulation phase. Crew support coordinated with Flight surgeon with regard to psychological impact of health related actions.

***Interactions*:**

FD	Crew support gave the **FD** an assessment of crew status and morale. FD used this for daily schedule planning, especially with regard to workload distribution amongst crew members.
MDRS (Flight Crew)	Crew Support had a private channel with the Flight Crew and was available for advice and support related to the psychological situation of the crew.

Principal Investigators (PI)

The **Principal Investigators (PI)** had overall responsibility for the science operations of the payload complement on the MDRS. Their responsibilities included coordinating the resource allocation to each of the payloads out of the overall allocation, defining priorities for payload operations, resolving resource conflicts between payloads, approving change requests which impact the use of AustroMars resources, acting as an appeal route for Austrian PIs to the MCC Flight Director, and acting as a point of contact for Science issues to the Back up Mission Support. The PIs also had a strong influence on planning of EVA activities, by chosing the points-of-interest to be examined near the MDRS during EVA operations.

The PI position in the MCC was manned during the MDRS operations activities by various PIs. During the whole mission PIs and their teams were on call at their respective home institutions to resolve any anomalies with their experiments.

***Interactions*:**

FD	The **PI** coordinates with the **FD** for approval of all operations decisions and commitments with respect to payload issues. The PI and FD notified each other of MDRS and payload anomalies affecting the other’s operations and coordinated the impact of

	those anomalies on planned payload operations. The PI and FD coordinated the use of S/G link for payload issues. PI input helped the FD in planning daily schedules.
FCT	The PI interface is with the **FCT** for reporting and discussing payload status and coordinating real-time payload change requests.
Back up Mission Support (Denver/CO)	Coordination of payload re-planning proposals, recommendations and development are conducted with the **Mission Support Center**. The impact of payload and EVA operations on the environment near the MDRS was discussed with Denver.

8.2 MCC activities

Staff rotation and accomodation

With AustroMars being a project based on the work of many volunteers it was a non trivial task to ensure proper staffing of the MCC at all times. Only a few of the volunteers were able to stay at the MCC for the whole 3 week mission.

The number of on site staff was planned based on volunteer availability and scheduled mission and outreach activities. The lions share of the MCC lived in the YO-HO Youth hostel Salzburg, Paracelsusstrasse 9, 5020 Salzburg/Austria, approximately 10 minutes walk from the MCC. Others had found private accomodation.

All the newly arrived volunteers had to be shown around the MCC, trained in their respective positions and the necessary procedures.

Staff planning was done by MediaCom representatives, with help from General Support and Flight Director. The final staffing plan is shown below, however the original plan had to be slightly modified daily based on staff availabilty, travel and time restrictions etc.

MCC		SO	MO	TU	WE	TH	FR	SA
		09.04.	10.04.	11.04.	12.04.	13.04.	14.04.	15.04.
Flight	7 - 15	Michi	Michi	Michi	Michi	Michi	Michi	Michi
	15 - 23	Willi	Willi	Willi	Willi	Willi	Willi	Willi
	23 - 7	Dieter	Dieter	Dieter	Dieter	Dieter	Johannes	Johannes
Physician		Renate	Renate, Götz	Götz	Götz, Eva Maria	Eva Maria, Götz	Götz	Götz, Rosmarie
CapCom	7 - 15	Christian	Johannes	Ernst	Johannes	Johannes		Olivia
	15 - 23	Ernst	Ernst	Georg	Raphi	Georg	Makolm	Raphi
	23 - 7	Raphi	Raphi	Raphi	Georg	Raphi	Raphi	Makolm
MediaCom	7 - 15	Katja	Katja, Daniela	Katja, Daniela	Katja, Daniela	Daniela, Katja	Daniela	Daniela
Engineering	7 - 15	Olivia	Sigi	Harry F.	Sebastian	Harry F.land	Harry F.land	Sebastian, W.Jais
	15 - 23	Johannes	W.Jais, Harry	Johannes	Johannes,W.Jais	W.Jais	Mario	Mario
	23 - 7	Mario	Mario	Mario	Mario	Mario	H. Fuchs	H. Fuchs
Psychologist	24h in stand-by	Florian	Florian	Florian	Florian	Florian	Florian	Florian
PI GeoMars		Iris	Iris	Iris	Iris	Iris	Iris	Iris
PI BioMars		Flo	Flo	Flo	Flo	Flo	Flo	Flo
General Support	No shifts	Oliver	Oliver	Oliver	Oliver	Oliver	Sebastian	Christian

&			Sebastian	Katja	Gregor	Sebastian	Gerhard	
OCP		Sebastian		Gregor	Katja	Gregor	Mrkus H.	
		Sigi		Markus H.	Markus H.	Markus H.	Christian	
		Felix	Felix	Sebastian				

	SO 16.04.	MO 17.04.	TU 18.04.	WE 19.04.	TH 20.04.	FR 21.04.	SA 22.04.	SO 23.04.
Flight	Michi	Dieter	Dieter	Dieter	Dieter	Johannes, Michi	Johannes, Michi	
	Johannes	Michi	Mario	Mario	Mario	Michi	Michi	Simon F.
	Willi	Willi	Willi	Willi	Willi	Willi	Willi	Willi
Physician	Rosmarie	Rosmarie	Niki	Niki, Renate	Renate	Renate, Rosmarie	Rosmarie	Rosmarie
CapCom	Olivia	Makolm	Ernst			Raphi	Raphi	
	Makolm	Ernst	Georg	Raphi	Raphi	Raphi	Makolm	
	Ernst	Raphi	Raphi	Georg	Georg	Makolm	Makolm	
MediaCom	Gerhard	Olivia	Katja, Daniela	Katja, Daniela	Katja, Daniela	Katja, Daniela	Katja	Katja
Engineering		Simon F.	Michi	Michi	Michi	Harry	Simon F.	Simon F.
	Sebastian	Johannes	Johannes	Johannes	Johannes	Simon F.	Olivia	Johannes
	Mario	Mario	H. Fuchs	H. Fuchs	H. Fuchs	Mario	Mario	Mario
Psychologist	Florian	Florian	Florian	Florian	Florian	Florian	Florian	Florian
PI GeoMars	Iris	Iris	Iris	Iris	Iris	Iris	Iris	
PI BioMars	Flo	Flo	Flo	Flo	Flo	Flo	Flo	
General Support		Harry	Harry	Sebastian	Harry	Sebastian	Sebastian	Olivia
&		Sebastian	Simon F.	Harry	Sebastian			Sebastian
OCP		Gerhard	Sebastian	Simon F.	Simon F.	Bernhard		Flo
			Olivia		Bernhard			

Chapter 9

Science Archive & Mars 2030 Science Workshop

The aim of this section is to describe the concepts of information and knowledge management for AustroMars. Due to the expected large amount of heterogeneous data originated in different fields and at various points of time, general considerations are taken into account. The simulation is an interdisciplinary set up including 13 experiments.

The important time steps were:

a) the preparation phase with the planning of the set up, logistics, scheduling and detailed description
b) the simulation phase itself with the data collection and documentation of tasks

c) the reporting phase afterwards with the extraction of the relevant information and the transfer to the mission control center MCC
d) finally, the analysis and the conclusions drawn.

Scope

During the AustroMars simulation a lot of data was gathered. To gain add-on value to this raw data, classification was necessary. Metadata like Dublin Core ensure the detailed description of the set, the content is indexed by subject cataloguing. Here all relevant fields should be covered not within a new scheme but with cross concordances and overlap to commonly used schemes used by the community. The user aspects are important for retrieval and reuse of the simulation data. An online interface was required for direct information access. To ensure data availability a concise concept for archiving and retrieval has been introduced, the detailed programming activities and beta-tests are well underway, under the technical lead of Hannes Mayer, ÖWF software engineer.

Procedure

The team started with a workflow analysis in order to set up a scheme to handle the incoming amount of data. The MCC is responsible for the storage of the electronic streams. Physical objects and other data media has also be edited in the meta level. Finally subject classification has to be applied for everything regardless from the origin of the resource.

The following kind of data has been identified

- Simulation raw data
- Labelling
- Status messages
- Publications

So far the versioning of internal pdf documents is done according to
ID + Version in reference to AM [UnitNr]Versionletter[A-Z]

This gives a first hint on the internal structure. The following fields identified could be identified by keyword search:

1. Architecture (light & color)
2. Geology
3. Geophysics
4. Climate / Meterology
5. Exo- / Microbiology
6. Medicine
7. Physiotherapy
8. Psychology
9. Robotics / Engineering

DC Meta Data

Label	Definition
Title	A name given to the resource.
Creator	An entity primarily responsible for making the content of the resource.
Subject	A topic of the content of the resource.
Description	An account of the content of the resource.
Publisher	An entity responsible for making the resource available
Contributor	An entity responsible for making contributions to the content of the resource.
Date	A date of an event in the lifecycle of the resource.
Type	The nature or genre of the content of the resource.
Format	The physical or digital manifestation of the resource.
Identifier	An unambiguous reference to the resource within a given context.
Source	A Reference to a resource from which the present resource is derived.
Language	A language of the intellectual content of the resource.
Relation	A reference to a related resource.
Coverage	The extent or scope of the content of the resource.
Right	Information about rights held in and over the resource.

The 15 DC elements and their description

The following vocabulary with 12 categories is provided for the variable "Type":
Collection, Dataset, Event, Image, MovingImage, StillImage, Sound, Text, Interactive Resource, Physical Object, Service, Software.

Coverage can be temporal (period) and or spatial (point).

"Subject" can be more specified according to the following general library classification schemes:
DDC, LCC, UDK

Context and Theoretical Background

Subject Classification

- **AMC** Association for Computing Machinery Computing Classification System (1998)
- **MSC** 2000 Mathematic Subject Classification (started 1991)
- **PACS** 2001 Physics and Astronomy Classification Scheme
- **IPC** International Patent Classification
  (started 1954, 1971 spread around)

Thesauri

- **Ethics in the Life Sciences** (2004)
  12 fields, 2,505 descriptors; Engl. / German
- **AAT** (Art & Architecture 2003)
  133,000 terms and descriptors; Engl.
- **MeSH** (Medical Subject Headings 2000)
  15 fields, 22,568 descriptors; Engl.

ICC Information Coding Classification

0 Systema-tifier / Ontical Groups	01 Theories, Principles	02 Object, Component	03 Activity, Process	04 Property, Attribute	05 Persons	06 Institution	07 Tech & Production	08 Application & Determination	09 Distribution & Synthesis
1 Forms & Structures	11 Logic	12 Mathematics	13 Statistics	14 Systemo-logy	15 Organization Science & Tech	16 Metrology	17 Cybernetics	18 Standardization	19 Testing & nitoring
2 Energy & Matter	21 Mechanics	22 Physics of Matter	23 General & Technical Physics	24 Electronics	25 Physical Chemistry	26 Pure Chemistry	27 Chemical Tech & Engi	28 Energy Science & Tech	29 Electrical Engi
3 Cosmos & Earth (Geo)	31 Astronomy & Astro-physics	32 Astronautics & Space Research	33 Basic Geosciences	34 Atmospheric Sciences, Meteorology	35 Hydrospheric & Oceanologic Sciences	36 Geological Sciences	37 Mining	38 Materials Sciences & Metallurgy	39 Geography
4 Biological Entities	41 Basic Biological Sciences	42 Microbiology & Cultivation	43 Plant Biology & Cultivation	44 Animal Biology & Breeding	45 Veterinary Sciences	46 Agriculture & Horti-culture	47 Forestry & Wood Science & Tech	48 Food Sciences & Tech	49 Ecology & Environ-mental Sciences & Tech
5 Human Beings	51 Human Biology	52 Health & Theoretical Medicine	53 Pathology & Practical Medicine	54 Clinical Medicine & (Nature) Cure	55 Psychology	56 Education	57 Profession Science, Labour, Leisure	58 Sport Science & Sport	59 Household [Economics] & Home Life
6 Society	61 Sociology	62 State & Politics	63 Public Administration	64 Money & Finances	65 Social Aid, Social Politics	66 Law	67 Area planning & Urbanism	68 Military Science & Tech	69 History Science & History
7 Material Products	71 General & National Economics	72 Business Economics	73 Tech	74 Mechanical & Precision Engi	75 Building	76 Commo-dity Sciences & Tech	77 Vehicle Science & and Tech	78 Transportation Tech & Services	79 Utilities & Service Economics

8 Intellectual Products	81 Science of Science	82 Info Science	83 Informatics, Computer Science	84 Info in general	85 Commu Science	86 Mass Commu	87 Printing & Publishing	88 Printing & Publishing	89 Semiotics
9 Cultural-Spiritual Products	91 Language & Linguistics	92 Literature & Philology	93 Music & Musicology	94 Fine Arts	95 Performing Arts [Theatre]	96 Culture Sciences narrower sense	97 Philosophy	98 Religion & Secret Teachings	99 Christian Religion [& Theology]

Dahlberg's scheme of scientific subjects

Abb.: Commu = Communication
Engi = Engineering
Info = Information
Tech = Technology

Mars 2030 Workshop

Mars 2030 was a small and highly focused workshop bringing together scientists from the field of Mars analogue research. It is also the AustroMars scientific symposium, presenting data and conclusions from an April 2006 high-fidelity field mission simulating the first human expedition on Mars in the desert of Utah.

The event shall foster networking within the analogue research community in a field which is becoming a rapidly emerging topic of interest for future human exploration beyond Earth orbit. It shall explore the opportunities analogue research stations offer.

This event became a highly productive workshop, allowing discussions on Mars analogue science issues on a very practical and interdisciplinary level and making a connex between analogue science practicioneers and the academic world with respect to human and robotic exploration activities.

Workshop topics included:

- Mars Analogue Research – Value, Limits and Opportunities, current and forthcoming initiatives
- Life Sciences: crew selection, psychological aspects, training; planetary protection and search for life, medical aspects (crew health support, emergency medicine, sleep research)
- Physical Sciences: Mars planetology, exploration strategies

- Technology: robotic exploration challenges, habitability

Mars 2030 was hosted by the Austrian Space Forum c/o Institute for Astro- and Particle Physics/Univ. of Innsbruck and the Centre for GeoInformatics (Z_GIS) at Salzburg University.

The Mars 2030 Workshop Venue

The Natural Science Faculty of Salzburg University is one of the most beautiful Campuses in Austria. Surrounded by beautiful landscape, the faculty is an inspiring place to exchange ideas and create an academic environment. The conference site is within walking distance to the Old Town of Salzburg.

Salzburg University
Natural Science Faculty
Hellbrunnerstrasse 34
5020 Salzburg, Austria

Workshop partner/host organization

Z_GIS

The Centre for GeoInformatics (Z_GIS) at Salzburg University is a well established centre of competence, active in research, continuing education and industry cooperation. Its range of activities include educational programmes, outreach initiatives and international collaboration projects, with competence being built from basic and applied research primarily funded through international programs. Chair: Prof. Dr. Josef Strobl

Workshop-Programme

Saturday, 23rd September 2006

19:30 „Mars night" (in german): public space show, Austria's biggest Mars-related event in 2006. A show including short presentations about Mars & Human Mars Exploration, images, impressions and vistas from the AustroMars Mission. (Admission is free for Mars 2030 participants.)
Location: Salzberghalle Hallein/Salzburg (15-20 min by car from the City of Salzburg)

Sunday, 24th of September 2006

09:00 Opening statements
Gernot Groemer (OeWF, organizer), Josef Strobl (Univ. of Salzburg),

09:30 Keynote address: *Sheryl Bishop, Human Factors Research (UTMB Texas) on*

"Getting There from Here: Using Analogues for Space Research"

10:30 Coffee break

10:45 Session A1: AustroMars project introduction, science capabilities & mission
Session Chair: Gernot Groemer (OeWF)
Presenters: Alexander Soucek (ESA/ESRIN), Gernot Groemer (OeWF), Norbert Frischauf (BAH/OeWF)

12:00 Lunch break (Reserved at Raschhofer´s Rossbräu - Herrnau Alpenstraße 48)

14:00 Session A2: Mars Analogue Engineering: Rovers, Habitats and Equipment
Session Chair: Norbert Frischauf (OeWF)

- *Gernot Kronreif (Austrian Research Centers, invited): Robotic perspectives*
- *Norbert Frischauf (OeWF): Lessons learned from the AustroMars rover*
- *Raphaela Hechl (ISU): Communication strategies at AustroMars*
- *Yunir Gautlin (SGAC) : Design of Telemetry, Tracking and Command Subsystem of Mars Gravity Biosatellite.*

16:00 Coffee break

16:30 ESA/NASA's Exploration Strategy: *Norbert Frischauf (BAH/OeWF)*

17:00 Panel & Discussion: Human factors research as mission enabling knowledge – Putting into perspective: what kind of mission riscs can be attributed to crew factors.
Moderator: Alexander Soucek (ESA)
Panelists: Sheryl Bishop (UTMB), Norbert Frischauf (BAH/OeWF), Luzian Wolf (OT), Nandu Goswami (Med. Univ. Graz)

<u>Monday, 25th of September 2006</u>

09:00 Session B1: Mars analogue projects: who is doing what & where? (Antarctic Stations, Underwater, desert and arctic habitats, bed rest studies, isolation experiments, laboratory simulations (e.g. LBNP))
Session Chair: Andreas Roessler (Med. Univ. Graz):

- *Barbara Imhof (TU Vienna):* "Past, Present and Planned Terrestrial Simulation Facilities"
- *Grasser Erik, Nandu Goswami (Med. Univ. Graz):* „Cardiovascular and hormonal responses induced by forced syncopal studies"
- *Oliver Botta (ISSI Bern): "*The Arctic Mars Analog Svalbard Expedition (AMASE) 2006"

10:45 Coffee break

11:00 Session B2: Planetary Protection & the Search for Life
Session Chair: Birgit Sattler

- *James Garry (Univ. of Leiden)* "Responses of a halophilic species to Mars-like environmental stresses"

12:00 Lunch break (University Cafetaria)

13:30 Session B3: Life Sciences & Human Factors: medical and crew performance research
Session Chair: Luzian Wolf

- *Birgit Högl (Med. Univ. Innsbruck):* "The pupillograph measurements during the AustroMars campaign"
- *Sheryl Bishop (Univ. of Texas)* "Assessing Group Dynamics in a Mars Simulation"

15:00 Coffee break & Participants photo

15:30 Session B4: Life Sciences & Human Factors: medical and crew performance research
Session Chair: Birgit Högl

- *Renate Mauschitz (Med. Univ. Graz): "*Emergency Medicine under Simulated Extraterrestrial Conditions*"*
- *Luzian Wolf (Object Tracker): "*Technology for Activity and Vigilance Monitoring"
- *Richard Scheuring (Wyle Lab/NASA JSC)* "Medical Emergency Simulations during the Haugthon Mars Project in the High Arctic" (via Teleconference)

19:00 Evening-Event (optional, in german): "Windows to Science"

Announcement of the "Windows to Science"-Initiative by Secretary of State for Research and Innovation, Eduard Mainoni; Salzburg Airport (close to conference site) ("Windows to Science" is a government sponsored public "viewpoint" about aerospace developments in the city of Salzburg).

Evening Reception with Austria's cosmonaut Franz Viehböck
"Sound of Space" (Percussion Performance Drumatical Theatre)
"UFO-Race Live-Act" (Peter Janisch & Space Crew)

Tuesday, 26th of September 2006

09:00 Session C1 & C2: Mars Planetary (Analogue-)Sciences and Ongoing & Upcoming Mars (Analog) missions

Session Chair: Gernot Groemer (OeWF)

- *Josef Strobl (Univ. of Salzburg):* "Mapping Mars - Lessons in Cartography and Remote Sensing"
- *Wolfgang Jais (Austrian Space Forum)*: "Capacity calculations for a Sabatier-based fuel production line on Mars"
- *Thomas Böttcher (TU Munich)*: "The Archimedes Project"
- *Gernot Groemer, Birgit Sattler (Univ. of Innsbruck): "*BioMars - New Insights about Cross-Contamination Procedures for Analogue Environments
- *Gernot Groemer (OeWF):* "The PolAres-Programme"

11:00 Coffee break

11:30 Panel & Discussion: Mars Analogue Environments - Values, constraints & opportunities; Site selection criteria
Moderator : Gernot Groemer
Panelists : Birgit Sattler (Univ. of Innsbruck), Oliver Botta (ISSI), Barbara Imhof (TU Vienna), James Garry (Univ. of Leiden)

12:30 Workshop summary & conclusion

Participants List

First Name	Second Name	Title	Affiliation	Country
Katja	**Bedenik**	Mag.	Austrian Space Forum	Slovenia
Luciano	**Belviso**	Mag.	Italian Space Forum	Italy
Sheryl	**Bishop**	Prof. Dr.	Univ. of Texas, Medical Branch	USA
Oliver	**Botta**	Dr.	International Space Science Institute	Switzerland
Thomas	**Böttcher**		Mars Society Germany / LMU Munich	Germany
Trond	**Dagfinn Trovel**	Mr.	SSETI	Germany
Norbert	**Frischauf**	DI	Austrian Space Forum	Austria
James	**Garry**	Dr	Astrobiology Group, Univ. Leiden	Netherlands
Yunir	**Gataullin**	Mr.	Space Generation Advirosy Council	Germany
Pascal	**Gilles**	Dr.	ESA	Italy
Nandu	**Goswami**	Dr.	Med. Univ. Graz/IAP	Austria
Anna	**Grinberg**		University of Waterloo	Canada
Gernot	**Grömer**	Mag.	Austrian Space Forum	Austria
Raphaela	**Hechl**		Austrian Space Forum	Austria
Armin	**Hendrich**	Mag.		Austria
Birgit	**Högl**	Prof. Dr.	Med.Univ.Innsbruck, Univ.klinik Neurologie	Austria
Barbara	**Imhof**	Dipl.-Ing.	Liquifier Systems Group	Austria
Florian	**Juen**	Dr.	Univ. Innsbruck, Inst. f. Psychologie	Austria
Gernot	**Kronreif**	Dr.	Austrian Research Centers Seibersdorf	Austria
Christian	**Makolm**		Austrian Space Forum	Austria
Renate	**Mauschitz**	Dr.	Graz Medical School	Austria
Hannes	**Mayer**	Ing.	Austrian Space Forum	Austria
Götz	**Nordmeyer**	Dr.	ÖWF	Austria
Götz	**Nordmeyer**	Dr.	Austrian Space Forum	Austria
Rosmarie	**Oberhammer**	Dr.	General Hospital Bruneck	Italy
Doris	**Peham**	Mag.	Univ. Innsbruck, Inst. f. Psychologie	Austria
Andreas	**Rössler**	Dr.	Med.Univ. Graz/IAP	Austria
Birgit	**Sattler**	Dr.	Univ. Innsbruck, Inst.f. Limnologie	Austria
Alexander	**Soucek**	Mag.	ESA	Italy
Stefan	**Stanger**		University of Salzburg	Austria
Mara	**Stepjanovic**	Mag.	Austrian Space Forum	Austria
Josef	**Strobl**	Prof. Dr.	Univ. Salzburg, Center f. Geoinformatics	Austria
Bijal	**Thakore**		International Space University	France
Luzian	**Wolf**	Dipl.-Ing.	Object Tracker	Austria

Chapter 10
Education & Outreach

Reaching the public was a core value for the project. Science behind closed doors is a lost opportunity. From its very beginning, the start of the definition phase in mid 2004, AustroMars was prepared and adapted to be what we can call a *public project*.

10.1. Outreach Overview

Rationale for the involvement of a broad public

<u>I.) Science is not rooted in itself</u>

Even though many scientists are sceptical vis-à-vis the public, it can be stipulated that the public has a certain right to be included in the communication of science. If science is the quest for knowledge, it needs someone who carries and someone who applies the knowledge. The understanding of the origins of life or the future of the solar system is an understanding for everyone.

Scientists are needed to first *get* the understanding and then to *share* it, not lock it or keep it. This is true even the more in a field which continuously claims to be searching the answers to the great *questions of humankind*, as astronomy does. **AustroMars therefore understood itself as vehicle to find and share knowledge.**

<u>II.) The interest-feeding loop: Towards politics via the public</u>

Politicians listen to people and reflect upon what people regard as positive. Occasionally they do what people want to do them. In a less polemic and also in a less strict sense, we can see a connection between the public opinion and the political opinion and therefore a direct utility in reaching both politicians and the public itself. When Kennedy declared the Moon landing a national goal of highest priority – and even the more in the decade to follow – the US public identified to a large extend with this goal. Maybe also because Kennedy felt, among other ambitions, that the public would do so, it is that he made that step. **AustroMars therefore understood itself as vehicle to originate interest and fascination for Mars exploration to start within the public and reflect on politicians as well as to start with politicians and reflect on the public.**

<u>III.) The core commitment of the Austrian Space Forum</u>

MediaCom Daniela Scheer (middle) preparing press releases with Katja Bedenik (left) and Oliver Hauser (right) at the MCC.

Excerpt from the website of the Austrian Space Forum: *The ASF (Österreichisches Weltraum Forum, ÖWF) is a national network for aerospace specialists and space enthusiasts. Our organization serves as a communication platform between the space sector and the public; it is embedded in a global network of specialists from the space industry, research and policy. Hence, the ASF facilitates a strengthened Austrian space sector through enhancing the public visibility of space activities, technical workshops and conferences as well as Forum-related projects.*[12] Public outreach and bridge-building without loosing the scientific correctness is a core commitment of the AustroMars-leading

[12] www.oewf.org

organisation. **AustroMars therefore understood itself as vehicle to realize the policy of the Austrian Space Forum for a mutual benefit of participating organisations and the public.**

IV.) Fulfilling the purposes of Mars Society

Excerpt from the website of Mars Society – outlining the purpose of the Mars Society: *To further the goal of the exploration and settlement of the Red Planet. This will be done by (a) Broad public outreach to instil the vision of pioneering Mars, (b) Support of ever more aggressive government funded Mars exploration programs around the world, (c) Conducting Mars exploration on a private basis.*[13]

AustroMars therefore understood itself as vehicle to realize the policy of the Mars Society as partner organisation and to proactively contribute to its goals.

A tired, but enthusiastic Flight Director Willibald Stumptner giving a radio interview.

V.) Enhancement of the public discussion

As much as the preparation of a future Mars mission needs well-qualified experts, it is also fed by a public discourse on goals and means. Public debate (in a neutral understanding) keeps the topic alive and develops it further (see also above: feeding loop). The strong outreach of AustroMars helped to broach the issue of both Mars exploration in general as well as human space exploration in Austria (considering that the countries' efforts, due to the lack of related industry, do not focus on human spaceflight). **AustroMars therefore understood itself as vehicle to start, steer and foster public discussion of Human Mars exploration.**

The messages

AustroMars had various important messages to pass. These messages where national and international, scientific, technical and artistic, rational and emotional, well-grounded and high-

[13] www.Marssociety.org

flying. Not always it is possible to strictly separate them or to precisely focus on the right addressees. Nevertheless, by constant repetition – as it was a goal of the public outreach work of the project – the team of AustroMars could achieve a large and continuous coverage of the topic.

EXPLORATION IS KEY

Exploration, in the context of space as well as in general, is the key for understanding and preparing for the future. Exploration is a direct consequence of human's curiosity, and as such it has accompanied human history throughout the times. There are many good reasons to fly to Mars, as there are many reasons not to: AustroMars avoided justifying the human Mars endeavour, as is often done with hundreds of good or bad reasons – AustroMars simply presented it as logic step of curiosity, to be made one day for the sole reason of readiness to do it. **Public response:** It was generally very well perceived by the public that exploration is a human condition sine qua non, and that Mars is just a step to be done one day or another because humankind can and wants to do it. When it came to concrete reasons, e.g. a comparison between humans and robotic exploration, the debate immediately started.

MARS IS THE NEXT GOAL

Why Mars? As said above and will be said below, it is not a question of "Mars or nothing". In the specific field of the exploration of Outer Space, Mars is the perhaps most intriguing place other than the Earth, as it provides for the most similar conditions. Mars is furthermore easy to reach. For human space exploration (nota bene: *space* exploration, not necessarily for human exploration in general) Mars is the next logical step after the Earth's orbit and the Moon. Mars is likely to give answers to the quest for extraterrestrial life. It's a combination of very unemotional, rather very logical reasons why a flight to Mars is on the agenda of the major space agencies. **Public reaction:** Positive, because clear arguments without excitement or exaggeration, yet a clear dedication and fascination.

PREPARATION HAS STARTED

The wealth of information about Mars exploration and Mars mission preparation passed to the public during the months of AustroMars clearly showed that this topic is not a remote idea, but a matured undertaking. Even though a real flight will depend on a firm political decision, we are in the midst of preparation: Why delay things that can be done today? **Reaction of the public:** The AustroMars team was faced with curiosity as well as surprise, when people started to realise how much has already been done and how broad and elaborated current Mars exploration and mission preparation is. This "look behind the scenes", made possible by the numerous science and engineering partners of AustroMars, helped the topic to be perceived as something tangible by the broad public.

EVERYONE CAN

Perhaps the most important message of all. AustroMars made clear to the broad public as well as to more than 140 volunteers engaged in this project that any personal commitment counts. AustroMars showed that space exploration is not a domain of NASA employees or TV series, but a true "hands-on" experience, as long as someone is willing. Also, there is a great deal of questions still to be answered, and it does not need world-class experts for each and every problem. For many of the project team, AustroMars was the first close contact with the field of spaceflight and a unique opportunity to contribute to one of humankind's most fascinating endeavours. **Public response:** Two-fold. As much as this approach was appreciated, it triggered scepticism, rooted in the believe that spaceflight is a domain of world-class experts working in industry and institutions. In other words: "What can be done voluntarily can't be valuable." Maybe the heritage of AustroMars will prove the opposite.

(f.l.t.r.): G. Groemer (Crew representative), H. Weissenböck, F. Juen and H. Hörtnagl from the selection comittee announce the 15 finalists in a press conferences at the Univ. Hospital Innsbruck.

EVERYONE COUNTS

The flight to Mars is a long way made of thousands of mosaic stones – AustroMars was just one, maybe a very tiny one – still *one*. Every stone counts, and every help counts to make this stone. Through the publicity of its ambition, AustroMars helped to pass this message on to everyone interested, and to motivate. **Public response:** Often first disbelieve, then positive surprise, then interest.

CURIOSITY, TRIAL AND ERROR

It is allowed to make mistakes (*"It's no shame to be ignorant, but it's a shame to refuse learning"* – Socrates). AustroMars was, despite all professionalism and dedication, a very human project in the best sense of the word: The entire project team had not undertaken such an ambitious endeavour ever before. Also, the experiments performed were the output of a constant quest to learn and understand.

This mixture made AustroMars very tangible. **Reaction of the public:** broad understanding. Reflection of the own curiosity. The public saw “people from next door” who one day decided to add, with their knowledge and energy, to prepare Mars exploration – average Austrians sharing a common passion and willing “to go beyond”. This gave the public perception a very positive twist.

MARS IS NOT THE MOST IMPORTANT THING IN LIFE

It may sound contradictory and even ridiculous for a Mars analogue mission: In its outreach, AustroMars frankly admitted that a mission to Mars is not humankind’s first and only problem, neither a reaction to the current state of the world nor a preparation for a better future. AustroMars presented its ambition as a very normal undertaking like science and research in general, like music, art, sports – like any human activity followed by a number of people and organisations.

Through this approach, no public discussion started on “why spending money here and not there”, people understood that money is spent everywhere for different goals and in different ways – the sum of which is human life. **Reaction of the public:** This less radical approach (compared to some partners of AustroMars) was very appreciated by the public, and people started to see Mars exploration in a different light, less controversial, more natural.

Hands-on Experience: A visitor at the Marsnight trying out the EVA gloves when working on a transmitter mock-up.

The addressees

<u>Children</u>

Children and young people were certainly a core focus of AustroMars. It comes as a natural effect that children with their *inherent curiosity* as part of their adolescence are attracted by space projects – which, ultimately, are also driven by an inherent curiosity. Hence, children can especially identify with such topics. Secondly, the adventure factor (*chill factor*) contributes to a better reception. Last but not least, the topic of Mars exploration with its constant repetition of “future achievements” and “future generations” helps children to identify with these long-term perspectives, as they feel it could be them turning things into reality which today are being prepared. **It was a standard of any AustroMars presentation to the public to suppose that the first person to set foot upon Mars is already born.**

The natural reaction in the audience is both predictable and fascinating: Is it me, the younger ones ask. Is it my kid, the parents ask themselves. *Who is it?*

<u>Students</u>

Students approach the topic with much more reflection. They are still in the middle of their learning and studying processes, hence equipped with curiosity, but have learnt to question and to oppose in a scientific or political sense. AustroMars tried to address students both of scientific and other subjects, last but not least to underline the interdisciplinary approach which is needed for a future Mars venture. AustroMars also could serve as a vehicle to bring hands-on experience to interested students (and others), both by offering the chance to join the team (see below: *AustroMars – an open project*) and by bringing the topic inside the classroom. In few cases, students who joined the AustroMars team proceeded with space-related post-graduates or activities (motivated by what they have learnt to know within AustroMars). In concrete terms, core member of the MCC (and also crew finalist) R. Hechl participated in the International Space University (ISU) Summer Session programme (SSP) 2006 in Strasbourg, France; crew finalist G. Kaiser joined the ESA Envisat Summer School 2006 in Frascati, Italy. Although not perceived by the public, such "personal stories" are and will remain a success of the Austrian Space Forum – more than ever so far for its flagship project AustroMars.

<u>The general public</u>

AustroMars **constantly and continuously approached the general public** in manifold, professionally organised ways (see below: *Means of Communication* and *Internal conflicts in external communication*). Even though the topic has certain preferred target groups, it is – after all – a topic for everyone. AustroMars therefore tried not to make any exception in choosing its audiences.

<u>Critics</u>

The outreach work of AustroMars did not avoid the discussion with critics. Naturally, a reflected dialogue was given preference to an empty repetition of polemics (on both sides of the "Mars front", by the way). Crucial in this respect were (and still are) the contacts with the public during or after *presentations and lectures*. This allows for a dialogue and exchange of views. AustroMars therefore tried not to cocoon, but to be open.

Means of outreach and communication

Active outreach & "snowball effect"

AustroMars followed a very active outreach policy. It made use of the multiple outreach channels and press contacts already established by the Austrian Space Forum since 1999. Three main lines of outreach were established already in the project preparation before the kick-off: internet, classical media (print, radio, TV) and personal outreach. The ambitions were reflected in the programmatic structure of AustroMars, which dedicated a third of its team, grouped under what was called *Unit Red* or *Humanities* (see below), to press activities, event organisation, education and communication / outreach. A press officer, *Daniela Scheer*, took over the coordination of all print media, TV and radio contacts and helped both the scientists and engineers finding the right outreach channel as well as the press finding the right contact within AustroMars. The AustroMars website provided the press with sufficient material (texts, background stories, images in various resolutions) and contacts. With such a defined and large network, the story of AustroMars, both in the beginning as nationwide casting for crew members and support and during the climax of the actual simulation in Utah, was continuously and intensively covered all over Austria.

The **deliberate preparation and conduct of outreach**, however, was only one factor. The other element of success was coincidental, yet a bit expected: With the very first day of online announcement of AustroMars, flanked by a nationwide, two-page reportage in Austria's biggest Sunday weekly, a "snowball effect" never seen before in the Forum's history developed: In the first two weeks of September 2005 (after kick off of the announcement for crew members), more then a dozen radio and TV interviews on local, regional and national level, multiple newspaper articles, a 15 minute live TV interview, a feature in Austria's national evening news and numerous web articles literally boosted the project to become known across the country. The **novelty** of the undertaking certainly added to the big success, as did the **uniqueness**, the **topic**, the **story**, the **partner network**, the **combination of adventure and science character**, the **openness to volunteers**, the **reflection of dedication and fascination** and, last but not least, a small yet helpful doses of **disbelieve and curiosity** ("What?!"). In the later stages of AustroMars, the project clearly profited from the media hype of the very first weeks and its status.

Overall, the outreach can be grouped in four big waves of interest:

5. First wave: Kick-off and crew casting (September / October 2005)
6. Second wave: Announcement of crew, science teams and experiments (January 2006)
7. Third wave: The simulation in Utah (March / April 2006)
8. Fourth wave: Shut-down with science conference and large event (September 2006)

The following section briefly elaborates on the communication channels used:

Internet

A flagship of communication, both internally and externally, was the project website of AustroMars www.AustroMars.at. This website was composed and designed by the Space Forums web administrator *Olivia Haider*, who works as successful web designer in real life with a proven track of oeuvres from national and international clients. The website got numerous highly positive comments and served as information node for everyone inside and outside the project. The AustroMars web appearance hence can be described as pillar both of project management (document hub, education forum, information node and archive) and project communication & outreach (communication forum, press platform, media resource and contact point). Apart of its own website, AustroMars used the internet for outreach through mailing lists (e.g. various Austrian astronomy and science groups), crew training and education, etc.

Last but not least, the Austrian Broadcasting Corporation, ORF, used its internet system Switch-X for a continuous live coverage during the simulation in Utah, providing interviews and videos with the crew on a daily basis. Also, a web diary was published by *ORF online* directly from Utah, showing the interest for AustroMars in Austria.

Media: Print, TV, Radio

The most important partners (beside the science and engineering partners) were the media. Print media were used as main channel of communication through the establishment of a media cooperation with Austria's largest newspaper, Kronen-Zeitung, and its science journalist *Tobias Micke*, who not only brought a great deal of understanding of the matter, but also contacts and the ability to convey the fascination and work of AustroMars to the broad public. During its eight months of main activities (September 2005 – April 2006), AustroMars was featured five times with double or triple page articles in the "Kronen-Zeitung", always on Sunday, the biggest and most-read edition of the week. This equals a value of several ten thousands of Euros compared with paid advertisements of the same size, place and frequency.

Thanks to the regional spreading of team members, many local and regional newspapers had the opportunity to join in with exclusive stories – portraits of the crew members or team members, information about experiments or training locations, interviews with local VIP's during AustroMars events, etc.

TV and radio showed a similar interest and success. Thanks to good contacts to Austria's National Broadcasting Corporation, ORF, AustroMars got a news prime time feature, this means a headline story in Austria's main evening news. The daily TV boulevard magazine "Welcome Austria", a national three-hour afternoon show, dedicated an entire edition to Mars exploration and invited the project leaders as studio guests. News and youth magazines in Austria's regions, above all in the big cities of Vienna and Graz, featured the project several times, inviting studio guests or joining the preparation work of crew and MCC with film teams.

Personal outreach

The AustroMars team left the propagation of its project not only to the media. Personal activity was an important factor – the need to open up, to meet, to explain, to discuss, and – last but not least – to *entertain*. Popular catchphrases like *edutainment* and *infotainment*, both in good tradition of the activities of the Austrian Space Forum ÖWF, summarise these efforts. Such, various presentations were held already during the crew training phase, but especially after the successful simulation. The team offered (and still offers) public two-hour presentations throughout the country, fully elaborated in a modular approach (see below). Why personal outreach matters? Because authenticity is key to success. Nothing can compare to the presence of the crew, members of Mission Control or involved scientists during a presentation. This, coupled with technical features like multimedia setups (music, images, sounds) and a good deal of emotion and excitement, added to the relative popularity of AustroMars.

Events

Another outreach factor consisted in specially organised events alongside the project. This gave room to individual composition and choreography, focus on target groups and thematic separation at various stages. In the following, the main lines of events are summarised, featuring a short explanation:

Internal meetings and workshops: participation of the public

Whenever AustroMars teams met for workshops or training sessions, the local public was somehow involved or informed. Many activities especially during the crew training, such as glider flights, rover tests or medical examinations provided for a story to tell (with invited media) or triggered interest of spectators. Such, **necessary work in the course of the project was turned into additional public outreach activities**. Some examples:

- Glider flights (stress management) piloted by N. Frischauf near Graz
- Rover testing at Graz Technical University (TV reportage)
- AustroMars Crew Farewell Party, Graz (print and e-media coverage)
- AustroMars Science presentations and press conferences, Vienna

- Lower Body Negative Pressure (LBNP) Test, Graz
- ATV training, Tyrol (internet reportage)
- First aid training, Innsbruck (newspaper and radio coverage)


M. Spiss and C. Kandler posing for the Tyrolean press during the crew training at the Zeiss Planetarium Schwaz.

Press Conferences

Various press conferences with high political support through the presence of Austria's Secretary of State Eduard Mainoni gave a platform for intensive, highly focused media information. These events were mainly organised in Austria's capital, Vienna, due to the density of media representations and public institutions. With the involvement of political leaders such as Mr. Mainoni, who was, in his function as Secretary of State, a great supporter of the idea of AustroMars, also new information and outreach channels such as Ministry press info centres, press releases and publications could be used.

Crew Leaving Ceremony

A special event was organised one week prior to the crew and on-site support team departure in Graz: an entire "farewell party" for almost one hundred guests, including crew friends and families, the team, the partners, and selected press.

AustroMars Science Conference

Directly after the show "MarsNight", the Science Conference brought AustroMars to a scientific closing, featuring a three day get-together of all science and engineering teams, presenting and discussing the results of the experiments, lessons learned and possible future cooperation. The AustroMars science conference could attract international presence and helped rounding off the picture of almost two years of work for Austria's first large Mars analogue mission.

AustroMars on Demand: Mission Mars – Spaceflight into the future

With the end of the actual simulation and return of the crew (end of April 2006), the Austrian Space Forum developed and then offered a two-hour „en bloc" presentation **"Mission Mars -- Raumfahrt in die Zukunft"**. The presentation features an introduction in scientific and technical basics of spaceflight, the current knowledge of Mars exploration and international Mars programmes (NASA, ESA) as well as an interactive journey into the future. Booking of this presentation can be done online; after consultation with the respective host, the show is adapted to perfectly fit with the audience.

The AustroMars TV Reportage: 45 minutes prime time

A main element of AustroMars outreach was the production of a TV reportage. In cooperation with ORF and its science channel "Alpha Austria" *(Julius Kratky, Günther Löffelmann)* it was agreed to join forces in order to allow for a full-scale portrait of the project, including a camera team *(Alexander Tomsits and G. Löffelmann)* in Utah. The reportage

“AUSTROMARS – THE MISSION” was aired on May 15th in Austria (21:00 – prime time) and reached the broad public. It presents not only the project and Mars Society as main partner, but also the crew and the simulation itself, as well as Mission Control and general insights into the preparation of a human Mats mission. The professionally produced TV film is certainly a unique document of the time of AustroMars.

Internal conflicts in external communication

A well-known conflict arose during the AustroMars definition phase, as well as at few moments during the project execution: To what extend should a scientific project be accompanied and communicated by popular media? Does it harm the credibility of a project like AustroMars if it is seen in relation with outreach events, quiz games, “yellow press” interviews, etc.? The project philosophy, decided already well ahead of the actual kick-off, took a clear position: As long as excellence in science and technology is guaranteed, outreach and communication can be designed to reach the broad public, whatever it needs. A project must be able to operate and offer output on various very inhomogeneous levels – from the cooperating science institution to the kindergarten where interested youngsters are waiting for explanations. As long as a management structure can satisfy both (with a clear primacy of science), there is no reason to refrain from popular outreach. In this regard, the hierarchy of principles can be read as follows:

- Safety → Science → Simulation → *Popularisation*

AustroMars did not experience difficulties with this approach, although quite a deal of convincing had to be done vis-à-vis science partners to join this outreach policy.

10.2 Salzburg “Month of Mars”

Poster for the „Month of Mars“ in Salzburg.

While the AustroMars Crew was on their way to Utah the team left in Austria was occupied with establishing the Mission Control Center. The place chosen for it was the „Christian-Doppler High School“ in Salzburg, from there all activities of the Crew were permanently monitored and supervised. On this occasion Dr. Gabriele Burgstaller, Governor of the State of Salzburg, inaugurated the “Month of Mars” in Salzburg on the 7th of April. The idea was to give children as well as adults who are interested in space issues the unique opportunity to

- witness the activities in the Mission Control Center

- get their questions on space travel answered
- update their knowledge about crewed missions to planet Mars.

The admission was free and the events included

- **Mars Parcours:** A quiz game consisting of finding posters distributed all over the city and answering the questions posed there. All participants took part in a raffle.
- **Research Station in the House of Natur:** Here children could learn anything about the experiments performed by the Crew in Utah and try similiar experiments themselves.
- **Mars Breakfast:** Anyone who was interested could be part of the changing of shifts in the Mission Control Center and have breakfast with the team and chat with them about the background of the mission.
- **Guided Tours for children:** Kids up to the age of 12 years had the opportunity of a guided tour through the Mission Control Center which was created especially for them.
- **Guided Night Tours:** These tours cold be taken by employed persons who wanted to discuss questions concerning space travel in general und crewed missions to Mars in particular.
- **Lecture at the Adult Education Center in Salzburg:** „AustroMars – A Step on the Way to Mars“ on the 29th of April.
- **Guided Tours at the Observatory in Salzburg:** Once a week after sunset a team-member of AustroMars was present there and explained facts on the issue of a voyage to Mars.

Longterm repercussions

What fascinated the media concerning AustroMars was on the one hand the idea of a mission to Mars being within the reach of the next generation and on the other hand the fact that a small country like Austria could perfom such a mission which attracted scientific interest far beyond the borders. The most asked questions included the circumstances under which humans could execute a mission to our neighbour planet, how they would be able to survive, what kind of technologies there are still to be invented to be successful, which risks and dangers a future crew on the way to Mars would have to deal with and which abilities therefore make a good astronaut. But also the scientific experiments performed by the crew where an often discussed issue in the media reporting about AustroMars. In the meantime theses have been written, careers have been promoted, prizes have been awarded and even more than half a year after the successful end of the mission the press coverage is still going on.

10.3 Salzburg “MarsNight 2006” in Hallein

Public Space Show

On September 23rd, 2006, a multimedia spectacle for several hundred guests brought the outreach activities of AustroMars to an official end – and marked at the same time a highlight. Designed along the lines of one of Austria’s most successful public space events ever, the show “DESCENT FLIGHT” at the occasion of the landing of ESA’s Huygens space probe on Titan (14th January 2005), organised by the Forum, too, the show “MarsNight” featured two hours of entertainment and information, images, short lectures and acting – a well-received potpourri for 300 guests and a unique closing of AustroMars.

Event poster for the MarsNight.

In addition to a colourful presentation lasting for 2 hours plus a break with snacks and drinks, in order to “warm-up” the audience, the MarsNight team organized a “Mars Foyer”, where people could actually meet&greet flight crew members, fly a guided tour through the ISS and enjoy 3d Martian landscapes with video projection or try out the original flight hardware, such as gloves to do simulated assembly work for a W-Lan receiver. Others performed reaction time tests and compared their values to the ones obtained during the simuation in Utah.

The media echo was surprisingly high for this evening. Salzburg’s leading newspaper did a wonderful coverage, helping to fill the Salzberghalle in Hallein. Prof. Dr. Sheryl Bishop (PI from one of the psychological AutroMars Experiments, University of Texas) attended as well as panellist discussion various issues of crewed expeditions to Mars.

Chapter 11

Mission chronology

11.1 Local operations Utah, On-Site Support

A personal report by René Vidalli, Back-up Planetary Sciences

Johannes Gross, Johannes Nendwich and René Vidalli – three OSS crewmembers also coined as “Ghosts of Mars” on a trip through the analogue universe created by the Austria Space Forum, very close to but not actually involved, unobserved yet not unnoticed. Capable of sending things to Mars and back in warp speed, securing the crew’s survival, but also giving the crew tasks and challenges in their daily routine.

Interesting? – yes! A unique experience? – you bet!

3-31-06 Take-off into the unknown. While the crew members' flight plan is already set in every detail, the activities of the Mars-ghosts are only vaguely outlined. Flexibility, creativity and most of all constant availability will be the key factor. We are well prepared and fly over in the knowledge that we are a good team. We were all fine with the result of the selection process – the crew members had been chosen, and even though there is a slight possibility of one Mars-ghost mutating into an astronaut in case one team member has to drop out, we are all hoping that no changes in our team's composition will become necessary. Of course anyone who applied at AustroMars did so in the hope of getting into the habitat, but in 6 weekends of training a team free of any feelings of jealousy or resentment had evolved.

Salt Lake City – our last terrestrial station. The crew, OSS, the project photograoher Andreas and a fivesome consisting of editor Günther, camera man Alex, our artist Helene and trip winners Ingrid and Stefan try their best to mark off items on seemingly endless shopping lists. Very quickly it becomes obvious that an ability to improvise will be the key in the next few weeks.
The team, however, has displayed confidence and equanimity from the outset, and while the crew is still busy running errands, the OSS sets out towards Hanksville in the late afternoon. We are all eagerly awaiting what's in store for us, and the landscape we are transversing mile after mile makes it easy for our imagination to wander into spheres unknown.

By the time we reach the Whispering Sands Motel, it is pitch-dark and we are anxiously expected: our predecessors want to hand over the hab this very day and ask us to get over there as soon as possible. Since our crew will be late getting to Hanksville because of severe weather at the pass, we from OSS have the unexpected honor of welcoming Crew 47 back to earth and get an unforgettable first view of the space station. The first drive to the habitat, in the dark of night, seeing the fantastic rock formations in the car's eerie spotlight, and, taking a left turn, suddenly standing right in front of the dimly lit space station beamed the three of us directly to Mars.

The big welcome by crew 47, the long-awaited moment of actually being in the hab, and not least of all the pizza offered as a greeting made us ever more euphoric.

Enthusiasm notwithstanding, we still had to pay attention to our predecessors' important information. When our crew finally arrived at the habitat, Commander Dr. Jan Osborg explained the particulars and perils of the space station. A lot was said, especially regarding the engineering area, but at that time no one could have anticipated how much trouble the generators would give us. Or maybe one of us did: Joschi seems to have had dire premonitions and took notes of Emily Colvin's (Flight Engineer of the Station, editors note) every word.

Late at night, the OSS returned to the motel while the crew, as has become tradition, spent the night with its predecessors in the hab.

Preparation week:

After sleeping just a few hours, we were able to take in our surroundings in daylight for the first time. Looking out the windows of our Motel, we observed a very Mars-like barren landscape with elevations in all shades, from rusty red to white. And we instantly saw another thing: "Blondie's Eatery & Gifts" – fortunately, the sign across the road was no mirage – quite the opposite: Blondie's was to become an important source for sustaining the OSS' performance.

After a lengthy first breakfast we got on our way to the habitat, but not without first acquiring t-shirts with the legend: "Where the hell is Hanksville?" A question all of us had already pondered.

When we reached the space station, there was already a big buzz of activity. Crew 47 had departed earlier, and preparation of the AustroMarsians was well underway. The introductory remarks by HSO Gernot Grömer, who had participated in an earlier simulation, raised expectations even more among the rest of the crew, the OSS, and also our so-called "tourists" (Günther and Alex from TV station ORF, Tobias from the Kronenzeitung, Ingrid and Stefan, artist Helene and our photographer Andi). All were very impressed and caught a serious case of space fever. And all turned out to be valuable helpers during prep week.

In the days that followed, the difference between crew and OSS mainly showed in the color of their flight suits. According to their function, backup and crew members worked together to prepare their special experiments, and in the end, everyone lent a hand wherever it was needed. Crew and OSS, but also the "tourists" formed a cheerful, highly motivated and very cooperative team.

This was a good thing since – on top of extensive preparations for the many experiments planned – we ran across some unexpected difficulties. Primarily, the habitat's power supply had us worried and cost us precious hours which we could have used in other areas. Crew engineer Huti and backup Joschi were on constant call, with the support of Don Foutz, but even he could not come up with a way to fix a stubborn generator and its broken starter. In the end, we were forced to charge the hab's batteries from our cars, which was much more time-consuming and provided only minimal power.

But as mentioned before, no one let these things dampen their optimism and, with humor and lots of improvising, things progressed quite well.

Of course, highlights of prep week included putting on the trial EVA Suits, which the backups in particular enjoyed. Simply to open the habitat door in a space suit, to look at the Mars-like landscape and then drive an ATV to a point in the desert determined by GPS gave us a strong feeling of not being earth-bound any more. This was definitely one of the moments where the Mars-ghosts felt a desire to be part of the crew because it must be amazing how intense feelings get when you simulate a Mars landing in high fidelity mode for two weeks and without spectators or a photographer.

At night, the OSS had the opportunity to enjoy another “taste of space” since during prep week, the crew members mostly spent the night at the motel. To sit

late at night, just the three of us, in the upper story of the hab, gazing at nothing but the stars gleaming through the porthole and experiencing, after many working hours, a peacefulness and quiet that is very rare anywhere, can easily give you a feeling of complete insularity and isolation, if you are ready for it. And of course we were and felt a strong feeling of togetherness in a hostile environment, far away from home, protected only by a “high tech tin can”, where an e-mail from a girl-friend became something very special...

Naturally, there was very little time for such sentimentalities; the days were long and we needed at least a few hours of sleep...

Wendy, Coleman, Charly, WLAN, reports ... those were the terms which haunted Joschi even in his dreams. Sandwich was in charge of the numerous small repairs in and around the hab, while René, who – professional croupier that he is – had a hard time finding anyone who had time to play cards, took care of organizational things like shopping and commuting between the hab and the motel or Salt Lake City.

As always with such large projects, the to-do list kept growing longer and longer, but all participants were very committed, and as long as there was time to sleep, there was sufficient time to run errands as well. On day 6 of prep week, the team took a short time out and left for the steakhouse in Hanksville to stock up on calories with T-bone steak and spare ribs. Commander Norbert Frischauf, however, could not be persuaded to join in and, with undaunted and admirable effort, continued to fight for the resurrection of Sisi – our rover.
All these efforts paid of, since just before the departure of our “tourists” on the last day before the beginning of the simulation, Sisi was on her very best behavior and gave the camera team wonderful pictures from right outside the

engineers' airlock. To see Sisi roll her beautiful "eyes" which were sending pictures from the Mars landscape directly to the hab drew wild cheers from all of us.

So the delay in the departure of our "tourists" paid off, and after a very cordial good-by, René took them to Salt Lake City while Sandwich, Joschi and the crew worked on final preparations for the nocturnal flight to Mars.

The simulation

The timing was perfect as the first 3 of the crew (CDR, HSO, and XO) appeared at repeater hill in their space suits. At the very moment they first laid eyes on the habitat the first sun rays reached the space station, and Mars-ghost Sandwich and photographer and "half ghost" Andi, hidden under a jute net invisible to the crew of course, were able to hear by radio communication the intensity of their emotions. After years of hard work, the moment had finally arrived – ground safe for AustroMars!

As soon as the three had taken off their space suits, the moment had come for the first "in sim" action of the OSS: secretly getting the 3 space suits from the hab so the three crew members remaining on earth could set off to the space station as well. At about 10 a.m., the entire crew was gathered in the habitat and started working right away – the flight plan allocated no time for sentimentalities. The OSS, on the other hand, had no concrete plans whatsoever, but if any of the Mars-ghosts entertained ideas of just leaning back at that moment, he was in for a reality check since this was when the "Wendy story" began:

Wendy, which already had let us down several times during prep week, broke down the very first day of the simulation, and since it was now no longer possible to bring in cars to charge the hab batteries, we switched to reserve generator

“Coleman”. However, according to procedure this generator was limited to a few hours of operation. Since in a high-fidelity simulation, contact between crew and OSS is obviously prohibited but at the same time it was of extreme importance for us to know the charging status of the hab batteries to be able to time generator operation, the crew was asked to send an hourly report on power status to MCC which in turn would forward these numbers to us. The LAN-line Joschi and Sandwich had put in from the hab to the engineering area played a crucial role since it enabled us to keep in touch with the MCC via this line instead of only from the motel and could react faster since we did not have to drive back and forth. Both of them must have had a hunch during prep week that such a line might just prove to be very valuable.
Still, the crew had to reduce their power usage to a minimum, and some power downs at the space station were inevitable.
As mentioned before, there were strict regulations for the Coleman reserve generator, but it ran well and we had the impression we could actually use it more than we did. Since all reports and procedures talked of “Coleman”, it took a while until our assumption became certainty: Coleman was not Coleman but a long-run Honda which enabled us to provide the crew with sufficient power. It gave us some trouble too and was down a few times, but we were able to find the problem fairly quickly and fix it. However, this generator was not a permanent solution either, because it was a huge gas guzzler and we had to haul the gas in canisters every day. Towards the end of the first week, Don Foutz somehow managed to bring Wendy back to life, and we were hoping that would be a permanent solution to the power problem. But there were always new problems and we took a deep sigh of relief after each successful start.

Looking back, it is hard to remember all the trouble we had with power supply to MDRS, especially now that everything went all right and we can even laugh about it. It’s a fact though that these difficulties and all the phone calls, emails and reports cost us plenty of time and energy. Fortunately, our team work was super, and Andi helped very often as well, but our backup flight engineer Joschi was still carrying a huge load. Don too was constantly trying to solve the generator problems as quickly

as possible, but since Don was not just Don but “The Don”, his time was understandably limited.
We drove to the generators at least four times a day and ended up knowing every rock and every hole in “Cow Dung Road”.

So one of the jobs scheduled for the OSS beforehand – planning for anomalies for the purpose of testing the psychological resistance and improvisational skills of the crew – was automatically taken care of.

Another job we had was refilling and maintaining the ATVs since this may not be done in space suits, so during prep week we decided to set up an “automatic refill station” for the ATVs which was located in an area not visible from the hab. This way, the Mars-ghosts were able to have refilled and well functioning ATVs ready for the crew before each EVA. One big advantage for us was that we could use the ATVs ourselves whenever the crew did not need them. One of our jobs was to discover interesting waypoints via GPS to which the crew could then be sent by MCC to take samples or do experiments. Also, riding the ATVs was fun and always a welcome change in routine.

April 12 – sol 5 – after Joschi had finished the reports, we decided to go to the steakhouse in honor of Yuri Gagarin. Of course, our thoughts were with our crew who was probably celebrating with rice and water and had no idea that before midnight, when Wendy would require us to be back at the engineering area, a Mars-ghost would take a surprise to the back airlock.

On occasion, this airlock served to take things into and out of the hab in a “sim adequate” manner. We would deliver things inside the outer door which could be opened and closed absolutely soundlessly if one knew how. In the same place, the crew, instructed by the MCC, would leave tools, for example, or parts for the generators and ATVs.
Maintaining simulation was a key factor to us throughout the whole mission. Contacts to the crew took place exclusively through the MCC, and we went to

great length to prevent the crew from seeing us. How emotionally involved we were became obvious the one time when we did meet three crew members while driving in the engineering area. Even though it was not in the flight plan that the crew would be in this area, we were absolutely shocked by this violation of the sim. Fortunately, this was the only time that happened.

This does not mean we were not very close to the crew, on the contrary! Andi – our photographer – had taken a camouflage course in the Austrian military and had arrived with many good tips and a jute camouflage net. We explored suitable spots with him, which were interesting for the crew and at the same time let us to take pictures without being discovered. Backup MSL Sandwich deposited samples for BioMars several times; we then sent the GPS data to MCC which in turn forwarded the task to the crew for the EVA.

Andi was always accompanied by René: first of all, no one was supposed to wander off alone in the desert and secondly the ORF team had made a small video camera available to us to be able to get moving pictures from the in-sim-EVAs. Also, it was easier if two people set up the camouflage. The jute net blended so well into the surroundings that you could not see it even if you knew where it was. To avoid being detected by the crew, the two had to arrive at the site long before the crew, which gave them an emotional experience of the extraterrestrial kind: sitting up to three hours in this barren and still landscape, stuck in this one place, created an incredible feeling of inner peace and relaxation which is very rare in today's world.

Then, as soon as the engine noises of the ATVs announced the crew's arrival, they would jump into action: quickly hiding under the camouflage net, filming, taking pictures and having to stay there until the crew was out of sight again, which often was not exactly comfortable on the rocky ground. But being part of EVAs, watching the colleagues and listening in via radio communication was more than worth the occasional bruise.

Sol 8 gave us the saddest moment in our mission: the OSS was instructed by MCC to pick up Sisi at night and store it at the motel for the time being. CDR Frischauf used every minute the flight plan permitted to fix it, but finally he lost the fight with the complex technology of the rover. Sandwich and René found AustroMars' emotional symbol around midnight about 5 meters outside the engineering airlock alone in the moonlight.

The crew refused to let this get them down and got busy making new plans. After the (assumed) discovery of water vapor and methane on a nearby volcano which was unreachable by aerobot or rover, they worked quite enthusiastically in the area which is the driving force of mankind: exploration! The goal was the climbing of Factory Butte by an Austrian crew under the heading "Operation Edelweiß".

To make sure that the scientific experiments were not endangered, the crew decided to rise yet an hour earlier, showing admirable motivation and commitment. Unfortunately, the path to Factory Butte was cluttered with additional rocks (in the form of regulations, fears and lack of understanding). MCC in Salzburg showed little understanding for the new unplanned goal. Perhaps one had to be on site and share the efforts and difficulties we had already gone through to understand that apart from science and experiments emotional high points are important too, especially for (analogue) astronauts who go to great lengths to venture into new areas.

But the OSS was on site, and we were enthusiastic about the idea and wanted to do everything we could to support the crew with this goal. One of the problems was to get to the base of Factory Butte. There were said to be a few washed out areas insurmountable even for ATVs. Joschi and René did not hesitate long, let Sandwich drop them off at Factory Butte and started on foot towards MDRS. Five hours later, with the help of many

waypoints and a strong conviction that it should be easy to get to Factory Butte with ATVs, they reached the meeting point they had agreed upon. René took photographs of all important points and showed these to Don who needed to be convinced that the plan was feasible so he in turn could convince the people at the Mars society. In the meantime, Sandwich was looking for a way up to the top of Factory Butte; the top part seemed very difficult, but MSL Spiss and MSP Kandler are good mountain climbers and surely could have found a solution.
Sadly, there was no support from the outside, and operation Edelweiß fizzled out in the desert sand.

However, an emotional departure from AustroMars seemed to be essential, so on the last day of the sim, the crew was instructed by MCC to climb Skyline Rim, build a real "Stoamanei" (cone-shaped pile of rocks to raise flag, in Austrian dialect) and to raise the Mars flag as well as the Austrian flag.

Andi and René were once again present with their cameras after having gotten up very early since it would take additional time to get to the location, to get ready, and, last but not least have a cup of coffee at Blondie's.
On the entire Skyline Rim, there is only one spot where it is possible to get from the lower to the upper level without climbing gear: a narrow, steep path below an equally narrow rock ridge protruding into the plains for about 20 meters.

From far away the two were able to see the crew members approach with the ATVs (the crew had grouped exactly the same way it had the morning of the first day) and the special suits from BioMars shining in the early morning light. René was lying under the jute net on the rock ridge mentioned and observed the other three climbing up.
Once they reached the top, they did not do what we expected them to do, which was to continue towards Factory Butte, but they started building the "Stoamanei" in very close proximity to us.

Norbert, Alex and Gernot, the second part of the crew, arrived at Skyline Rim in the afternoon, and we clearly sensed how heavy the weight on them had been and how relieved they were now, on the last day of the mission, after years of preparation, looking down into the plains of MDRS and reviewing the many hurdles they had had to overcome. They took their time to enjoy the successful completion of the simulation.

Welcome back

The next morning, when the OSS arrived at 6:30 a.m. with the ATVs at Phobos Peak, as previously agreed, the crew had already climbed the peak and enjoyed – without spacesuit and helmet – the fresh air and the first rays of the rising sun. We had seen them from a large distance, and the closer we got, the more deeply moved we were. It was only two weeks, but seeing each other again was a very moving moment. After all, we worked for two entire weeks, albeit in different ways, for the same larger goal with a lot of commitment.
And we had truly earned our first breakfast back on Earth together: a fresh apple, a cold beer and a big cigar.

11.2 Flight Plans

This is a compilation of all daily flight plans of the Flight Control Team which were re-arranged on a 12h basis to ensure a maximum output of the flight crew throughout the mission. Suggestions from scientists as well as from the flight crew were considered on a near-real time basis.

Saturday, 8th of April 2006

08.04.2006

Habitat time	MCC time	CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
6:00	14:00			
6:15	14:15			
6:30	14:30	landing 06:25	landing	landing
6:45	14:45	2 miles off	2 miles off	2 miles off
7:00	15:00	habitat 08:00	habitat	habitat
7:15	15:15	Ingress	Ingress	Ingress
7:30	15:30	EVA suit undonning	EVA suit undonning	EVA suit undonning
7:45	15:45	Establish Power	Powerup Computers	Comm Check SwitchX
8:00	16:00	Power up computers		
8:15	16:15			
8:30	16:30	Establish MCC contact 08:26		
8:45	16:45			
9:00	17:00			
9:15	17:15			
9:30	17:30			
9:45	17:45	Rover activation	Check equipment for completeness & intactness	Check safety systems
10:00	18:00			check fire detec.
10:15	18:15		FOOD & experiments	Check equipment for
10:30	18:30			completeness & intactness
10:45	18:45			EVA SUITS
11:00	19:00			
11:15	19:15			
11:30	19:30		Install Object Tracker	
11:45	19:45			
12:00	20:00			
12:15	20:15	Declare Ground safe	Declare Ground safe	Declare Ground safe
12:30	20:30	(MCC-Press)	(MCC-Press)	cooking
12:45	20:45			
13:00	21:00	lunch	lunch	lunch
13:15	21:15			
13:30	21:30			
13:45	21:45	Rover activation		wash the dishes
14:00	22:00			
14:15	22:15	Rover activation	ground and	Store h/w
14:30	22:30		hab save	Laboratory areas

14:45	22:45		operations	
15:00	23:00		Inventory	
15:15	23:15		Food storage	Store h/w
15:30	23:30			Laboratory areas
15:45	23:45			
16:00	0:00			
16:15	0:15	Rover control to MCC		
16:30	0:30			
16:45	0:45			
17:00	1:00	Switch X Telecon	Switch X Telecon	
17:15	1:15			
17:30	1:30			
17:45	1:45	Eng. Image analysis Hab	CRW photo selection	
18:00	2:00			INSTALL FAMOS
18:15	2:15		INSTALL FAMOS	
18:30	2:30			
18:45	2:45			
19:00	3:00	salive sample + dinner	salive sample + dinner	salive sample + dinner
19:15	3:15			
19:30	3:30			
19:45	3:45			
20:00	4:00	Reports #	Reports #	wash the dishes
20:15	4:15			Reports #
20:30	4:30		Comm Link	
20:45	4:45		Time #	
21:00	5:00			
21:15	5:15			FAMOS #
21:30	5:30			
21:45	5:45			
22:00	6:00		FAMOS #	
22:15	6:15			
22:30	6:30			
22:45	6:45			
23:00	7:00			
23:15	7:15			
23:30	7:30			
23:45	7:45			

		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
8:45	16:45			
9:00	17:00			
9:15	17:15			
9:30	17:30	landing	landing	landing
9:45	17:45	2 miles off	2 miles off	2 miles off
10:00	18:00	habitat	habitat	habitat
10:15	18:15	Ingress	Ingress	Ingress
10:30	18:30	EVA suit undonning	EVA suit undonning	EVA suit undonning
10:45	18:45	Check all ops systems	FIND FAMOS	
11:00	19:00	Power check		
11:15	19:15	Battery checks	Install Object Tracker	Check equipment for
11:30	19:30			completeness & intactness
11:45	19:45	Prep. Engineering station		EVA SUITS
12:00	20:00			
12:15	20:15	Declare Ground safe	Declare Ground safe	Declare Ground safe

12:30	20:30	(MCC-Press)	cooking	(MCC-Press)
12:45	20:45			
13:00	21:00	lunch	lunch	lunch
13:15	21:15			
13:30	21:30			
13:45	21:45		wash the dishes	Take microbio. CRW sample
14:00	22:00			
14:15	22:15	Store h/w		Lite-Suit up & enter Greenhab
14:30	22:30	Engineering areas	ground and	Take water samples
14:45	22:45		hab save	
15:00	23:00		operations	
15:15	23:15		Inventory	
15:30	23:30	Verify/Adjust Webcams		Analyse water quality
15:45	23:45		Food storage	
16:00	0:00			
16:15	0:15			
16:30	0:30	Itinary planning	Itinary planning	
16:45	0:45	for GeoMars EVA	for GeoMars EVA Prep for GeoMars	
17:00	1:00	Prep for GeoMars EVA	EVA	
17:15	1:15			
17:30	1:30			
17:45	1:45	Eng. Image analysis Hab	INSTALL FAMOS	
18:00	2:00			
18:15	2:15			INSTALL FAMOS
18:30	2:30		cooking	cooking
18:45	2:45			
19:00	3:00	salive sample + dinner	salive sample + dinner	salive sample + dinner
19:15	3:15			
19:30	3:30			
19:45	3:45			
20:00	4:00	Reports #	wash the dishes	Reports #
20:15	4:15			
20:30	4:30	Comm Link	Reports #	
20:45	4:45	Time #		
21:00	5:00			
21:15	5:15			
21:30	5:30		FAMOS #	
21:45	5:45			FAMOS #
22:00	6:00			

Sunday, 9. April, 2006

09.04.2006

no anomaly with psychological effect today!

	MCC Zeit	CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
6:00	14:00		wake up	wake up
6:15	14:15		breakfast	breakfast
6:30	14:30		gel-washing :-)	water-washing :-)
6:45	14:45	wake up		
7:00	15:00	breakfast		
7:15	15:15	gel-washing :-)		Verify OT is operational
7:30	15:30		Pupillomyograph	Assist Pupillomyograph
7:45	15:45			Assist Pupillomyograph
8:00	16:00		hab save	
8:15	16:15		operations	Assist donning EVA-CRW
8:30	16:30	EVA-Engineering		EVA-Habcom for Engineering
8:45	16:45	check surrounding		
9:00	17:00	activate observatory		
9:15	17:15			
9:30	17:30			
9:45	17:45			
10:00	18:00			
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15	Ingress		Assist undonning EVA-CRW
11:30	19:30	EVA: undress		
11:45	19:45	EVA: massage	cooking	
12:00	20:00			
12:15	20:15	lunch	lunch	lunch
12:30	20:30			
12:45	20:45			
13:00	21:00		wash the dishes	
13:15	21:15	Declare Ground operational		
13:30	21:30		Pupillomyograph	Assist Pupillomyograph
13:45	21:45	Rover activation	Assist donning EVA-CRW	EVA: GeoMars
14:00	22:00		EVA-Habcom for Engineering	incl. Aerobot test
14:15	22:15			
14:30	22:30			Emergency samples
14:45	22:45			
15:00	23:00			
15:15	23:15			
15:30	23:30			
15:45	23:45	Rover control to MCC		
16:00	0:00			
16:15	0:15			
16:30	0:30			
16:45	0:45		Assist undonning EVA-CRW	
17:00	1:00			EVA: undress
17:15	1:15			EVA: massage
17:30	1:30	Reports #	Reports #	Reports #

17:45	1:45			
18:00	2:00	saliva sample	saliva sample	saliva sample
18:15	2:15	PsychoMars test #	cooking	cooking
18:30	2:30			
18:45	2:45		dinner	dinner
19:00	3:00			
19:15	3:15			
19:30	3:30			
19:45	3:45		Pupillomyograph	Assist Pupillomyograph
20:00	4:00	dinner		PsychoMars test #
20:15	4:15		PsychoMars Test	
20:30	4:30			
20:45	4:45			
21:00	5:00	wash the dishes		
21:15	5:15	Reports #		
21:30	5:30	Comm Link		
21:45	5:45	Time #		
22:00	6:00			
22:15	6:15			
22:30	6:30			
22:45	6:45			
23:00	7:00			
23:15	7:15			
23:30	7:30			
23:45	7:45			

no anomaly with psychological effect today!

		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
6:00	14:00			wake up
6:15	14:15		wake up	breakfast
6:30	14:30		breakfast	gel-washing :-)
6:45	14:45	wake up	gel-washing :-)	
7:00	15:00	breakfast, washing		
7:15	15:15	water-washing :-)		
7:30	15:30			
7:45	15:45		Pupillomyograph	hab save
8:00	16:00		hab save	operations
8:15	16:15		operations	
8:30	16:30	EVA-Engineering		
8:45	16:45	check surrounding		
9:00	17:00	activate observatory		
9:15	17:15			
9:30	17:30			
9:45	17:45			
10:00	18:00			
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15	Ingress		
11:30	19:30	EVA: undress		
11:45	19:45	EVA: massage		cooking
12:00	20:00			

12:15	20:15	lunch	lunch	lunch
12:30	20:30			
12:45	20:45			
13:00	21:00			wash the dishes
13:15	21:15	Prepare EVA		
13:30	21:30	Prepare EVA		
13:45	21:45	EVA: GeoMars		
14:00	22:00	incl. Aerobot test	Pupillomyograph	Assist Pupillomyograph
14:15	22:15			Greenhab duty
14:30	22:30	Emergency samples	EVA Itinery planning	
14:45	22:45			
15:00	23:00			
15:15	23:15			
15:30	23:30			
15:45	23:45			
16:00	0:00			Verify fluid mgmt. Procurmnt
16:15	0:15		CRW photo selection/caption	
16:30	0:30			
16:45	0:45			
17:00	1:00	EVA: undress	GeoMars sample procurem.	
17:15	1:15	EVA: massage		
17:30	1:30	Reports #		
17:45	1:45		Pupillomyograph	Assist Pupillomyograph
18:00	2:00	saliva sample	saliva sample	saliva sample
18:15	2:15		PsychoMars test #	PsychoMars test #
18:30	2:30			
18:45	2:45	dinner		
19:00	3:00			
19:15	3:15			
19:30	3:30			
19:45	3:45			
20:00	4:00	PsychoMars test #	dinner	dinner
20:15	4:15			
20:30	4:30			
20:45	4:45			
21:00	5:00		Reports #	wash the dishes
21:15	5:15		Comm Link	
21:30	5:30		Time #	
21:45	5:45			

Monday, 10th of April 2006

10.04.2006

Hab Zeit	MCC Zeit	CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
5:45	13:45			wake up
6:00	14:00		wake up	breakfast
6:15	14:15		breakfast	tab-washing :-)
6:30	14:30	wake up	gel-washing :-)	
6:45	14:45	breakfast		
7:00	15:00	gel-washing :-)		install FAMOS
7:15	15:15		install FAMOS	Assist Pupillomyograph
7:30	15:30		Pupillomyograph	Assist Pupillomyograph
7:45	15:45	Lab/Workshop cleaning	EVA: LiMa	assist CRW donning
8:00	16:00			
8:15	16:15	Rover	+ATV	EVA-HabCom
8:30	16:30			
8:45	16:45			
9:00	17:00			
9:15	17:15			
9:30	17:30			
9:45	17:45			
10:00	18:00	Switch X Telecon		
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15	Gold-foil preperation (Suitbag)		
11:30	19:30			
11:45	19:45			
12:00	20:00			
12:15	20:15	cooking		
12:30	20:30		EVA: undress	assist CRW undonning
12:45	20:45	lunch	EVA: massage	
13:00	21:00		lunch	lunch
13:15	21:15			
13:30	21:30			
13:45	21:45			
14:00	22:00	wash the dishes	Pupillomyograph	
14:15	22:15		FAMOS #	Assist Pupillomyograph
14:30	22:30	EVA:WLAN installation	LiMa:	FAMOS #
14:45	22:45		conserve	EVA Itinery planning
15:00	23:00	use ATV if necessary	samples	
15:15	23:15			
15:30	23:30			
15:45	23:45			
16:00	0:00			
16:15	0:15			
16:30	0:30			
16:45	0:45		CRW photo selection/caption	
17:00	1:00			
17:15	1:15			

17:30	1:30		Reports #	cooking
17:45	1:45			
18:00	2:00	salive sample + dinner	salive sample + dinner	salive sample + dinner
18:15	2:15			
18:30	2:30			
18:45	2:45			
19:00	3:00	wash the dishes	FAMOS #	FAMOS #
19:15	3:15	Reports #	Pupillomyograph	EVA: TeleMars
19:30	3:30		Reports	
19:45	3:45	HabCom in IVA for	Comm Link	
20:00	4:00	TeleMars EVA	Time #	
20:15	4:15			
20:30	4:30			
20:45	4:45			
21:00	5:00			
21:15	5:15			
21:30	5:30			
21:45	5:45			
22:00	6:00		FAMOS #	
22:15	6:15		Pupillomyograph	
22:30	6:30			
22:45	6:45			
23:00	7:00			
23:15	7:15			EVA: undress
23:30	7:30			EVA: massage
23:45	7:45			FAMOS #

		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
6:00	14:00		wake up	
6:15	14:15		breakfast	
6:30	14:30	wake up	water-washing :-)	wake up
6:45	14:45	breakfast		breakfast
7:00	15:00	tab-washing :-)		water-washing :-)
7:15	15:15		Pupillomyograph	
7:30	15:30		install FAMOS	
7:45	15:45		EVA: LiMa	install FAMOS
8:00	16:00	Verify OT is operational		EVA: LiMa
8:15	16:15		+ATV	
8:30	16:30	Housekeeping		+ATV
8:45	16:45	Vakuum cleaning both decks		
9:00	17:00			
9:15	17:15			
9:30	17:30			
9:45	17:45			
10:00	18:00	Switch X Telecon		
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15	Gold-foil preperation (Suitbag)		
11:30	19:30			

11:45	19:45			
12:00	20:00			
12:15	20:15			
12:30	20:30	cooking	EVA: undress	EVA: undress
12:45	20:45		EVA: massage	EVA: massage
13:00	21:00	lunch	lunch	lunch
13:15	21:15			
13:30	21:30			
13:45	21:45			
14:00	22:00	wash the dishes	FAMOS #	Assist Pupillomyograph
14:15	22:15		Pupillomyograph	FAMOS #
14:30	22:30	assist CRW donning	EVA:WLAN installation	conserve
14:45	22:45			samples
15:00	23:00	EVA-HabCom		LiMa
15:15	23:15			
15:30	23:30			
15:45	23:45			
16:00	0:00			
16:15	0:15			
16:30	0:30			Greenhab duty
16:45	0:45	assist CRW undonning		
17:00	1:00			
17:15	1:15			
17:30	1:30	Reports #		cooking
17:45	1:45			
18:00	2:00	salive sample + dinner	salive sample + dinner	salive sample + dinner
18:15	2:15			
18:30	2:30			
18:45	2:45			
19:00	3:00	EVA: TeleMars		wash the dishes
19:15	3:15		FAMOS #	Assist Pupillomyograph
19:30	3:30		Pupillomyograph	Assist Pupillomyograph
19:45	3:45		Reports #	Comm Link
20:00	4:00			Time #
20:15	4:15			
20:30	4:30			
20:45	4:45			
21:00	5:00			
21:15	5:15			
21:30	5:30		FAMOS #	
21:45	5:45		Pupillomyograph	Assist Pupillomyograph
22:00	6:00			
22:15	6:15		Assist Pupillomyograph	FAMOS #
22:30	6:30			
22:45	6:45			
23:00	7:00			
23:15	7:15	EVA: undress		
23:30	7:30	EVA: massage		
23:45	7:45			

Tuesday, 11th of April 2006

Suit-donning: 1 h trip-time: min. 30 min Suit-undonning: 30 min - 1h massage: 30 min min. time: 2,5 h	EVA-trip:

11.04.2006

HAB-TIME	MCC-TIME	CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
6:00	14:00		wake up	
6:15	14:15		breakfast	
6:30	14:30	wake up	water-washing :-)	wake up
6:45	14:45	breakfast	(med data gathering	breakfast
7:00	15:00	water-washing :-)	before breakfast)	gel-washing :-)
7:15	15:15	(med data gathering		(med data gathering
7:30	15:30	before breakfast)	FAMOS #	before breakfast)
7:45	15:45	Switch X	Pupillomyograph	Switch X
8:00	16:00		EVA Lima	
8:15	16:15		mit ATV	
8:30	16:30		Start EVA	
8:45	16:45	Verify OT is operational		FAMOS #
9:00	17:00			
9:15	17:15	EVA planning		EVA planning
9:30	17:30			
9:45	17:45			
10:00	18:00			
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15			
11:30	19:30			
11:45	19:45			
12:00	20:00			
12:15	20:15			
12:30	20:30			
12:45	20:45	CogHealth screening		CogHealth screening
13:00	21:00	Data Saving		Data Saving
13:15	21:15		End EVA	
13:30	21:30		FAMOS #	cooking
13:45	21:45	Assist Pupillomyograph	Pupillomyograph	
14:00	22:00	Assist Pupillomyograph	lunch	lunch
14:15	22:15	lunch		
14:30	22:30			
14:45	22:45			
15:00	23:00		EVA: massage	wash the dishes
15:15	23:15			
15:30	23:30	LiMa:		CRW photo processing
15:45	23:45	conserve		
16:00	0:00	samples		
16:15	0:15			
16:30	0:30		CogHealth screening	

16:45	0:45		CRW photo selection/caption	
17:00	1:00			
17:15	1:15			FAMOS #
17:30	1:30		FAMOS #	
17:45	1:45		Pupillomyograph	Assist Pupillomyograph
18:00	2:00	Reports #	Reports #	Assist Pupillomyograph
18:15	2:15			cooking
18:30	2:30			
18:45	2:45	salive sample + dinner	salive sample + dinner	salive sample + dinner
19:00	3:00			
19:15	3:15			
19:30	3:30	wash the dishes		
19:45	3:45			med data gathering
20:00	4:00	med data gathering	med data gathering	Reports #
20:15	4:15			Comm Link
20:30	4:30			Time #
20:45	4:45	Movie	Movie	Movie
21:00	5:00			
21:15	5:15			
21:30	5:30		FAMOS #	
21:45	5:45			
22:00	6:00			FAMOS #
22:15	6:15			
22:30	6:30			
22:45	6:45			
23:00	7:00			
23:15	7:15			
23:30	7:30			
23:45	7:45			

		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
6:00	14:00		wake up	wake up
6:15	14:15		breakfast	breakfast
6:30	14:30	wake up	tab-washing :-)	
6:45	14:45	breakfast	(med data gathering	(med data gathering
7:00	15:00	gel-washing :-)	before breakfast)	before breakfast)
7:15	15:15	(med data gathering		FAMOS #
7:30	15:30	before breakfast)	Pupillomyograph	tab-washing :-)
7:45	15:45		FAMOS #	
8:00	16:00	assist CRW donning	EVA Lima	EVA: LiMa
8:15	16:15		mit ATV	mit ATV
8:30	16:30	EVA-HabCom	Start EVA	Start EVA
8:45	16:45			
9:00	17:00			
9:15	17:15			
9:30	17:30			
9:45	17:45			
10:00	18:00			
10:15	18:15			

10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15			
11:30	19:30			
11:45	19:45			
12:00	20:00			
12:15	20:15			
12:30	20:30			
12:45	20:45			
13:00	21:00	assist CRW undonning	End EVA	End EVA
13:15	21:15		EVA: undress	EVA: undress
13:30	21:30	cooking		
13:45	21:45		FAMOS #	
14:00	22:00	lunch	Pupillomyograph	FAMOS #
14:15	22:15		Lunch	
14:30	22:30			Lunch
14:45	22:45			
15:00	23:00	wash the dishes	EVA: massage	
15:15	23:15			EVA: massage
15:30	23:30			
15:45	23:45		GPS-Data post processing	LiMa:
16:00	0:00			conserve
16:15	0:15			samples
16:30	0:30			
16:45	0:45			
17:00	1:00		CogHealth screening	
17:15	1:15	CogHealth screening	Reports	FAMOS #
17:30	1:30	Reports		Greenhab duty
17:45	1:45		FAMOS #	
18:00	2:00		Pupillomyograph	
18:15	2:15	cooking		
18:30	2:30			
18:45	2:45	salive sample + dinner	salive sample + dinner	salive sample + dinner
19:00	3:00			
19:15	3:15			
19:30	3:30	wash the dishes		
19:45	3:45		med data gathering	med data gathering
20:00	4:00	med data gathering		Reports #
20:15	4:15			Comm Link
20:30	4:30			Time #
20:45	4:45	Movie	Movie	Movie
21:00	5:00			
21:15	5:15			
21:30	5:30			CogHealth screening
21:45	5:45		FAMOS #	
22:00	6:00			
22:15	6:15			FAMOS #

Wednesday, 12th of April 2006, Yuri's Night Anniversary

12.04.2006 Hab	MCC	CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
6:00	14:00		wake up	
6:15	14:15		MedData Gathering	wake up
6:30	14:30	wake up	breakfast	MedData Gathering
6:45	14:45	MedData Gathering	tab-washing :-)	breakfast
7:00	15:00	breakfast		water-washing :-)
7:15	15:15	tab-washing :-)	Pupillomyograph	
7:30	15:30		FAMOS #	Pupillomyograph
7:45	15:45	Switch X Telecon	Verify OT is operational	FAMOS #
8:00	16:00	Assist Pupillomyograph	assist CRW donning	EVA: LiMa
8:15	16:15	Assist Pupillomyograph	EVA-HabCom	
8:30	16:30	ROVER		
8:45	16:45			
9:00	17:00			
9:15	17:15			
9:30	17:30			
9:45	17:45			
10:00	18:00			
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15			
11:30	19:30		assist CRW undonning	EVA: undress
11:45	19:45			EVA: massage
12:00	20:00			cooking
12:15	20:15	lunch	lunch	lunch
12:30	20:30			
12:45	20:45			
13:00	21:00			
13:15	21:15	ROVER	FAMOS #	wash the dishes
13:30	21:30	Assist Pupillomyograph	Pupillomyograph	
13:45	21:45	ROVER	EVA: GeoMars	FAMOS #
14:00	22:00	Assist Pupillomyograph		Pupillomyograph
14:15	22:15	LiMa:	Track & Trace	LiMa:
14:30	22:30	conserve		conserve
14:45	22:45	samples		samples
15:00	23:00			
15:15	23:15			
15:30	23:30			
15:45	23:45			
16:00	0:00			
16:15	0:15			EVA Itinery planning
16:30	0:30	Reports #		
16:45	0:45			
17:00	1:00		EVA: undress	
17:15	1:15		EVA: massage	Reports #

17:30	1:30	Comm Link	Reports #	Comm Link
17:45	1:45	Time #		Time #
18:00	2:00		FAMOS #	
18:15	2:15		Pupillomyograph	
18:30	2:30	Assist Pupillomyograph	cooking	FAMOS #
18:45	2:45	Assist Pupillomyograph		Pupillomyograph
19:00	3:00	salive sample + dinner	salive sample + dinner	salive sample + dinner
19:15	3:15			
19:30	3:30			
19:45	3:45			
20:00	4:00	MedData Gathering	wash the dishes	MedData Gathering
20:15	4:15	Yuris Night	MedData Gathering	Yuris Night
20:30	4:30		Yuris Night	
20:45	4:45			
21:00	5:00			
21:15	5:15			
21:30	5:30			
21:45	5:45			
22:00	6:00		FAMOS #	FAMOS #
22:15	6:15			

		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
6:00	14:00		wake up	wake up
6:15	14:15		MedData Gathering	MedData Gathering
6:30	14:30	wake up	breakfast	breakfast
6:45	14:45	MedData Gathering	gel-washing :-)	gel-washing :-)
7:00	15:00	breakfast		
7:15	15:15	water-washing :-)		Assist Pupillomyograph
7:30	15:30		Assist Pupillomyograph	FAMOS #
7:45	15:45		FAMOS #	Switch X Telecon
8:00	16:00			Pupillomyograph
8:15	16:15		Pupillomyograph	EVA: LiMa
8:30	16:30		Greenhab duty	
8:45	16:45			
9:00	17:00			
9:15	17:15			
9:30	17:30			
9:45	17:45			
10:00	18:00			
10:15	18:15		MEDMARS	
10:30	18:30		transfering skin probes to Eppendorf eprouvetten	
10:45	18:45			
11:00	19:00			
11:15	19:15			
11:30	19:30	EVA: undress		EVA: undress
11:45	19:45	EVA: massage	cooking	EVA: massage
12:00	20:00		lunch	
12:15	20:15	lunch		lunch
12:30	20:30			
12:45	20:45			
13:00	21:00		wash the dishes	

13:15	21:15	Assist Pupillomyograph	FAMOS #	Pupillomyograph
13:30	21:30	Assist Pupillomyograph	Pupillomyograph	FAMOS #
13:45	21:45	EVA: GeoMars	EVA: GeoMars	assist CRW donning
14:00	22:00			
14:15	22:15	Track & Trace	Track & Trace	EVA-HabCom
14:30	22:30			
14:45	22:45			
15:00	23:00			
15:15	23:15			
15:30	23:30			
15:45	23:45			
16:00	0:00			
16:15	0:15			
16:30	0:30			
16:45	0:45			
17:00	1:00	EVA: undress	EVA: undress	assist CRW undonning
17:15	1:15	EVA: massage	EVA: massage	
17:30	1:30	Track & Trace	Track & Trace	Take microbio. CRW sample
17:45	1:45	wrap-up phase	wrap-up phase	
18:00	2:00		Assist Pupillomyograph	Pupillomyograph
18:15	2:15	Assist Pupillomyograph		FAMOS #
18:30	2:30	Reports #	Pupillomyograph	cooking
18:45	2:45		FAMOS #	
19:00	3:00	salive sample + dinner	salive sample + dinner	salive sample + dinner
19:15	3:15			
19:30	3:30			
19:45	3:45			
20:00	4:00	MedData Gathering	MedData Gathering	wash the dishes
20:15	4:15	Yuris Night	Yuris Night	MedData Gathering
20:30	4:30			Yuris Night
20:45	4:45			
21:00	5:00			
21:15	5:15			
21:30	5:30			
21:45	5:45			
22:00	6:00			
22:15	6:15		FAMOS #	FAMOS #

Thursday, 13th of April 2006

Suit-donning: 1 h	EVA-trip:
trip-time: min. 30 min	
Suit-undonning: 30 min - 1h	
massage: 30 min	
min. time: 2,5 h	

13.04.2006

		CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
7:30	15:30			wake up
7:45	15:45	wake up	wake up	breakfast
8:00	16:00	breakfast	breakfast	tab-washing :-)
8:15	16:15	gel-washing :-)	gel-washing :-)	
8:30	16:30			med data gathering
8:45	16:45	med data gathering	med data gathering	Verify OT is operational
9:00	17:00	FAMOS #	FAMOS #	Assist Pupillomyograph
9:15	17:15		Pupillomyograph	Assist Pupillomyograph
9:30	17:30	spare time	spare time	spare time
9:45	17:45			
10:00	18:00			
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15			
11:30	19:30	cooking		
11:45	19:45			lunch
12:00	20:00	lunch	lunch	
12:15	20:15			
12:30	20:30			
12:45	20:45			
13:00	21:00	wash the dishes		FAMOS #
13:15	21:15	assist CRW donning	Pupillomyograph	EVA: MedMars
13:30	21:30		FAMOS #	put suit on
13:45	21:45	EVA-HabCom	EVA: MedMars	
14:00	22:00		put suit on	
14:15	22:15			Track & Trace
14:30	22:30		Simulated Broken Leg Med EVA at the edge of com	Simulated Broken Leg Med EVA at the edge of com
14:45	22:45			
15:00	23:00		range ca 500 m from hab	range ca 500 m from hab
15:15	23:15		(EVA on foot, no ATVs,	(EVA on foot, no ATVs,
15:30	23:30		one patient, one	one patient, one
15:45	23:45		crewman for filming, two helpers ..HSO assigns roles)	crewman for filming, two helpers ..HSO assigns roles)
16:00	0:00			
16:15	0:15			
16:30	0:30		EVA: undress	EVA: undress
16:45	0:45			
17:00	1:00			apply cast (broken ankle/
17:15	1:15	assist CRW undonning		lower leg)
17:30	1:30			patient has to keep cast

17:45	1:45			for at least 4 hours
18:00	2:00	salive sample + dinner	salive sample + dinner	salive sample + dinner
18:15	2:15			
18:30	2:30			
18:45	2:45	med data gathering		
19:00	3:00	Reports #	med data gathering	med data gathering
19:15	3:15		FAMOS #	FAMOS #
19:30	3:30		Pupillomyograph	Assist Pupillomyograph
19:45	3:45		Comm Link	Comm Link
20:00	4:00		Time #	Time #
20:15	4:15			
20:30	4:30		(Com Window with earth)	(with flight surgeon)
20:45	4:45			
21:00	5:00			
21:15	5:15			spare time
21:30	5:30			
21:45	5:45			
22:00	6:00			
22:15	6:15			Remove Cast
22:30				

		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
7:45	15:45		wake up	
8:00	16:00	wake up	breakfast	wake up
8:15	16:15	breakfast	water-washing :-)	breakfast
8:30	16:30	tab-washing :-)		water-washing :-)
8:45	16:45		med data gathering	
9:00	17:00	med data gathering	Pupillomyograph	med data gathering
9:15	17:15		FAMOS #	FAMOS #
9:30	17:30	spare time	spare time	spare time
9:45	17:45			
10:00	18:00			
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15			
11:30	19:30		cooking	
11:45	19:45			
12:00	20:00	lunch	lunch	lunch
12:15	20:15			
12:30	20:30			
12:45	20:45			
13:00	21:00		wash the dishes	FAMOS #
13:15	21:15	EVA: MedMars	FAMOS #	Assist Pupillomyograph
13:30	21:30	put suit on	Pupillomyograph	Assist Pupillomyograph
13:45	21:45		Housekeeping Vakuum cleaning both decks	EVA: MedMars
14:00	22:00			put suit on
14:15	22:15	Track & Trace		
14:30	22:30	Simulated Broken Leg Med EVA at the edge of		Simulated Broken Leg Med EVA at the edge of
14:45	22:45	com		com
15:00	23:00	range ca 500 m from hab	Greenhab duty	range ca 500 m from hab

15:15	23:15	(EVA on foot, no ATVs,		(EVA on foot, no ATVs,
15:30	23:30	one patient, one		one patient, one
15:45	23:45	crewman for filming, two helpers ..HSO assigns		crewman for filming, two helpers ..HSO assigns
16:00	0:00	roles)		roles)
16:15	0:15			
16:30	0:30	EVA: undress	GeoMars sample procurem.	EVA: undress
16:45	0:45			
17:00	1:00		check-in Reports #	
17:15	1:15			
17:30	1:30		cooking	
17:45	1:45			
18:00	2:00	salive sample + dinner	salive sample + dinner	salive sample + dinner
18:15	2:15			
18:30	2:30			
18:45	2:45		wash the dishes	wash the dishes
19:00	3:00	med data gathering	med data gathering	med data gathering
19:15	3:15	Assist Pupillomyograph	Pupillomyograph	
19:30	3:30	Reports #	FAMOS #	FAMOS #
19:45	3:45		Track & Trace	Track & Trace
20:00	4:00		wrap-up phase	wrap-up phase
20:15	4:15			
20:30	4:30			
20:45	4:45			
21:00	5:00			

Friday, 14th of April 2006

Suit-donning: 1 h trip-time: min. 30 min Suit-undonning: 30 min - 1h massage: 30 min min. time: 2,5 h	EVA-trip:

14.04.2006 no anomaly with psychological effect today!

Hab	MCC	CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
6:45	14:45	wake up		
7:00	15:00	breakfast	wake up	wake up
7:15	15:15	water-washing :-)	breakfast	breakfast
7:30	15:30	med data gathering	water-washing :-)	gel-washing :-)
7:45	15:45	Switch X Telecon		
8:00	16:00		med data gathering	med data gathering
8:15	16:15		FAMOS #	FAMOS #
8:30	16:30	Verify OT is operational	Pupillomyograph	Assist Pupillomyograph
8:45	16:45	spare time	spare time	Pupillomyograph
9:00	17:00			spare time
9:15	17:15			
9:30	17:30			
9:45	17:45			
10:00	18:00			
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15			
11:30	19:30			
11:45	19:45			cooking
12:00	20:00	lunch	lunch	
12:15	20:15			
12:30	20:30			lunch
12:45	20:45			
13:00	21:00	CRW photo selection/caption		
13:15	21:15			wash the dishes
13:30	21:30			
13:45	21:45		Assist Pupillomyograph	Pupillomyograph
14:00	22:00		Pupillomyograph	Assist Pupillomyograph
14:15	22:15		FAMOS #	FAMOS #
14:30	22:30	PsychoMars test #	PsychoMars test #	CRW photo processing
14:45	22:45			
15:00	23:00			
15:15	23:15			PsychoMars test #
15:30	23:30	saliva sample	saliva sample	
15:45	23:45			
16:00	0:00			
16:15	0:15			saliva sample
16:30	0:30			
16:45	0:45			
17:00	1:00	Reports		

17:15	1:15		FAMOS #	FAMOS #
17:30	1:30		Assist Pupillomyograph	Pupillomyograph
17:45	1:45		Pupillomyograph	Assist Pupillomyograph
18:00	2:00		cooking	
18:15	2:15	dinner		dinner
18:30	2:30		dinner	
18:45	2:45			
19:00	3:00	Reports		
19:15	3:15		wash dishes	
19:30	3:30			
19:45	3:45	Reports #	Reports #	
20:00	4:00	Comm Link		
20:15	4:15	Time #		
20:30	4:30			
20:45	4:45	Movie	Movie	Movie
21:00	5:00			
21:15	5:15			
21:30	5:30			
21:45	5:45			
22:00	6:00			
22:15	6:15			

no anomaly with psychological effect today!

		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
6:45	14:45	wake up	wake up	
7:00	15:00	breakfast	breakfast	wake up
7:15	15:15	gel-washing :-)	tab-washing :-)	breakfast
7:30	15:30		med data gathering	tab-washing :-)
7:45	15:45	med data gathering	Switch X Telecon	
8:00	16:00			med data gathering
8:15	16:15		Pupillomyograph	Assist Pupillomyograph
8:30	16:30	Verify/Adjust Webcams	FAMOS #	FAMOS #
8:45	16:45		Assist Pupillomyograph	
9:00	17:00	spare time	Assist Pupillomyograph	Pupillomyograph
9:15	17:15		spare time	spare time
9:30	17:30			
9:45	17:45			
10:00	18:00			
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15			
11:30	19:30			
11:45	19:45	cooking		
12:00	20:00		lunch	lunch
12:15	20:15			
12:30	20:30	lunch		
12:45	20:45			
13:00	21:00		Assist Pupillomyograph	Pupillomyograph
13:15	21:15	wash the dishes	Pupillomyograph	Assist Pupillomyograph
13:30	21:30		FAMOS #	FAMOS #
13:45	21:45			

14:00	22:00		GeoMars sample procurem.	Sample Preparation
14:15	22:15			
14:30	22:30			Glove Box Work
14:45	22:45			
15:00	23:00			
15:15	23:15	PsychoMars test #		
15:30	23:30			
15:45	23:45		GPS-Data post processing	Greenhab duty
16:00	0:00			
16:15	0:15	saliva sample		
16:30	0:30			
16:45	0:45			
17:00	1:00		PsychoMars test #	PsychoMars test #
17:15	1:15	Reports		
17:30	1:30			
17:45	1:45		saliva sample	saliva sample
18:00	2:00	cooking		
18:15	2:15			
18:30	2:30			
18:45	2:45	dinner	dinner	dinner
19:00	3:00			
19:15	3:15	wash the dishes		
19:30	3:30			
19:45	3:45	Reports #		
20:00	4:00	Comm Link	Assist Pupillomyograph	Pupillomyograph
20:15	4:15	Time #	Pupillomyograph	Assist Pupillomyograph
20:30	4:30		FAMOS #	FAMOS #
20:45	4:45	Movie	Movie	Movie
21:00	5:00			
21:15	5:15			
21:30	5:30			
21:45	5:45			
22:00	6:00			
22:15	6:15			

Saturday, 15th of April 2006

15.04.2006

		CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
6:15	14:15		wake up	
6:30	14:30	wake up	breakfast	wake up
6:45	14:45	breakfast	tab-washing :-)	breakfast
7:00	15:00	tab-washing :-)		water-washing :-)
7:15	15:15		med data gathering	
7:30	15:30	med data gathering		med data gathering
7:45	15:45		Switch-X Telecon	
8:00	16:00	Habcom EVA		EVA Exploration Mgmt.
8:15	16:15		FAMOS #	radiation shelter
8:30	16:30		Assist Pupillomyograph	
8:45	16:45		Pupillomyograph	Rover ausschleusen
9:00	17:00		EVA Itinerary planning	Rover Familienbilder
9:15	17:15			
9:30	17:30			
9:45	17:45			
10:00	18:00			
10:15	18:15		Check safety system	
10:30	18:30		Fire detection	
10:45	18:45		Environmental systems	
11:00	19:00		CO-Monitors	
11:15	19:15			EVA undon
11:30	19:30	help undon EVA suits	cooking	EVA massage
11:45	19:45	lunch		
12:00	20:00		lunch	lunch
12:15	20:15			
12:30	20:30			
12:45	20:45	wash the dishes		
13:00	21:00			Verify OT is operational
13:15	21:15	EVA: GeoMars	Habcom EVA	Reports #
13:30	21:30			
13:45	21:45	Rover Familienbilder		
14:00	22:00			Data Saving
14:15	22:15			Computer Backup
14:30	22:30			
14:45	22:45			
15:00	23:00			
15:15	23:15	Track & Trace 2		Med Mars EVA
15:30	23:30	"Forward contamination"		Documentation
15:45	23:45	siehe Crash BioMars.doc		
16:00	0:00	einreiben mit gefüllter Tube		
16:15	0:15			
16:30	0:30	EVA: undress		
16:45	0:45	EVA: massage	help undon EVA suits	
17:00	1:00	Reports #		Reports #
17:15	1:15		Reports #	
17:30	1:30			cooking
17:45	1:45		cooking	
18:00	2:00	salive sample + dinner		salive sample + dinner

18:15	2:15		salive sample + dinner	
18:30	2:30			
18:45	2:45	med data gathering	med data gathering	med data gathering
19:00	3:00	wash the dishes		
19:15	3:15	Reports #	CRW photo selection/caption	
19:30	3:30		for daily report	
19:45	3:45		Assist Pupillomyograph	Pupillomyograph
20:00	4:00		Pupillomyograph	Assist Pupillomyograph
20:15	4:15		FAMOS #	FAMOS #
20:30	4:30			
20:45	4:45			
21:00	5:00	Internal Feedback Session	Internal Feedback Session	Internal Feedback Session
21:15	5:15			
21:30	5:30	FeedbackVOX Trans to MCC	FeedbackVOX Trans to MCC	FeedbackVOX Trans to MCC

		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
6:15	14:15			wake up
6:30	14:30	wake up	wake up	breakfast
6:45	14:45	breakfast	breakfast	gel-washing :-)
7:00	15:00	water-washing :-)	gel-washing :-)	
7:15	15:15			med data gathering
7:30	15:30	med data gathering	med data gathering	
7:45	15:45			Switch-X Telecon
8:00	16:00	spare time	EVA Exploration Mgmt.	
8:15	16:15		radiation shelter	FAMOS #
8:30	16:30			Pupillomyograph
8:45	16:45		Rover ausschleusen	Assist Pupillomyograph
9:00	17:00		Rover Familienbilder	spare time
9:15	17:15			
9:30	17:30			
9:45	17:45			
10:00	18:00			
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15		EVA undon	
11:30	19:30	cooking	EVA massage	
11:45	19:45			
12:00	20:00	lunch	lunch	lunch
12:15	20:15			
12:30	20:30			
12:45	20:45		wash the dishes	
13:00	21:00	wash the dishes		Sample preparation
13:15	21:15		EVA: GeoMars	Glove Box work
13:30	21:30			
13:45	21:45	Miscellaneous	Rover Familienbilder	
14:00	22:00	Hab Maintenance		
14:15	22:15			
14:30	22:30			Greenhab duty
14:45	22:45			
15:00	23:00		Track & Trace 2	

15:15	23:15		"Forward contamination"	
15:30	23:30		siehe Crash BioMars.doc	
15:45	23:45	PsychoMars test #	einreiben mit gefüllter Tube	PsychoMars test #
16:00	0:00			
16:15	0:15			
16:30	0:30		EVA: undress	
16:45	0:45		EVA: massage	saliva sample
17:00	1:00	saliva sample	Reports #	
17:15	1:15			
17:30	1:30	Reports #		Reports #
17:45	1:45			
18:00	2:00	salive sample + dinner	salive sample + dinner	salive sample + dinner
18:15	2:15			
18:30	2:30	med data gathering		
18:45	2:45		med data gathering	med data gathering
19:00	3:00	wash the dishes		
19:15	3:15		Assist Pupillomyograph	Pupillomyograph
19:30	3:30		Pupillomyograph	Assist Pupillomyograph
19:45	3:45		FAMOS #	FAMOS #
20:00	4:00		GPS-Data post processing	Sample preparation
20:15	4:15		GeoMars EVA	Glove Box work
20:30	4:30		Documentation	
20:45	4:45			
21:00	5:00	Internal Feedback Session	Internal Feedback Session	Internal Feedback Session
21:15	5:15			
21:30	5:30	FeedbackVOX Trans to MCC	FeedbackVOX Trans to MCC	FeedbackVOX Trans to MCC

Sunday, 16th of April 2006, Easter Sunday

16.04.2006

		CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
5:45	13:45			
6:00	14:00	wake up	wake up	wake up
6:15	14:15	Skin samples	Skin samples	Skin samples
6:30	14:30	gel-washing :-)	gel-washing :-)	tab-washing :-)
6:45	14:45	breakfast	breakfast	breakfast
7:00	15:00			
7:15	15:15	Medical Measurement		
7:30	15:30	Skin samples 1 h after washing	Skin samples 1 h after washing	Medical Measurement
7:45	15:45	Pupillomyograph	Medical Measurement	Skin samples 1 h after washing
8:00	16:00	Briefing	Briefing	Briefing
8:15	16:15		Switch X Telecon	Verify OT is operational
8:30	16:30			FAMOS #
8:45	16:45	EVA: GeoMars	FAMOS #	Pupillomyograph
9:00	17:00	mit ATV	Pupillomyograph	EVA: GeoMars
9:15	17:15	Track & Trace 1	Assist Pupillomyograph	mit ATV
9:30	17:30	Backward		Track & Trace 2
9:45	17:45	Contamination		Forward
10:00	18:00			Contamination
10:15	18:15		Spare time	
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15			
11:30	19:30			
11:45	19:45			
12:00	20:00		Housekeeping	
12:15	20:15		Vakuum cleaning both decks	
12:30	20:30			
12:45	20:45			
13:00	21:00		FAMOS #	
13:15	21:15		Assist Pupillomyograph	
13:30	21:30	EVA: undress	Pupillomyograph	
13:45	21:45	EVA: massage	cooking	EVA: undress
14:00	22:00			EVA: massage
14:15	22:15	lunch	lunch	lunch
14:30	22:30			
14:45	22:45			
15:00	23:00			
15:15	23:15		wash the dishes	
15:30	23:30	Track & Trace	Reports	Track & Trace
15:45	23:45	wrap-up phase		wrap-up phase
16:00	0:00	radiation warning	radiation warning	radiation warning
16:15	0:15			
16:30	0:30			
16:45	0:45			
17:00	1:00			
17:15	1:15			
17:30	1:30			

17:45	1:45			
18:00	2:00	Medical Measurement	Medical Measurement	Medical Measurement
18:15	2:15	Briefing	Briefing	Briefing
18:30	2:30			
18:45	2:45	Reports	Reports	Reports
19:00	3:00			
19:15	3:15			cooking
19:30	3:30			
19:45	3:45			
20:00	4:00	salive sample + dinner	salive sample + dinner	salive sample + dinner
20:15	4:15			
20:30	4:30			
20:45	4:45	Medical Measurement	wash the dishes	Medical Measurement
21:00	5:00	Pupillomyograph	Medical Measurement	FAMOS #
21:15	5:15	Spare time	FAMOS #	Spare time
21:30	5:30		Spare time	
21:45	5:45		Assist Pupillomyograph	Pupillomyograph
22:00	6:00		Pupillomyograph	Assist Pupillomyograph
22:15	6:15	VOX with MCC	VOX with MCC	VOX with MCC
		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
5:45	13:45			wake up
6:00	14:00	wake up	wake up	Sample preparation
6:15	14:15	Skin samples	Skin samples	Skin samples
6:30	14:30	tab-washing :-)	water-washing :-)	water-washing :-)
6:45	14:45	breakfast	breakfast	breakfast
7:00	15:00			
7:15	15:15		Skin samples 1 h after washing	Medical Measurement
7:30	15:30	Medical Measurement	Medical Measurement	Skin samples 1 h after washing
7:45	15:45	Skin samples 1 h after washing	FAMOS #	Assist Pupillomyograph
8:00	16:00	Briefing	Briefing	Briefing
8:15	16:15	help don EVA suits	Switch X Telecon	FAMOS #
8:30	16:30			Reports
8:45	16:45		Assist Pupillomyograph	
9:00	17:00		Assist Pupillomyograph	
9:15	17:15		EVA: GeoMars	Pupillomyograph
9:30	17:30		mit ATV	Glovebox work
9:45	17:45			Work on Crew samples
10:00	18:00			
10:15	18:15			
10:30	18:30			
10:45	18:45	Habcom EVA		
11:00	19:00			
11:15	19:15			
11:30	19:30			
11:45	19:45			
12:00	20:00			Greenhab duty
12:15	20:15			
12:30	20:30			
12:45	20:45			
13:00	21:00			FAMOS #
13:15	21:15			Pupillomyograph

13:30	21:30			Assist Pupillomyograph
13:45	21:45	help undon EVA suits	EVA: undress	cooking
14:00	22:00		EVA: massage	
14:15	22:15	lunch	lunch	lunch
14:30	22:30			
14:45	22:45			
15:00	23:00	wash the dishes		
15:15	23:15			
15:30	23:30	Reports	Lab/Workshop cleaning	Spare time
15:45	23:45			
16:00	0:00	radiation warning	radiation warning	radiation warning
16:15	0:15			
16:30	0:30			
16:45	0:45			
17:00	1:00			
17:15	1:15			
17:30	1:30			
17:45	1:45			
18:00	2:00	Medical Measurement	Medical Measurement	Medical Measurement
18:15	2:15	Briefing	Briefing	Briefing
18:30	2:30			
18:45	2:45	Reports	Reports	Reports
19:00	3:00			
19:15	3:15		cooking	
19:30	3:30			
19:45	3:45			
20:00	4:00	salive sample + dinner	salive sample + dinner	salive sample + dinner
20:15	4:15			
20:30	4:30			
20:45	4:45	Medical Measurement	wash the dishes	Medical Measurement
21:00	5:00	Assist Pupillomyograph	Medical Measurement	FAMOS #
21:15	5:15	Assist Pupillomyograph	FAMOS #	Pupillomyograph
21:30	5:30	Spare time	Pupillomyograph	Assist Pupillomyograph
21:45	5:45		Spare time	Spare time
22:00	6:00			
22:15	6:15	VOX with MCC	VOX with MCC	VOX with MCC

Monday, 17th of April 2006

Suit-donning: 1 h trip-time: min. 30 min Suit-undonning: 30 min - 1h massage: 30 min min. time: 2,5 h	EVA-trip:

17.04.2006

Hab	MCC	CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
5:45	13:45		wake up	wake up
6:00	14:00	wake up	breakfast	breakfast
6:15	14:15	breakfast	water-washing :-)	gel-washing :-)
6:30	14:30	water-washing :-)		
6:45	14:45		med data gathering	med data gathering
7:00	15:00	med data gathering		Assist Pupillomyograph
7:15	15:15		Pupillomyograph	Assist Pupillomyograph
7:30	15:30		FAMOS #	FAMOS #
7:45	15:45	Switch X Telecon	Switch X Telecon	
8:00	16:00			
8:15	16:15		long distance EVA: GeoMars	
8:30	16:30	assist CRW donning	with ATV	assist CRW donning
8:45	16:45		Track & Trace 2	
9:00	17:00	optional Engineering	Forward	EVA-HabCom
9:15	17:15	for Aerobot Testing	Contamination	(for both teams)
9:30	17:30	on foot near HAB		
9:45	17:45	if winds are not too strong		
10:00	18:00		Waypoint 1: Coal Mine Wash	Wlan Configuration
10:15	18:15		optional: Waypoint 2:	
10:30	18:30	Wlan Configuration	Factory Butte	
10:45	18:45		assessment	
11:00	19:00			
11:15	19:15		take with you : extra	
11:30	19:30		water, emergency rations,	
11:45	19:45	EVA: undress	medical emergency equip.	
12:00	20:00	EVA: massage		
12:15	20:15			
12:30	20:30			
12:45	20:45	assist CRW undonning	EVA: undress	assist CRW undonning
13:00	21:00		EVA: massage	cooking
13:15	21:15			
13:30	21:30		lunch	lunch
13:45	21:45	optional Engineering EVA		
14:00	22:00	for Wlan testing		
14:15	22:15		FAMOS #	wash the dishes
14:30	22:30		Pupillomyograph	Assist Pupillomyograph
14:45	22:45		Reports	FAMOS #
15:00	23:00			Reports
15:15	23:15		EVA Itinerary planning	
15:30	23:30			
15:45	23:45			Calibrate EVA-Suit-Sensors
16:00	0:00		Factory Butte expedition	and medical equipment

16:15	0:15		with data from morning	free time
16:30	0:30	EVA: undress	scouting EVA	
16:45	0:45	EVA: massage	CRW photo selection/caption	
17:00	1:00	Reports #		
17:15	1:15		Reports #	
17:30	1:30	cooking		FAMOS #
17:45	1:45		Pupillomyograph	Assist Pupillomyograph
18:00	2:00	dinner	FAMOS #	
18:15	2:15		dinner	
18:30	2:30			dinner
18:45	2:45	wash the dishes		
19:00	3:00			wash the dishes
19:15	3:15	PsychoMars test #		
19:30	3:30		PsychoMars test #	Reports #
19:45	3:45	saliva sample		
20:00	4:00		saliva sample	PsychoMars test #
20:15	4:15			
20:30	4:30			saliva sample
20:45	4:45			
21:00	5:00	med data gathering		
21:15	5:15	Reports #	med data gathering	
21:30	5:30	VOX Comm Link	FAMOS #	med data gathering
21:45	5:45	Time #		FAMOS #
22:00	6:00	Internal Briefing / Feedback	Internal Briefing / Feedback	Internal Briefing / Feedback
22:15	6:15	topic: Factory Butte	topic: Factory Butte	topic: Factory Butte
22:30				
22:45				
23:00				
23:15				
23:30				
23:45				

		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
5:45	13:45		wake up	
6:00	14:00		breakfast	wake up
6:15	14:15	wake up	tab-washing :-)	breakfast
6:30	14:30	breakfast		tab-washing :-)
6:45	14:45	gel-washing :-)	med data gathering	
7:00	15:00		Pupillomyograph	FAMOS #
7:15	15:15	med data gathering	FAMOS #	med data gathering
7:30	15:30		Assist Pupillomyograph	Pupillomyograph
7:45	15:45			
8:00	16:00	Verify OT is operational		Geo-Mars Sample
8:15	16:15		long distance EVA: GeoMars	Documentation
8:30	16:30		with ATV	
8:45	16:45		Track & Trace 2	
9:00	17:00		Forward	optional Engineering
9:15	17:15		Contamination	for Aerobot Testing
9:30	17:30			on foot near HAB
9:45	17:45			if winds are not too strong
10:00	18:00	Wlan Configuration	Waypoint 1: Coal Mine Wash	

10:15	18:15		optional: Waypoint 2:	
10:30	18:30		Factory Butte	
10:45	18:45		assessment	
11:00	19:00			
11:15	19:15		take with you : extra	
11:30	19:30		water, emergency rations,	
11:45	19:45		medical emergency equip.	EVA: undress
12:00	20:00			EVA: massage
12:15	20:15			free time
12:30	20:30			
12:45	20:45		EVA: undress	
13:00	21:00		EVA: massage	
13:15	21:15	lunch	lunch	lunch
13:30	21:30			
13:45	21:45	optional Engineering EVA		
14:00	22:00	for Wlan testing		
14:15	22:15		GPS-Data post processing	FAMOS #
14:30	22:30			
14:45	22:45		Pupillomyograph	Assist Pupillomyograph
15:00	23:00		FAMOS #	Greenhab duty
15:15	23:15		GPS-Data post processing	
15:30	23:30			
15:45	23:45			
16:00	0:00			Reports
16:15	0:15			
16:30	0:30	EVA: undress		
16:45	0:45	EVA: massage	Geo-Mars Sample	Glove Box Work
17:00	1:00	Reports	Documentation	
17:15	1:15			
17:30	1:30	cooking	Reports #	
17:45	1:45			
18:00	2:00		Pupillomyograph	Assist Pupillomyograph
18:15	2:15		FAMOS #	FAMOS #
18:30	2:30	dinner	dinner	dinner
18:45	2:45	Reports #		
19:00	3:00			
19:15	3:15	PsychoMars test #		
19:30	3:30		PsychoMars test #	PsychoMars test #
19:45	3:45			
20:00	4:00	saliva sample	saliva sample	saliva sample
20:15	4:15			
20:30	4:30			
20:45	4:45			
21:00	5:00	med data gathering		
21:15	5:15	Reports #	med data gathering	med data gathering
21:30	5:30	VOX Comm Link		FAMOS #
21:45	5:45	Time #	FAMOS #	
22:00	6:00	Internal Briefing / Feedback	Internal Briefing / Feedback	Internal Briefing / Feedback
22:15	6:15	topic: Factory Butte	topic: Factory Butte	topic: Factory Butte

Tuesday, 18th of April 2006

18.04.2006

Hab	MCC	CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
6:00	14:00		wake up	wake up
6:15	14:15	wake up	breakfast	breakfast
6:30	14:30	breakfast	tab-washing :-)	water-washing :-)
6:45	14:45	tab-washing :-)		
7:00	15:00		med data gathering	med data gathering
7:15	15:15	med data gathering		Assist Pupillomyograph
7:30	15:30		Pupillomyograph	Assist Pupillomyograph
7:45	15:45		FAMOS #	FAMOS #
8:00	16:00		Switch X Telecon	
8:15	16:15			
8:30	16:30	assist CRW donning	EVA: MedMars	EVA: MedMars
8:45	16:45		put suit on	put suit on
9:00	17:00	EVA-HabCom		
9:15	17:15		Rescue unconscious	Rescue unconscious
9:30	17:30		astronaut from deep ravine	astronaut from deep ravine
9:45	17:45		by using rescue	by using rescue
10:00	18:00		equipment	equipment
10:15	18:15			
10:30	18:30		Try transport of patient with poles fastened to PLSS	HSO assigns roles (patient,
10:45	18:45			helpers, Fotographer/Video-
11:00	19:00		or use improvised	cameraman)
11:15	19:15		strecher, NOT by carrying him bodily. Also try transport	
11:30	19:30			
11:45	19:45		via ATV afterwards.	
12:00	20:00			
12:15	20:15		ATV use permitted	ATV use permitted
12:30	20:30			
12:45	20:45	assist CRW undonning	EVA: undress	EVA: undress
13:00	21:00		EVA: massage	EVA: massage
13:15	21:15		lunch	lunch
13:30	21:30			
13:45	21:45	lunch		
14:00	22:00			
14:15	22:15	PsychoMars test #	FAMOS #	
14:30	22:30		Pupillomyograph	Assist Pupillomyograph
14:45	22:45		Assist Pupillomyograph	FAMOS #
15:00	23:00	optional Engineering EVA	assist CRW donning	Post Med Mars EVA
15:15	23:15	for Aerobot Testing		Report
15:30	23:30	on foot near HAB	EVA-HabCom	
15:45	23:45	if winds are not too strong		
16:00	0:00	or WLAN network work		
16:15	0:15		assist CRW undonning	PsychoMars test #
16:30	0:30	EVA: undress		
16:45	0:45	EVA: massage		
17:00	1:00	PsychoMars test #	PsychoMars test #	
17:15	1:15			
17:30	1:30		saliva sample	
17:45	1:45	saliva sample	Reports #	saliva sample

18:00	2:00	cooking		
18:15	2:15		dinner	dinner
18:30	2:30	dinner		
18:45	2:45			
19:00	3:00	wash the dishes		
19:15	3:15	med data gathering	med data gathering	med data gathering
19:30	3:30	Reports #	FAMOS #	FAMOS #
19:45	3:45		Reports #	Reports #
20:00	4:00			
20:15	4:15	EVA Itinerary planning	PsychoMars test #	
20:30	4:30	Factory Butte expedition		VOX Comm Link
20:45	4:45	EVA Itinerary planning		Time #
21:00	5:00	Movie	Movie	Movie
21:15	5:15			
21:30	5:30			
21:45	5:45			
22:00	6:00			
22:15	6:15			

		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
6:00	14:00		wake up	
6:15	14:15		breakfast	wake up
6:30	14:30	wake up	gel-washing :-)	breakfast
6:45	14:45	breakfast		gel-washing :-)
7:00	15:00	water-washing :-)	med data gathering	
7:15	15:15		Pupillomyograph	FAMOS #
7:30	15:30	med data gathering	FAMOS #	med data gathering
7:45	15:45		Assist Pupillomyograph	Pupillomyograph
8:00	16:00			Switch X Telecon
8:15	16:15	Verify OT is operational		
8:30	16:30	EVA: MedMars	EVA: MedMars	EVA: MedMars
8:45	16:45			put suit on
9:00	17:00			
9:15	17:15	Rescue unconscious	Rescue unconscious	Rescue unconscious
9:30	17:30	astronaut from deep ravine	astronaut from deep ravine	astronaut from deep ravine
9:45	17:45	by using rescue	by using rescue	by using rescue
10:00	18:00	equipment	equipment	equipment
10:15	18:15			
10:30	18:30	Try transport of patient with poles fastened to	Try transport of patient with poles fastened to	Try transport of patient with poles fastened to
10:45	18:45	PLSS	PLSS	PLSS
11:00	19:00	or use improvised	or use improvised	or use improvised
11:15	19:15	strecher, NOT by carrying him bodily. Also try	strecher, NOT by carrying him bodily. Also try	strecher, NOT by carrying him bodily. Also try
11:30	19:30	transport	transport	transport
11:45	19:45	via ATV afterwards.	via ATV afterwards.	via ATV afterwards.
12:00	20:00			
12:15	20:15	ATV use permitted	ATV use permitted	ATV use permitted
12:30	20:30			
12:45	20:45	EVA: undress	EVA: undress	EVA: undress
13:00	21:00	EVA: massage	EVA: massage	EVA: massage
13:15	21:15		cooking	cooking
13:30	21:30			
13:45	21:45	lunch	lunch	lunch

14:00	22:00			
14:15	22:15			
14:30	22:30		wash the dishes	wash the dishes
14:45	22:45		Pupillomyograph	Greenhab duty
15:00	23:00	optional Engineering EVA	FAMOS #	
15:15	23:15	for Aerobot Testing		
15:30	23:30	on foot near HAB	Geo-Mars Sample	
15:45	23:45	if winds are not too strong	Documentation	
16:00	0:00	or WLAN network work		
16:15	0:15		PsychoMars test #	Glove Box Work
16:30	0:30	EVA: undress		
16:45	0:45	EVA: massage		
17:00	1:00			PsychoMars test #
17:15	1:15	Reports #		
17:30	1:30			
17:45	1:45	saliva sample	saliva sample	saliva sample
18:00	2:00	cooking	Reports #	Reports #
18:15	2:15			
18:30	2:30	dinner	dinner	dinner
18:45	2:45			
19:00	3:00	wash the dishes		
19:15	3:15	med data gathering		
19:30	3:30	PsychoMars test #	med data gathering	med data gathering
19:45	3:45		FAMOS #	FAMOS #
20:00	4:00		CRW photo selection/caption	PsychoMars test #
20:15	4:15			
20:30	4:30		VOX Comm Link	
20:45	4:45		Time #	
21:00	5:00	Movie	Movie	Movie
21:15	5:15			
21:30	5:30			
21:45	5:45			
22:00	6:00			
22:15	6:15			

Wednesday, 19th of April 2006

19.04.2006

		CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
6:30	14:30	wake up	wake up	wake up
6:45	14:45	breakfast	breakfast	breakfast
7:00	15:00	gel-washing :-)	gel-washing :-)	tab-washing :-)
7:15	15:15			
7:30	15:30			
7:45	15:45		Verify OT is operational	
8:00	16:00	Assist Pupillomyograph	FAMOS #	
8:15	16:15	Assist Pupillomyograph	Pupillomyograph	
8:30	16:30			
8:45	16:45			
9:00	17:00	SwitchX Telecon	EVA GeoMars	EVA GeoMars
9:15	17:15		Track&Trace 1	Track&Trace 2
9:30	17:30	HabCom		
9:45	17:45			
10:00	18:00			
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15			
11:30	19:30			
11:45	19:45			
12:00	20:00			
12:15	20:15			
12:30	20:30	Cooking		
12:45	20:45			
13:00	21:00	Lunch		
13:15	21:15			
13:30	21:30	wash the dishes		
13:45	21:45	Assist Crew Undonning		
14:00	22:00			
14:15	22:15			
14:30	22:30			
14:45	22:45			
15:00	23:00		EVA Massage	EVA Massage
15:15	23:15			
15:30	23:30	Lab Workshop Cleaning	Snack :-)	Snack :-)
15:45	23:45			
16:00	0:00		Fotoselection	Data Saving
16:15	0:15			
16:30	0:30	Reports #	Reports #	Reports #
16:45	0:45			
17:00	1:00			
17:15	1:15			
17:30	1:30	cooking	FAMOS #	repair/check
17:45	1:45		Pupillomyograph	

18:00	2:00	salive sample + dinner	salive sample + dinner	salive sample + dinner
18:15	2:15			
18:30	2:30			
18:45	2:45			
19:00	3:00	wash the dishes	Reports #	Reports #
19:15	3:15	Reports #		
19:30	3:30			
19:45	3:45			spare-time
20:00	4:00			
20:15	4:15	Comm Link	Comm Link	
20:30	4:30	Time #	Time #	
20:45	4:45			
21:00	5:00			
21:15	5:15			
21:30	5:30			
21:45	5:45			
22:00	6:00		FAMOS #	
22:15	6:15			
22:30	6:30			"carpe noctum"
22:45	6:45			
23:00	7:00			

		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
6:30	14:30	wake up	wake up	wake up
6:45	14:45	breakfast	breakfast	breakfast
7:00	15:00	tab-washing :-)	water-washing :-)	water-washing :-)
7:15	15:15			
7:30	15:30			
7:45	15:45		FAMOS #	
8:00	16:00		Pupillomyograph	
8:15	16:15		spare-time	spare-time
8:30	16:30		& get well	& get well
8:45	16:45			
9:00	17:00	EVA GeoMars	Assist Donning	SwitchX Telecon
9:15	17:15			
9:30	17:30			
9:45	17:45			
10:00	18:00			
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15			
11:30	19:30			
11:45	19:45			
12:00	20:00			
12:15	20:15			
12:30	20:30			
12:45	20:45			
13:00	21:00		Lunch	Lunch

13:15	21:15			
13:30	21:30		GeoMars Sample Procurement	Greenhab Duty
13:45	21:45			
14:00	22:00			
14:15	22:15			
14:30	22:30			
14:45	22:45		MedMars pure culture	MedMars pure culture
15:00	23:00	EVA Massage		
15:15	23:15			
15:30	23:30	Snack :-)		
15:45	23:45			
16:00	0:00	GeoMars Sample Procurement		
16:15	0:15			
16:30	0:30			
16:45	0:45			
17:00	1:00			
17:15	1:15			
17:30	1:30	cooking	Pupillomyograph	Assist Pupillomyograph
17:45	1:45	salive sample + dinner	FAMOS #	Assist Pupillomyograph
18:00	2:00		salive sample + dinner	salive sample + dinner
18:15	2:15			
18:30	2:30			
18:45	2:45			
19:00	3:00	wash the dishes	repair/check	repair/check
19:15	3:15	Reports #		
19:30	3:30		Reports #	Reports #
19:45	3:45			
20:00	4:00	Verify/Adjust Webcams		
20:15	4:15		spare-time	spare-time
20:30	4:30			
20:45	4:45			
21:00	5:00			
21:15	5:15			
21:30	5:30			
21:45	5:45		FAMOS #	
22:00	6:00			
22:15	6:15	Carpe noctem		
22:30	6:30			
22:45	6:45			
23:00	7:00			

Thursday, 20th of April 2006

Suit-donning: 1 h EVA-trip:
trip-time: min. 30 min
Suit-undonning: 30 min - 1h
massage: 30 min

min. time: 2,5 h

20.04.2006 no anomaly with psychological effect today!

		CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
6:00	14:00	wake up	wake up	wake up
6:15	14:15	breakfast	breakfast	breakfast
6:30	14:30	water-washing :-)	water-washing :-)	gel-washing :-)
6:45	14:45			
7:00	15:00			
7:15	15:15	med data gathering	med data gathering	med data gathering
7:30	15:30		Pupillomyograph	assist Pupillomyograph
7:45	15:45	Verify OT is operational	FAMOS #	assist Pupillomyograph
8:00	16:00	Skin samples	Switch X Telecon	FAMOS #
8:15	16:15			Skin samples
8:30	16:30		Skin samples	
8:45	16:45			
9:00	17:00	EVA Itinerary planning	EVA Itinerary planning	EVA Suit Sensor Calibration
9:15	17:15			and Suit Maintenance
9:30	17:30			
9:45	17:45			
10:00	18:00	Telecom with engineering	Lab Workshop Cleaning	
10:15	18:15	team about WLAN		
10:30	18:30	setup	Vaccuming	
10:45	18:45			
11:00	19:00		cooking	cooking
11:15	19:15	lunch		
11:30	19:30		lunch	lunch
11:45	19:45			
12:00	20:00		wash the dishes	wash the dishes
12:15	20:15	EVA: GeoMars		assist CRW donning
12:30	20:30		FAMOS #	
12:45	20:45			
13:00	21:00			
13:15	21:15		Spare Time	EVA-HabCom
13:30	21:30			
13:45	21:45			
14:00	22:00			
14:15	22:15			
14:30	22:30			
14:45	22:45			
15:00	23:00			
15:15	23:15			
15:30	23:30			
15:45	23:45			
16:00	0:00			
16:15	0:15			

16:30	0:30			
16:45	0:45		CRW photo selection/caption	
17:00	1:00			
17:15	1:15		Reports #	
17:30	1:30	EVA: undress		
17:45	1:45	EVA: massage		assist CRW undonning
18:00	2:00	saliva sample	saliva sample	saliva sample
18:15	2:15	med data gathering	cooking	cooking
18:30	2:30	dinner		
18:45	2:45		dinner	dinner
19:00	3:00			
19:15	3:15		wash the dishes	wash the dishes
19:30	3:30	Reports #	FAMOS #	med data gathering
19:45	3:45		med data gathering	FAMOS #
20:00	4:00	PsychoMars test #	PsychoMars test #	PsychoMars test #
20:15	4:15			
20:30	4:30			
20:45	4:45			
21:00	5:00			
21:15	5:15			
21:30	5:30			
21:45	5:45	Internal Feedback	Internal Feedback	Internal Feedback
22:00	6:00			
22:15	6:15			COMLINK VOX
22:30	6:30			(optional)

no anomaly with psychological effect today!

		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
6:00	14:00	wake up	wake up	wake up
6:15	14:15	breakfast	breakfast	breakfast
6:30	14:30	gel-washing :-)	tab-washing :-)	tab-washing :-)
6:45	14:45			
7:00	15:00			
7:15	15:15	med data gathering	med data gathering	med data gathering
7:30	15:30	Skin samples	FAMOS #	FAMOS #
7:45	15:45		Pupillomyograph	Skin samples
8:00	16:00	Switch X Telecon	Skin samples	
8:15	16:15			
8:30	16:30		Greenhab duty	
8:45	16:45			
9:00	17:00	Greenhab Repair work		
9:15	17:15			
9:30	17:30			
9:45	17:45			
10:00	18:00		GPS-Data post processing	
10:15	18:15			
10:30	18:30		GeoMars Sample	
10:45	18:45		documentation	
11:00	19:00			
11:15	19:15	lunch		
11:30	19:30			lunch
11:45	19:45		lunch	
12:00	20:00			

12:15	20:15		FAMOS #	EVA: GeoMars
12:30	20:30		EVA: GeoMars	
12:45	20:45			
13:00	21:00	Spare Time	Track and Trace 2	Track and Trace 2
13:15	21:15			
13:30	21:30			
13:45	21:45			
14:00	22:00			
14:15	22:15			
14:30	22:30			
14:45	22:45			
15:00	23:00			
15:15	23:15			
15:30	23:30			
15:45	23:45			
16:00	0:00			
16:15	0:15			
16:30	0:30			
16:45	0:45			
17:00	1:00			
17:15	1:15			
17:30	1:30		EVA: undress	EVA: undress
17:45	1:45		EVA: massage	EVA: massage
18:00	2:00	saliva sample	saliva sample	saliva sample
18:15	2:15	med data gathering	med data gathering	med data gathering
18:30	2:30	dinner	dinner	dinner
18:45	2:45			
19:00	3:00			
19:15	3:15			
19:30	3:30	Reports #	FAMOS #	PsychoMars test #
19:45	3:45		PsychoMars test #	FAMOS #
20:00	4:00	PsychoMars test #		PsychoMars test #
20:15	4:15			
20:30	4:30			
20:45	4:45			
21:00	5:00			
21:15	5:15			
21:30	5:30			
21:45	5:45	Internal Feedback	Internal Feedback	Internal Feedback
22:00	6:00			

Friday, 21st of April 2006

21.04.2006

Hab	MCC	CDR (Commander)	XO (First Officer)	HSO (Health&Safety Officer)
6:00	14:00		wake up	wake up
6:15	14:15		breakfast	breakfast
6:30	14:30		tab-washing :-)	water-washing :-)
6:45	14:45	wake up		
7:00	15:00	breakfast	FAMOS #	
7:15	15:15	tab-washing :-)	Pupillomyograph	Assist Pupillomyograph
7:30	15:30			Assist Pupillomyograph
7:45	15:45	Switch X Telecon	assist CRW donning	Switch X Telecon
8:00	16:00		EVA-HabCom	
8:15	16:15			
8:30	16:30	Verify OT is operational		
8:45	16:45			
9:00	17:00			Housekeeping
9:15	17:15			Vacuum cleaning both decks
9:30	17:30			
9:45	17:45	Final Report		
10:00	18:00			
10:15	18:15			
10:30	18:30			Greenhab duty
10:45	18:45			
11:00	19:00			
11:15	19:15			
11:30	19:30			
11:45	19:45			
12:00	20:00	cooking	assist CRW undonning	cooking
12:15	20:15			
12:30	20:30	lunch	FAMOS #	
12:45	20:45		Pupillomyograph	lunch
13:00	21:00		lunch	
13:15	21:15			
13:30	21:30			
13:45	21:45	wash the dishes		wash the dishes
14:00	22:00		GeoMars EVA	
14:15	22:15	GeoMars EVA		GeoMars EVA
14:30	22:30			
14:45	22:45			
15:00	23:00		Track&Trace 2	Track&Trace 2
15:15	23:15			
15:30	23:30			
15:45	23:45			
16:00	0:00			
16:15	0:15			
16:30	0:30			
16:45	0:45			
17:00	1:00			
17:15	1:15			
17:30	1:30			

17:45	1:45			
18:00	2:00			
18:15	2:15			
18:30	2:30		EVA: undress	
18:45	2:45	EVA: undress	EVA: massage	EVA: undress
19:00	3:00	EVA: massage	GeoMars EVA	EVA: massage
19:15	3:15	Reports #	Reports #	Reports #
19:30	3:30			
19:45	3:45		FAMOS #	FAMOS #
20:00	4:00		Pupillomyograph	Assist Pupillomyograph
20:15	4:15	salive sample + dinner	salive sample + dinner	salive sample + dinner
20:30	4:30			
20:45	4:45			
21:00	5:00			
21:15	5:15	put suit on	put suit on	put suit on
21:30	5:30			
21:45	5:45	LiMa EVA	LiMa EVA	LiMa EVA
22:00	6:00	Night-active lifeforms	Night-active lifeforms	Night-active lifeforms
22:15	6:15	on Mars?	on Mars?	on Mars?
22:30	6:30			
22:45				
23:00		EVA: undress	EVA: undress	EVA: undress
23:15		EVA: massage	EVA: massage	EVA: massage
23:30				
23:45				

		FE (Flight Engineer)	MSP (Mission Specialist Planetary sciences)	MSL (Mission Specialist Life sciences)
6:00	14:00		wake up	
6:15	14:15	wake up	breakfast	wake up
6:30	14:30	breakfast	gel-washing :-)	breakfast
6:45	14:45	water-washing :-)		gel-washing :-)
7:00	15:00			
7:15	15:15		FAMOS #	
7:30	15:30		Pupillomyograph	
7:45	15:45	GeoMars EVA	GeoMars EVA	GeoMars EVA
8:00	16:00	put suit on	put suit on	put suit on
8:15	16:15	Track&Trace 1	Track&Trace 1	
8:30	16:30			
8:45	16:45			
9:00	17:00			
9:15	17:15			
9:30	17:30			
9:45	17:45			
10:00	18:00			
10:15	18:15			
10:30	18:30			
10:45	18:45			
11:00	19:00			
11:15	19:15			
11:30	19:30			
11:45	19:45			
12:00	20:00	EVA: undress	EVA: undress	EVA: undress
12:15	20:15	EVA: massage	EVA: massage	EVA: massage

12:30	20:30			
12:45	20:45	lunch	lunch	Assist Pupillomyograph
13:00	21:00			lunch
13:15	21:15			
13:30	21:30			
13:45	21:45	Assist Pupillomyograph	Pupillomyograph	
14:00	22:00	assist CRW donning	FAMOS #	
14:15	22:15	EVA-HabCom	GeoMars Sample	CRW photo processing
14:30	22:30		Processing	
14:45	22:45			Choose pictures
15:00	23:00			for daily reports
15:15	23:15		Med Mars pure culture	Med Mars pure culture
15:30	23:30		(Helper)	
15:45	23:45			
16:00	0:00			
16:15	0:15			
16:30	0:30			
16:45	0:45		EVA Report	
17:00	1:00			
17:15	1:15			
17:30	1:30			
17:45	1:45			
18:00	2:00			
18:15	2:15			Choose pictures
18:30	2:30	assist CRW undonning		for daily reports
18:45	2:45		FAMOS #	
19:00	3:00		Pupillomyograph	
19:15	3:15	Reports #	Reports #	Reports #
19:30	3:30			
19:45	3:45	cooking	cooking	
20:00	4:00			salive sample + dinner
20:15	4:15	salive sample + dinner	salive sample + dinner	
20:30	4:30			
20:45	4:45			
21:00	5:00	wash the dishes		wash the dishes
21:15	5:15	put suit on	HabCom	put suit on
21:30	5:30		assist Crew	
21:45	5:45	LiMa EVA		LiMa EVA
22:00	6:00	Night-active lifeforms		Night-active lifeforms
22:15	6:15	on Mars?		on Mars?
22:30	6:30			
22:45	6:45			
23:00	7:00	EVA: undress		EVA: undress
23:15	7:15	EVA: massage	assist CRW undonning	EVA: massage
23:30	7:30			

Saturday, 22nd of April 2006:

All-crew: Wake-up call at 05:00, dress up and verify landing on Utah rendezvous point. Proceed to Phobos peak for meeting with Search and Rescue Team, aka OSS.

11.3 Daily reports

Mars Society mission rules required filing a series of communications written by the flight crew at the end of each work day. These daily dispatches were the basis for mission control Salzburg and mission support Denver to gain an overview on what has been achieved by the crew on that particular day. For the back-seat teams it also provided an early warning system to recognize possible future equipment failures and other problems.

At the end of the day, a specific time slot was allocated for each crew member to file these narratives and send them together with scientific data and measurements to the MCC CapCom operator console via satellite internet. At the beginning of this procedure, the commander or the XO would file an overview when to expect which reports. The reports had to include the commander's report as an overview, a detailed engineering report and the HSO report during the simulation. In addition, if there was an EVA that day, an appropriate description of these activities was included, too.

The engineering report – in a real mission – would mostly be generated in an automated way; nevertheless the flight engineer would include a series of personal observations. Most of the health data of the research station were available at the engineering workstation within the habitat. However, additional readings had to be taken at the engineering area where the main power supply was positioned as well as at the ATV storage area. Therefore it was decided to have a split engineering report partly filed by the Flight Engineer Christian Hutsteiner as well as by the Back-up Flight Engineer Johannes "Joschi" Gross. MCC would then combine both reports into a single engineering report which was the basis for the work of the engineering back seat team of the Mars Society under the lead of Paul Graham in Colorado.

The content and extent of these reports was a major issue during the entire campaign, as these would require a delicate balance between spending time by writing reports and doing exploratory activities. The entire reporting activity started on day after arrival at the Mars Desert Research Station. As the logbook entries were compiled during the sleep period of the flight crew, all dates describe the activities which have been done the day before. All writings have been screened and cleared by the Mars Society, the Mission Control Centre's Flight Control Team as well as the media unit of the AustroMars project.

A full compilation of all flight log book entries has been attached in Appendix 4. The following section is an excerpt from the log books: the salient features from the Commander’s field campaign reports which were written at the very last day of the mission, already in out of sim-mode.

End-of-Mission Summary
Norbert Frischauf Reporting

[…]

Flight Crew and the On-Site Support Team left Austria early on Friday 31 March 2006, then spent a day in Salt Lake City acquiring the remaining equipment and supplies. We arrived at the Hab on Saturday 1 April 2006 and took over the station from Crew 47's Commander, Jan Osburg, around 10:00 the following day, after we had received an excellent MDRS training by crew 47. The rest of Sunday was spent with the unpacking of stuff, fixing of the ATVs and a successful test-flying of the Aerobot.

On Monday the unpacking of specific gear continued and Wendy got fixed again (exchange of broken starter). MSL and MSP went to Salt Lake City to retrieve the AustroMars Rover, while the rest of the crew did some photo and video shooting together with the Austrian Broadcasting Corporation.

Tuesday saw the execution of a successful Search and Rescue dress rehearsal. Also the Aerobot was finally outfitted with a "Black Widow" Webcam, which was tested successfully, unfortunately we could not test fly the Aerobot because of very strong winds. Both the PsychoMars and MedMars experiment were initiated to have a base line sample.

On Wednesday, the AustroMars Rover "Sisi" was successfully started up (at least partially); the MedMars Monitoring experiment and a dress rehearsal of the EVA suit donning procedure was held.

Thursday featured a public outreach activity in the morning during a live telecon with the Austrian Secretary of State Mr. Eduard Mainoni while he was visiting the MCC Salzburg. 30 guests and several media representatives from TV and print media attended the event. Inside the MDRS, the preparation of the laboratory area continued, the EVA room was cleaned up and an airlock light installed. We finalised the sealing of the window and installed a battery terminal. Alexander, our First Officer, celebrated his 28th birthday and stated that this was for sure the most peculiar one in his life (so far). On Friday, we did the final preparation of the Hab for the start-up of the simulation. The rover preparation was successfully finished, hardware and software are running and the rover made its first movements outside. Our "part-time crew" (TV team, newspaper contest winners, artist) left early afternoon, leaving just Crew and OSS at MDRS site. OSS procedures during Simulation were finalised together with Mission Control in Denver and MCC Salzburg. There was also a public outreach activity in the morning during a second live telecon, this time with the Govenor of the Federal State of Salzburg, Ms. Gabriele Burgstaller, during the MCC-organised "Mars Party" in Salzburg, involving dozens of guests, families of the crew, VIP, etc.

We entered full simulation mode as planned on Saturday morning, immediately before sunrise. The AustroMars mission was then officially started at 0500 with EVA crew #1 (Frischauf, Groemer, Soucek) being deployed northerly of WPT 359. After a walk through the dawning of the day, the crew reached Repeater Hill just in time to see a magnificent sunrise behind the Hab. Following some minutes of calm and enjoyment, the crew inspected the outside of the hab and then entered the main airlock for a 10min re-pressurization. After the EVA was completed, EVA Crew #2 was cleared to leave the descent vehicle at landing site and approach the hab, where the crew (Spiss, Kandler, Hutsteiner) arrived shortly after 10 a.m. The rest of the day was extremely busy with establishing power and communication, storing equipment, declaring Hab ground safe, etc. Various experiments started today already, including: Myograph, fluid balancing, installing of Object tracker experiment, medical routine measurements (weight, blood pressure, body fat and body water), saliva sample, skin probe sample.

During the first official night on the Red Planet, everyone recovered from the previous day's early morning landing. Sunday chased the crew out of beds at 0600. After breakfast and power check, N. Frischauf (CDR) and Christian Hutsteiner (FE) prepared for the first regular EVA, which served as engineering EVA checking the outside of the Hab, the ATVs, the Greenhab (outside), etc., leading to ground operational declaration.

No anomalies reported. During this EVA, Frischauf and Hutsteiner also took a camera with them, and the real-time videos received were stunning. A second EVA afterwards was conducted to take Geology emergency samples, preparing for an eventual emergency return to Earth. Other activities of the day included Rover testing and work, the Pupillograph experiment, the PsychoMars questionnaires and saliva samples, and more Monday was marked by two EVAs, the first one for BioMars sample return, the second one for WLAN installation and operation testing. The BioMars EVA resulted in six samples taken and brought back under sterile conditions; all samples were procured in the AustroMars Glovebox during the afternoon. Other activities of the day included saliva sampling, reports, work on broken PLSS #3, and the first test batteries for the FAtigue Monitoring System (FAMOS) experiment. Two hobo spiders were discovered in the crew quarters.

The power issue of the first few days had finally been solved.

Tuesday's main activities during the morning included the second BioMars EVA covering a total distance of 16km and collecting 10 samples, media activities (switch-x videoconference system in superior quality), another Rover test (the crew does not give up and chases two electronic problems, one in the power distribution system, another in the Telecommand Unit) and EVA planning for tomorrow. The afternoon was intensively packed with diverse tests, including, as every day, the Pupillograph, FAMOS, Object Tracker, urine samples and others, as well as a new psychological test (CogHealth). Furthermore, primary cultures were procured from todays biological samples in the GloveBox.

Power issues have stabilised. Everything was on track.

The crew shot a Yuris Night video to greet all participants of the next day's world space parties. Wednesday started with the third LiMa (Life on Mars) EVA in three days, again collecting samples from two WPTs, and, filling the last 30min, trying to fly the Aerobot, a flying device with mounted optical MiniCam for local area reconnaissance. Due to heavy winds, however, this testing had to be postponed. Breakfast and lunch were framed like every day by various tests (FAMOS, Pupillograph, medical measurements).

In the afternoon, the second EVA crew of the day prepared for a novelty in the history of the MDRS: For the first time, sterile suits were used on top of the EVA suits to quantify contamination during an EVA, in general and locally on different areas of the suit (also, micro spherules were applied on one normal EVA suit to quantify cross-contamination). This extensive experiment required two hours for suit-donning, including two assistants in sterile TYVEK suits. Difficulties were discovered only from a technical point of view (attachment of sample bags and fragility of sterile silver-gold suits). Nevertheless this first AustroMars Track and Trace EVA added a unique new feature to the list of MDRS experiments and discoveries; the sample patches will be procured and examined in the coming days, and the crew eagerly awaited the second attempt the next day, combined with a MedMars rescue operation simulation - a challenge, that's for sure. After a new round of skin and saliva samples early evening, the crew prepared for the first relaxing evening of the mission: to celebrate Yuris night on this very special 12th April 2006, 45 years after the door to human endeavours in space was first opened.

Thursday saw a mission feedback and wrap-up session in the morning and a medical rescue operation EVA in the afternoon. The EVA was originally intended as a geological excursion to take more samples from a site where white piles indicated gypsum abundances south of Phobos Hill. After taking that sample, XO Soucek in an "intended" mission anomaly, fell down and injured his right ankle. A level 3 emergency (means: abort EVA; secure equipment and crew, return to station) was declared and telemedical support initiated by the Habcom to the Flight surgeon team at Mission Control.

Two additional crew members donned their suits in an emergency procedure which allows for a suit-up in about 20 minutes (instead of 60 minutes). The medevac team arrived about 30 minutes later on-scene, bringing a) equipment to stabilize the injured leg and b) to administer a liquid "analgesic" (lemon juice) into the drinking water system of the patient.

In an exhausting exercise, two EVA-team members carried the patient back to the hab, cycling him through the airlock and provide further medical treatment including the application of a cast.

Friday was a day of relaxation for the crew as no EVA was conducted. Activities concentrated on an extensive documentation of samples and data collected so far. Housekeeping procedures and daily tests (FAMOS, Pupillograph, Object Tracker, saliva and urine, medical basic data) were undertaken as well as the third part of the PsychoMars questionnaire battery. GreenHab work concentrated on fixing of the grey water sump pump and of the WebCams.

Saturday saw three EVAs involving five crew members. The first EVA was devoted for radiation shelter management (filling of sandbacks, medical measurements), the second EVA for GeoMars (sample collection), the third EVA for repairing and testing Repeater Hill station and testing Aerobot. Various Hab activities including the bi-weekly safety check (smoke and CO detectors, fire extinguishers, airlocks), greenhab and housekeeping were undertaken. A successful test of the Aerobot took place in the afternoon, as well as a Crew feedback session with the MCC in the evening.

Sunday three crew members attempted the first long-range GeoMars EVA to White Rock Canyon. They collected various important geological samples and applied drilling techniques. Meanwhile the remaining crew had to fight against the storm and was forced for a short moment to break simulation in order to climb to the roof and fix a part destroyed by the wind. The operation was successful, images and a report on this event had been sent by MSL M. Spiss. The day ended with a simulated radiation warning and the crew spending two hours in the airlocks, our radiation shelter.

On Monday there was a short power cut between 1810 and 1830. We had also no internet connection as of 1500, but it was restablished at 1900.

Very strong winds shook the hab, but no further damages to the hab structure occured. Crew secured outer hatch of main airlock after a strong gust had opened it (although it was firmly closed, as indicated by green airlock light). No damages, as outgoing EVA crew was in airlock at that time.

With Sol 9, the crew of AustroMars added another aspect to its intensive program: From now on until the end of the mission, we have switched to "exploration mode", based on a simulated discovery of traces of methane and water vapour at Factory Butte. Various scenarios and activities were being worked out together with MCC Salzburg, including establishment of long-range communication. Due to the high workload of the entire team, the crew's day started at 0500 sharply and included a long-range scouting EVA to Coal Mine Wash and an Engineering EVA to establish a new WLAN network. All scientific test series were continuing as usual, on top of the new scenario. The crew was extremely motivated and therefore had no problems with the prolonged daily schedules to come. Very strong winds in the entire area required careful work, especially during EVAs. The long-range scouting EVA had marked about six new waypoints which were detailed in the respective EVA report, and two new names for formations discovered on the way.

Tuesday was a calm sunny day, and the Hab did not disintegrate any more because of storm. Everything was in good status, except the nominal internet connection. From that time on until the end of the mission we were relying on WildBlue sat connection and it proved to be reliable. Nevertheless the normal connection disabled by yesterday’s storm will have to be re-established. ATV3 - suffering from a flat tire when an old tire patch failed - was running again and in perfect shape after repairs.

Generator was down most of the day, at 1800 we were still running on battery, but work was going on to fix the problem. Tuesday's main activity was a five hour emergency rescue operation EVA to train the rescue of an astronaut out of a (small) canyon under sim conditions. For this, AustroMars brought extensive equipment from Austria's Mountain Rescue Association and MSL M. Spiss, a trained mountain rescuer and expert, conducted the test.

Everything worked well and we proved, both from a medical, engineering and logistics side, that such rescue operations are feasible and, given the right equipment (in this case specially designed by Austria's Mountain rescue association, patented and worldwide in use), safe and effective. The afternoon saw another engineering EVA to Repeater Hill in order to work on the WLAN network as well as to test the Aerobot. Besides, all scientific test were successfully performed as usual.

Wednesday featured a one longe-range combined BioMars and GeoMars EVA, performed by the XO, the HSO and the FE, led to interesting areas around the waypoints 235 and 239. The EVA crew took a dozen new waypoints and samples. A sterile external suit was in use again, as well as micro spherules applied to special patches on a normal suit, to measure cross-contamination. While the three person EVA crew was on mission, Mission Control surprised the remaining analogue astronauts with a medical anomaly (CDR was seriously burned by a small explosion in the labor), which they mastered without major difficulties (even though HSO was on EVA) - thankfully the crew ha d an extensive first aid training beforehand. The day concluded with reporting and science test cycles.

On Thursday we found out that the 12 V bilge pump was not strong enough to pump the water from the greywater tank into the Greenhab - FE and MSL found an interim solution with a bucket at ground niveau, where one pumps the greywater from the tank in, afterwards the 12 V pump can take it from there. In the morning Mission Control injected a medical anomaly - at 09:30, our Health and Saftey Officer "fell off a ladder" and got a deep, strongly bleeding wound on his left lower arm, which had to be treated immediately.

As also the second medical expert of the team, our Mission Scientist for Life Sciences, was not available (GreenHab duty), two "greenhorns", CDR and XO, had to help, and XO performed a two-hour surgery stitching the wound in a sterile environment, demonstrating that such proceedings can be undertaken in the confined environment like the MDRS hab. The afternoon featured another long-range EVA (CDR, MSL, MSP), combining engineering tasks and geological sample collection, and leading to Skyline Rim on foot. From there, direct

Vox contact could be established with the Hab without Repeater Hill's help.

Friday, the last day of the AustroMars Mission saw a finale that was absolutely in alignment with this remarkable mission. Besides the usual communication issues with our primary satellite connection, which is constantly interrupted for very long periods and then starts to work surprisingly again, our Mission Control Center in Salzburg had organised the flight plan in such a way that two teams would explore Skyline Rim in alignment with Operation Edelweiss.

As on the day before, we were again able to establish direct radio communication with the MDRS from the edge of Skyline Rim. But as the quality of the signal was today only bearable and sometimes communication could not be continued at all, any crew that intends to follow our footsteps, continuing the exploration of Skyline Rim, should make sure the radio repeater at Repeater Hill is fixed and operational again.

Once we had left Skyline Rim, HSO, XO and CDR wanted to go to a specific point at the Tank Wash to obtain some geological samples. Unfortunately this EVA had to be aborted on the way to the geological site because of radio communication problems. In the evening the whole crew gathered in the MDRS again, packing stuff and preparing for the flight home to mother Earth. This last evening was of course something special and we intended to celebrate it in a way that none of us will ever forget it.

On Saturday morning the door of the MDRS was again opened and immediately thereafter we met our On-Site-Support team, Johannes Nendwich, René Vidalli and Johannes Gross, as well as Andreas Köhler, our photographer - AustroMars was successfully finished after 3 weeks of intensive preparation and execution.

Almost all of the AustroMars experiments could be finished successfully and according to plan, further analysis is still pending. For two of the remaining ones (FoodMars and TeleMars), the scientific return is less than expected because of events that were not anticipated, hampering certain aspects of these experiments. The Rover was partially successful as it proved its functionality in the Martian terrain, but could not be further tested due to a technical defect, which could not be repaired with the limited resources available at the MDRS.

Detailed research results will be compiled in a comprehensive Final Science Report, which is expected for 2007.

Media outreach was enormous. A preliminary analysis lists: more than 50 newspaper articles (including leading national and international media), 20+ TV coverages (including national main news and a one-hour documentary), dozens of radio and internet interviews, a plethora of complementary measures, like exhibitions, guided tours, class rooms presentations, K-12 outreach and the organisation of large local and national events.

In summary, Crew 48 "AustroMars" accomplished nearly all of its ambitious research and engineering goals and had a great time together.

We are extremely grateful for the support of the Austrian federal ministry of Transport, Innovation and Technology, as well as other major entities, enabling us to acquire our research equipment and cover shipping and transportation cost.

We also very much appreciate the support from our On-Site-Support Team as well as that of the Mission Control Center in Salzburg. And then nothing of that all would have been possible without the support we have received from the Mars Society and its dedicated team of mission support volunteers.

Ad Martem!
AustroMars Crew signing off

Chapter 12

Lessons Learned, Implications

These lessons learned are an honest reflection on what areas offer room for improvement. Although some of these feedbacks may seem fairly obvious, it should be pointed out that in such a large project many factors such as politics, finances etc. play such an important role, that other issues, e.g. from the technical side, tend to be underrepresented.

This lessons-learned section is the official part of a multifold effort to acquire the feedback from all people involved in the project.

Crew training, Mission set-up & Pre-flight activities

- The webcams were extremely useful, also for the crew, because it meant giving a face to the people on the other end of the line. It was also an excellent tool to keep the public informed. It was never a problem for the flight crew or the MCC staff.
- During the Prep-Week, the OSS activities were not well planned and there was a huge amount of time assigned to making adjustments to the power situation at the MDRS.

- Each flight crew member was assigned to various experiments, so that a personal connection to the experimenters was ensured. This was considered to be an excellent move, because the time slots allocated for the experimental trainings were rather short given the complexity of some tasks. This turned out to be extremely useful, when anomalies would appear during the simulation itself and short-term decisions had to be taken.
- For most of the training activities, other team members were entitled to participate on a case-to-case basis to a) create a system of incentives and b) enhance the social bounds between the flight crew members and the rest of the team.
- Ideally, there should have been a dedicated training weekend which is exclusively focusing on communication between the MCC and the flight crew and the OSS.

Mission Control

- The communication strategy needs to be trained more exhaustively between the flight crew and the MCC. E.g. for Skype communication, there should be a “master” window for technical communication and a “private channel”
- In the MCC, an operator console for OSS would have been great. OSS had the feeling that, at certain points, they were a forgotten element.
- Engineering: was rather a dull job at MCC, although (given a better communication) there would have been exhaustive work to be done → the workload was very random
- CapCom and outreach activities need to be separated strictly
- The staff of the MCC did not know each other well enough, before coming together for the mission operations. A specific set of training units for the MCC crew would have been an advantage
- Instead of using audio-communication during the prep-week, written communication would have been better, as this allows a more flexible approach and, at the same time, has the advantage of being available and searchable for incoming shifts.
- The CapCom duty involved the task of communicating with various people at the same time (sometimes, there were a dozen skype-communications going on at the same time), which was too much.
- Shift change often meant loss of information; hence, for each and every staff position in the MCC, there should be a checklist of how to transfer the duty.
- The preparatory week was nearly consumed by setting up the MarsMonth outreach activities in Salzburg, Austria; this project was understaffed and had to deal with an immense workload.

- Although there were job descriptions available for all MCC staff members, they did not include a step-by-step procedure what to do when which led to some frustration and it took several days, until everyone knew, what was expected of him/her.

On-Site Support

- Although the photographer was de-facto a member of the OSS team, he was not conceived as one, e.g. for the psychological tests, preparatory activites, etc. Including him in the flight plan would have created another person who can be assigned tasks.
- During the pre-week, the OSS should have had more time to explore the environment and potential EVA target sites.
- Information: Sometimes, the flight planes got relayed very late to the OSS and sometimes, there were tasks scheduled, which could not be fulfilled in time, due to the late transmission. It was therefore also difficult to keep all OSS members at the same level of knowledge.
- The tent used for the OSS-operations was not a proper base installment. It would have been better/easier, if there would have been a dedicated OSS operations room e.g. in Hanksville or a second, larger tent just for the work.
- At the end of the prep-week, a list of operating procedures was completed for the OSS and OK'ed by the XO: however, these sets were never acknowledged by MCC, e.g. no printing of information leaflets for tourists.

Outreach

- During mission critical phases, the media have to be kept out strictly from MCC operations
- On-site, the media teams must not interfere with the crew at the station. Especially the last few days, even as proper media time was scheduled, in reality, the time demand for the press was much higher. This has to be taken into account.
- The outreach communication plan (OCP) was not functioning properly and there was a great deal of improvisation which kept the outreach machinery going. Especially when it comes to preparation and marketing, the advance-warning times need to be in the order of sometimes a few weeks.
- The MediaCom operator console was mainly considered as a passive function for incoming press requests. However, this could be turned into a much more proactive post if a dedicated team would be behind that particular staff-member.

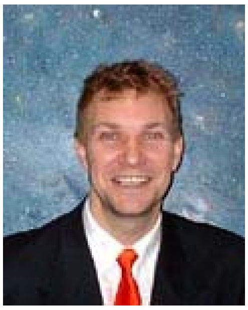
Management

- AustroMars was a prototype for space projects which are beyond an amateur level. It was generally conceived that the level of professionalism, the project itself, including the media activities, was superb.
- It was generally conceived as a big plus that some people from the project management team were always available, anytime 24/7 and that there was virtually no barrier to contact them directly.
- To keep a detailed information flow, the project management issued a monthly mail which gave a short overview on what everyone was doing. This tool was easy to create & use and was generally perceived as an excellent information pathway. At the same time, it created an archive on what was going on in AustroMars.
- Although there was an executive management group under the lead of Willibald Stumptner, it was generally conceived that the presence of all three project managers in Utah was not very good, although all major management decisions had been made already at that time of the simulation.
- Especially w.r.t. the OCP and MCC duties which were not part of the daily routine, it was conceived that giving out orders would be better than asking for volunteers to take additional workload.
- The coordination with the Mars Society had potential for improvement. It took more than a week into the hot phase, until the arrangement was made, that only the MCC Austria would serve as flight control entity and that the MS Mission Support Group was not the primary contact except for certain technical matters. It was felt that the AustroMars Definition Document was not properly studied by the MDRS team in advance and that there were social issues as well. However, it should be pointed out, that there was an excellent and open-minded communication on a management level, but that did not turn out to be the case for the every-day operations between Mission Control and Mission Support.
- Project managers should not be involved in individual projects/experiments too much, because that takes away their perspective.
- Most volunteers considered it a privilege to be part of the mission. The amount of things learned and personal experiences gained for their everyday lives were immense, refreshing and extremely motivating.
- There was a plethora of information with an advanced knowledge base system which was also reflected in a software tool which was generated for AustroMars. However, it turned out that for volunteers who did not use that particular system on a daily basis it was too complicated and too powerful for an average user.

- There should be a definitive separation between content-related topics (e.g. science work). The philosophy of AustroMars was not properly reflected in the management structure. There was a heavy focus on the crew selection & training, more effort should have been put into logistics issues to avoid last-minute heroism.
- When it comes to financing of the individual sub-projects (e.g. especially for the science/ tech experiments), a dedicated service unit should be installed to help with finding funding opportunities the proposal writing, preferably well in advance.

13 Appendix 1:
The team of AustroMars

13.1 Project Management



Dipl.-Ing. Norbert FRISCHAUF
Born in 1968 in Vienna
Aerospace Engineer, Booz Allen Hamilton

Education

2005	Mini-MBA at the University of St. Gallen
1997	International Space University (ISU), Houston/Texas. (Project: "International Strategies for the Exploration of Mars")
1994-1996	Astronomy at the University of Vienna (basic study)
1990-1998	Technical Physics at the Vienna University of Technology

- ESA/ASA Summer School in Alpbach 1994, 1995 and 1996
- System engineering courses at the University of Southampton (1998) and at the Technical University Delft (1999)

Space Related Experience

2004-2005	Investigator for the first Austrian experiment on ISS, foreseen to be launched in 2006 („Urey-Miller“)
since 2004	Experiments at the Technical University Graz with a new space propulsion system
since 2001	System engineer for future studies and technologies at Booz Allen Hamilton; Norbert mainly works in aerospace engineering in projects for the European Space Agency ESA.
1998-2001	Expert for Avionics for ESA and Booz Allen Hamilton; Development of communications- and encryption systems for the Automated Transfer Vehicle (ATV)
1995-2003	Energy- and system engineer for the European lunar mission *LunarSat* (the project was cancelled in 2003)
1994-1998	Co-project manager for two experiments at the European Research Center for Particle Physics (CERN) in Genva, Switzerland
1995-1998	**Work on a satellite communications project at IT-Austria**
1990-1994	Development engineer for satellite avionics at Austrian Aerospace

Mag. Gernot E. GRÖMER
Born in 1975 in Linz
Astrophysicist, Univ. Innsbruck

Education

1997	International Space University at the NASA Johnson Space Center, Houston/Texas.
1993-2004	Astronomy und Physics at the University of Innsbruck
1985-1993	High School in Linz

- ESA/ASA Summer School in Alpbach 1995 (Mercury-Orbiter), Tutor at the Summer School 2003: „Working and Living in Space“
- Training at the Red Cross as a EMT-Basic („Rettungssanitäter“) 1993, EMT-Paramedic (“Notfallsanitäter”) 1995, special training in the area of adult education and professional communications

Space Related Experience (Excerpt)

2004	Project manager of a research project in space medicine in the framework of the ESA 37th Parabolic Flight Campaign in Bordeaux/France. Microgravity time: 30 min
1998-2003	Public outreach and education coordinator für the European lunar mission *LunarSat* (the project was cancelled in 2003)

2003	Crewmember of the Mars Desert Research Station as crew astronomer and health and safety officer (simulation of the first human mission to Mars in Utah)
since 2001	Founding member of the "FUSE"-network in the framework of ESA's exploration programme Aurora
2000-2001	Project manager of the "Voll der Mond" programme (a space related roadshow for LunarSat in Upper Austria).
1998	Assistant professor at the Department for Space Physical Sciences at the International Space University, NASA Lewis Research Center, Cleveland/Ohio.
1993-2005	Several space- and astronomy-related research sojourns in Italy, South Korea, Chile and the US

Mag. Alexander SOUCEK, MSS
Born in 1978 in Salzburg
Mission Management and Strategy Office
Directorate of Earth Observation Programmes, ESA

Studied law at the University of Salzburg and space sciences in Strassbourg/France. Research activities in space law and space policy at the Space Policy Institute, G. Washington University, Washington D.C., NASA Goddard Space Flight Center, Maryland, UN Office for Outer Space Affairs (Vienna), the German Space Operations Center; member of the European Centre for Space Law (ECSL). Working as Programme Coordinator for the European Space Agency in Frascati (Italy).

Education

2003-2004	Legal practice at the district court Linz and state court of Salzburg
2002-2003	Master of Space Studies studies at the International Space University, Strassbourg, France. Graduation with "cum laude"
1997-2002	Law studies at the Paris-Lodron-University Salzburg

Space Related Experience (Excerpt):

2004-2005	Project management of various aerospace events (such as "Sinkflug 01/05" (Huygens landing on Titan); delegation member of the UNCOPUOS Legal Subcommittee; 37th ESA Parabolic Flight Campaign
2003	Space Policy Institute, Elliot School of International Affairs, George Washington University, Washington D.C.; partially at NASA Goddard Space Flight Center, Greenbelt; Work for the Columbia Accident Investigation Board (CAIB).

2002	Scientific staff for the Institute for International Law, Univ. of Salzburg; editor of the Space Law Newsletter Austria.
2001	Management of Austrias largest space related student contest „*spacecity salzburg*“ (3500 participants)
2000	Studnicki Płeszka Çwiakalski Górski law firm in Krakau, Poland
1999	United Nations (Internship): UN Office for Outer Space Affairs, Vienna, staff for the UNISPACE III conference
1998	German Space Operations Centre (GSOC) Oberpfaffenhofen, Germany

Executive Team (“Stabsgruppe”)

Willibald Stumptner, Flight Director

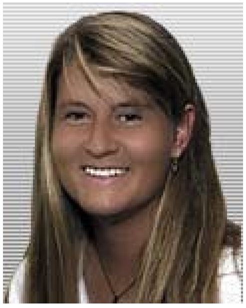
Born 1967 in Graz; high school Lichtenfels in Graz; student of technical physics at the technical university in Graz, and meteorology and geophysics at the Karl-Franzens-University Graz; Space Camp 1991; International Space University (1995); stay abroad ath the European Synchrotron Radiation Facility, Grenoble; 6 years at the Space Research Institute of the Austrian Academy of Sciences in Graz (atmospheres of planets, especially Mars and Titan) ; At present working as project manager at Energy Styria (Steweag).

- **Mag. Katja Bedenik** (Logistics)
- **Mag. Daniela Scheer** (Media)
- **Florian Selch** (Science)
- **Raphaela Hechl** (Outreach)

13.2.Science

Unit leader: Mag. Gernot Groemer.

AM 11 BioMars



Team leader: Dr. Birgit Sattler

Born 1969 in Schwaz/Austria, studied Biology with a focus on micro biology and limnology at the University of Innsbruck until 1993; Ph.D. on "Microorganisms in High Mountain Lakes", 1997. Since 1992 assistant and radiation protection apointee at the University of Innsbruck. Specialised on extremophile life in ice and snow in alpine and polar regions. Three Antarctic expeditions and two into the high arctic.

BioMars Team:

- Univ.-Prof. Dr. Roland Psenner, Univ. Innsbruck
- Florian Selch, BSc, Univ. Wien
- Dr. Susanne Klammer, Univ. Innsbruck

AM 12 TeleMars

Team leader: Dr. Rudolf Albrecht, ESO Garching

Astrophysicist at the European Southern Observatory in Garching/Germany

TeleMars Team:

- Mag. Katharina Bischof, Univ. Wien
- Paul Beck, Univ. Wien
- MMag. Michaela Lechner, Univ. Innsbruck

AM 13 PhysioMars

Team leader: Sandra Lengauer

PhysioMars Team

- PT Elisabeth Zebenholzer, MAS

AM 14 GeoMars

Team leader: Iris Lenauer

Born 1985, Sir-Karl-Popper.School in Vienna, studies of geology at the University of Vienna with a focus on geochemistry.

GeoMars Team

- Univ. Doz. Dr. Christian Köberl, Univ. Wien
- Veronica Zabala, Arizona State University

AM 15 MedMars

Team leader: Dr. Rosmarie Oberhammer

Anesthesiologist at the University Hospital Innsbruck and General Hospital Bruneck/Italy

MedMars Team

- Dominik Stumpf, Med. Univ. Wien
- Dr. Max Jordis, LKH Mürzzuschlag
- Dr. Renate Mauschitz, Med. Univ. Graz
- OA Dr. Nikolaus Steinhoff, LKH Hochegg
- Dr. Klaus Legner, Wien
- Dr. Kurt Kretzschmar, OHB Teledata Bremen
- Andreas Schinner, Innsbruck (Medical engineer)
- Dr. Berthold Moser, Univ. Hospital Innsbruck
- Dr. Dietmar Fuchs, Med. Univ. Innsbruck
- Markus Laner (EVA suit electronics upgrade)

AM 16 PsychoMars

Team leader: Dr. Florian Juen

Born 1974, Ph.D. in Psychology at the University of Innsbrucj, clinical psychologist, teacher at the Institute for Psychology; research focus in emotion – cognition – interaction.

PsychoMars Team

- Ao. Univ. Prof. Dr. Harald Bliem, Univ. Innsbruck
- Ao. Univ. Prof. Dr. Barbara Juen, Univ. Innsbruck
- Univ. Doz. Dipl. Psych. Dr. Cord Benecke, Univ. Innsbruck
- Mag. Dr. Doris Peham, Univ. Innsbruck
- Mag. Dr Florian Juen, Univ. Innsbruck
- Dr. Ludwig Wolfgang Pilsz, Univ. Innsbruck
- Mag. Dietmar Kratzer, Univ. Innsbruck
- Mag. Dr. Thomas Beck, Med. Univ. Innsbruck
- Mag. Manuela Werth, Med. Univ. Innsbruck
- Mag. Manuela Sax, Med. Univ. Innsbruck
- Dr. Sheryl Bishop, Univ. of Galveston/Texas
- Dr. Gerhard Schuhfried, Univ. Innsbruck

AM 17 LBNP

Team leader: Univ.-Prof. Dr. med. Helmut G. Hinghofer-Szalkay

Since 1970 research and teaching at the Medical University Graz, Habilitation 1981. 1984-1985 Research Fellow, Ames Research Center (Moffett Field, California). Founder & director of the Institute for Adaptive and Spaceflight Medicine. Since 1995 Univ.professor at the Institute for Physiology, Medical University Graz/Austria.

LBNP Team

- Dr. Max Jordis, KH Mürzzuschlag
- Dr. Andreas Rössler, Med. Univ. Graz
- Univ.-Ass. Erik Grasser, Med. Univ. Graz

Total unit members: 42

13.3. Technology

Unit leader: DI Norbert Frischauf

AM 21 Habitability

Team leader: Univ.-Ass. DI Barbara Imhof, TU
Born 1969, studied architecture at the Technical University of Vienna, Master of Space Studies at the Internationalen Space University in Strassburg, France. Since 1998 University assistent at the Institute for Construction at the University of Vienna. 1997-2003 ESCAPE*spHERE in Vienna. 2003 Co-founder of LIQUIFER. Researcher for the BIOPLEX –Experiment, NASA Johnson Space Center, Houston, TX-USA and other habitability studies, e.g. for ESA.

Habitability Team

- DI Sandra Häuplik, Techn. Univ. Wien

AM 22 Crew Management

Team teader: Willibald Stumptner
Born 1967 in Graz; studied technical physics at the TU Graz and Geophysics at the University of Graz, Space Camp 1991; International Space University 1995; Research at the European Synchrotron Radiation Facility, Grenoble; 6 years at the Institute for Space Research at the Austrian Academy of Sciences (Planetary atmospheres and astrobiology); Currently project manager at the Energie Steiermark AG.

Crew Management team

- Mag. Raphaela Hechl
- Mag. Katja Bedenik

AM 23 MDRS Rover „Sisi“ and Aerobot

Team leader: Manfred Hettmer
President of the Austrian Mars Society; co-researcher and coordinator for various space related projects, devellopment of a plasma-engine for spaceflight. Co-founder of the company Quasar.

MDRS Rover-Team

- DI Norbert Frischauf
- Christopher Vasko, Techn. Univ. Vienna
- Robert Klotzner, Austrian Armed Forces
- DI Uwe Kraus, TGM Vienna
- Florian Kuttner, Austrian Armed Forces
- Janos Kanzcar, Vienna
- DI Hans Czylok
- DI Alfred Fuchs
- Janos Kancsar
- Dominik Pfeifer

Aerobot Team

- DI Norbert Frischauf
- Clemens Koza
- Christian Hutsteiner, Austrian Armed Forces, Air Force
- Gerhard Groemer

AM 25 Object Tracker and AM 26 Fatigue Monitoring System

Team leader: DI Luzian Wolf

Studies of electronics at the TU Vienna, Fulbright Scholarschip, Master of Science in Biomedical Engineering at the Drexel University, Philadelphia, Pennsylvania, USA. Project manager for various technology an devellopement projects in the area of biology/physiology at the European Space Technology Centre in Noordwijk/The Netherlands. Consultant and projcet manager for the FAMOS (Sowoon Technologies Sarl, Lausanne, CH), and Object-Tracker OT Systems.

OT / Famos Team

- Univ.-Prof. Dr. Christian Cajochen, Univ. of Basel
- Dr. Ninoslav Marina, Sowoon Technologies

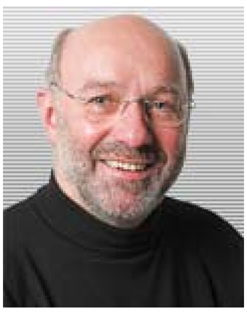
Support Team Utah

- Paul Graham, Alpine Aerospace (MDRS Chief Engineer)
- Don Foutz, Whispering Sands Motel Hanksville
- William Fung-Schwaz, Univ. of Salt Lake City

Total unit members: 27

13.4. Humanities

AM 31 Documentation & Media



Team leader: Gerhard Grömer

Born 1951, since 1971 police officer, since 1974 working for the Federal Criminal Police Office, since 2005 investigator in the area of economic fraud, legal studies at the University of Linz.

Documentation & Media Team

Andreas Köhler, photographer

- Harald Fauland
- Mag. Daniela Scheer, media activities
- Maria Pflug-Hofmayr, Wien
- DI Thomas Warwaris
- DI Christoph Waclawiczek
- Tobias Micke, Kronenzeitung
- Dr. Guenther Loeffelmann, Austrian Broadcasting Cooperation, ORF
- Alexander Tomsits, motion picture camera, ORF

AM 32 Social Sciences, Law & Philosophy, Art

- Mag. Mara Stepjanovic, legal affairs
- Dr. Manfred Aschaber
- Michael “Mike” Koeberl, AustroMars memorabilia
- Mag. Wolfgang Mildner
- Mag. Renate Schuler

AM 33 Public Outreach & Education, Event Organisation

- Mag. Katja Bedenik, event management
- Harald Fauland, event management and media
- Christian Gatterer
- Mag. Hubert Lehenbauer
- Mag. Kurt Reindl

Total Unit Members

LSU: 23

Humanities: 20

13.5. Logistics and Support

AM 41 Administration, Archive, Science Archive

Administrations-Team:

- Bettina Frischauf (Finances)
- Dipl.-Phys. Kerstin Zimmermann (Science Archive)
- Dipl.-Ing. Patrick Wikus (Definition Document)

- Mag. Walter Schuster (Quality Management)
- Olivia Hauser (Transportation)
- Rene Kolb (Transportation)
- Mag. Julia Wertaschnig
- Dr. Walter Kopp, Unifund (Fund-raising)

AM 42 IT Services, Databases, CI

Team leader: Olivia Haider

Born 1975, pedagogic academy in Stams/Austria, language assistant in France. Applied informatics at the Management CenterInnsbruck, team leader for the IT services for the Education & Outreach division of the European Moon orbiter LunarSat-team. Webdeveloper in a major Austrian internet company.

IT Services Team

- Markus Keller, Univ. of Innsbruck
- Oliver Hauser, Univ. of Innsbruck
- Nikolei Haider
- Wolfgang Jais, Univ. of Innsbruck
- Ing. Hannes Mayer, Salzburg
- Markus Keller
- MMag. Michaela Lechner, Univ. of Innsbruck
- Dr. Patrick Wikus, European Center for Nuclear Research, CH

AM 43 Personnel, Crew & Volunteers

Team leader: Markus Haider

Personnel Team

- Christian Haider
- Hermann Brunner
- Walter Schuster
- David Gschließer
- Michaela Lechner

13.6. Mission Control

Lead Flight Director

- Willibald Stumptner

Flight Directors

- Mag. Dieter Maier
- Simon Feigl
- Florian Selch
- Michael Taraba

MCC Development

- DI Martin Canales, European Space Operations Center
- Boris Wilthan

CapComs

- DI Raphaela Hechl
- Mag. Christian Makolm
- DGKP Christoph Posselt
- DI Ernst Stelzmann

Flight Operators Science & Engineering

- DI Georg Kaiser
- Iris Lenauer
- Mario Lassnig

IT Services

- Mag. Wolfgang Jais
- Ing. Hannes Mayer
- Mag. Harald Fuchs
- DI Thomas Jelinek

General Support

- Sebastian Sams
- DI Susanne Buettner

- DI Gerald Derflinger
- Mag. Mélanie Albiger, Postal Services France
- Elisabeth Sams, catering
- students from the C.Doppler Gramar School (approx.10)

Total Unit members: 23

Total team statistics	Team size
Science-Unit:	42
Engineering-Unit	27
Humanity-Unit	20
Logistics & Support-Unit	23
MCC-Unit:	33
Total	**145**

13.7. Crew

Flight Crew

Commander (CDR)

Norbert Frischauf, born 1968, holds a master of engineering degree from the Technical University Vienna; International Space University summer school (Houston/Texas). Member of the Space Generation Advisory Council (Board of Mentors). Research activities at the European Centre for Nuclear Research (Geneva/Switzerland), project manager of various ÖWF-events (e.g. the Science Fiction Week). System engineer of the European LunarSat mission and future studies and -technologies at the European Space Technology Centre of the European Space Agency in Noordwijk, the Netherlands. At present act as high-technology consultant for Booz Allen Hamilton in Europe.

First Officer (XO)

Alexander Soucek, born 1978, studied law at the Paris Lodron University, Salzburg, and obtained a master of space studies degree at the International Space University in Strassbourg, France. Research activities in the field of space law and space policy at the Space Policy Institute, George Washington University, Washington D.C., NASA Goddard Space Flight Center, Maryland, the Office for Outer Space Affairs of the United Nations (Vienna), the German Space Operations Center (Darmstadt, Germany); member of the European Centre for Space Law (ECSL), project manager of Austria's largest space contest "spacecity salzburg". Flight Crew 37th ESA Parabolic Flight Campaign. At present working for the European Space Agency in Frascati near Rome (Italy).

Health and Safety Officer (HSO)

Gernot Groemer, born 1975, masters degree in astronomy (Leopold-Franzens University, Innsbruck), International Space University summer school (Houston/Texas), teaching assistent at the ISU summer school (Cleveland/Ohio). Member of the Space Generation Advisory Council (Board of Mentors). Various research sojourns in Italy, USA and Chile. Outreach coordinator of the european lunar mission LunarSat, simulation of a crewed expedition on Mars in Utah. Flight Crew 37th ESA Parabolic Flight Campaign.

Flight Engineer (FE)

Christian Hutsteiner, born 1972 in Innsbruck, grown up in the tyrolean mountains, professional school for aviation in Langenlebarn, secondary school for mechanical engineering and aviation in Eisenstadt, draftee time in Graz at the military airport at the Saab S-35 Dragon homebase and 1994 education to get a helicopterpilot, until now working as a pilot on Utility helicopter S-70 Black Hawk and AB 212 Huey in Langenlebarn, repeated emergency trainings on Simulators in West Palm Beach/Florida and Stockholm, training for physiological behaviour in the aviation in Königsbrück/Deutschland, survivaltraining with special forces, several missions abroad in Albania and Kosovo.

Mission Specialist Planetary Sciences (MSP)

Christoph Kandler, born in 1974, studies of geodesy at the University of Innsbruck and the University of Technology in Graz, completed his degree in civil engineering (Dipl.-Ing.) in 1997 with emphasis on geo-information, employed at technical consultant DI Weiser for three years, since 2000 freelance technical consultant for surveying as director of Weiser-Kandler Civil Engineering OEG in Schwaz/Tyrol, main focus on gps-measurements, technical surveying and terrestrial laserscanning, realisation of several new projects especially in the area of gps-aided monitoring of landslides and technical surveying. Married with Heidrun since 2000, their favorite hobby at the time: their son Paul (15 months).

Mission Specialist Life Sciences

Markus Spiss, born 1977, study of Biomedical Science at the University Hospital Innsbruck. Diploma thesis at the Tyrolean Cancer Research Institute in Innsbruck, collaboration at international research projects at the biochemical department of the University Zurich and at the oncology department of the Medical University in Zürich. Since 2 years Application Scientist at a renowned medical robotic company in Switzerland. Paramedic at the Austrian mountain Rescue Foundation and member of the Society of Alpine and Altitude Medicine.

Back-up Flight Crew
(Served as On-Site-Support during the Simulation)

Back-up Life Sciences (BU-L)

Johannes Nendwich, born 1969 in Waldviertel/Austria, Highschool in Krems, study of technical physics (in parts also technical mathematics) at the Technical University Vienna. Study of astronomy at the University Vienna. Placement/Contract for services/scholarship at the research center Seibersdorf. 1995/1996 serving at the Austrian Army. Research Promotion Projects at the Institute of Astronomy at the University of Vienna, software projects (document -identification, -registration and -processing), Enviromental NGO Engagement and cave explorer.

Back-up Planetary Sciences (BU-P)

Rene Vidalli, born in 1966, 1976-1983: HIB Liebenau (public school emphasising physical education), 1983-1984: visiting highschool in the USA, 1984-1986: BORG Graz (high school),

graduating with Matura (general qualification for university entrance), 1986-1987: volunteering in the Austrian Army for one year, 1996-2002: studies of sport sciences, master's degree (Mag.), since 1990: croupier at Casinos Austria. Marathons in Graz, Vienna and London, several triathlons (among them two ironman triathlons in Klagenfurt in 2004 and 2005).

Back-up Flight Engineer (BU-FE)

Johannes Gross, born 1979 in Vienna, International Study Program Petroleum Engineering at Mining University of Leoben and at Colorado School of Mines in Golden, Colorado. Technical training at appropriate energy companies in Austria, Germany and Albania. Board member of the Society of Petroleum Engineers (SPE) Student Chapter Leoben (2001 - 2003). Partizipatipion at various European Student Council Meetings. Project Assistant for emissionprognosis and airquality at TU Vienna (2004 - 2005). From 2006 training to fieldengineer for Schlumberger Oilfield Services.

14 Appendix 2: Literature

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15 Appendix 3: Flight Log Books

April 2^{nd} 2006

C o m m a n d e r ' s   C h e c k - I n
N o r b e r t   F r i s c h a u f   R e p o r t i n g

Crew Status: Everyone is a bit tired after the long trip (Austria -> Munich -> Atlanta -> Salt Lake City -> Hanksville), but enthusiastic that AustroMars is finally really starting. Everyone is OK and starting to feel "at home in the MDRS" (after the great introduction by crew 47), mood is excellent, the first real anomaly has stricken (Wendy is down)

Major Anomalies: Wendy (the Diesel Generator) is down. A repair can only be undertaken on Tuesday when the new starter has supposedly arrived

Major Achievements: ATVs were fixed, all three run smoothly now, familiarization with the ATVs went well. First test flight of AustroMars aerobot commenced successfully

Brief Narrative of Today's Activities: Shopping and packing, that describes best today's activities. After everyone has arrived yesterday late night in the Comfort Airport Inn hotel (after approx. 25 hours of travel), the MDRS 48 crew and support, met at breakfast. After enjoying a typical American hotel-style breakfast we organized for our transportation. At the end the AustroMars team had secured one minivan from the Mars Society and one additional personal car and three minivans, rented at the Salt Lake City airport.

Activities for Tomorrow: Hab and ATV familiarization. Additional AustroMars Aerobot test flights; MedMars Telemetry construction; TV shots.

Commander's Journal
Norbert Frischauf Reporting

After the bags and suitcases were loaded, two minivans were sent to pick up the AustroMars equipment/experiments from William Fung-Schwarz. Everything was retrieved but the AustroMars-Rover, which is supposedly still on its way from Los Angeles to Salt Lake City. Having loaded in the AustroMars equipment/experiments, we picked up Helene Keller (the AustroMars artist) from the airport, bought the required food supplies and some additional clothing and moved on to Hanksville.

From here the AustroMars split into two; while the Backup crew and the visitors stayed in Hanksville, the crew moved on to the MDRS to meet crew 47.

After a hearty welcome ("Welcome Crew 48" in red-white-red, the Austrian colors), Commander Jan Osburg and his crew gave us an excellent 1-hour briefing of the critical MDRS systems and the upgrades that they had done. Finally we went to bed to enjoy our first night in the MDRS, three of us slept in the loft, the other three ones in the second floor.

A busy station: providing appropriate meals for up to 15 people at once can be a challenge on a command deck which is designed for 6 people.

As soon as the new day started dawning the AustroMars crew left the habitat and climbed up repeater hill to watch the sunrise - a magnificent experience. Afterwards we had a final chat with crew 47 and bid them a nice farewell. The rest of the morning was used for unpacking our stuff and getting more familiar with the MDRS. Our visitors and the reports enjoyed a tour through the MDRS surroundings and the habitat.

In becoming familiar with the ATVs, the little hick-ups of the vehicles got fixed. ATV No. 3 ("the barking one") was examined to have a loose throttle line, once this was repaired and the spark plugs were cleaned this vehicle started to run smoothly again.

The major anomaly of today was the breakdown of Wendy. We had shut it down to identify the reason for the diesel leakage, which happened to be at the fuel pump. When we tried to start it up again, Wendy did not come up for unclear reasons. Don Foutz came over at 16:00, but could not fix Wendy either, neither changing the oil nor the air intake filter, nor re-charging the batteries helped to mitigate the problem.

At the end the starter was identified as a root cause for the starting problem. A spare starter will be available earliest on Tuesday, until then we will re-charge the Hab's batteries with our two cars and an associated set of starter cables.

One of the highlights of today was the successful test of the AustroMars Aerobot, a powered paraglider, which will be used for airborne reconnaissance for the AustroMars rover and particular EVAs. Despite gusty winds we managed to start and land the aerobot successfully. Our confidence is such that tomorrow we will conduct the next tests with the areobot, this time using the gloves of the space suit while being in control.

E n g i n e e r i n g   R e p o r t
C h r i s t i a n   H u t s t e i n e r   &   J o s c h i   G r o s s   R e p o r t i n g

Generator/Electricity:

Casper: not used

Wendy Hobbs Meter: 3248.8 hrs
Voltage: 0 VAC
Frequency: 0 Hz
Oil Level: full
Oil Pressure: 0 PSI
Water Drained: no

Notes/Comments: Seems that Wendy doesn't like male crew engineers!! We started Wendy in the morning without troubles, she runs until noon. She lost about one quart of diesel and we shut her down to clean the area around the fuel pump. Then we tried to start her without success. Then we contacted Don via messenger and he came out at app. 3:30. He tried also to start her - also without success. Then he changed oil- and air filter (the air filter was fully blocked)! After recharging Wendy's batteries with 2 cars Don made several attempts to start her. Then the starter gave up! Don said the new starter will come on Tuesday and until that we will use Coleman which is running without problems or charge the batteries of the Hab with 2 cars!!!

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
21:46 - 26.9 - 13 - 15 - on - float
01:05 - 26.9 - 14 - 14 - on - float
01:20 - 24.5 - 05 - 14 - off
07:09 - 23.8 - 05 - 11 - off
07:51 - 26.5 - 07 - 11 - on - bulk
11:32 - 26.6 - 11 - 12 - on - float
12:43 - 24.1 - 09 - 14 - off
18:12 - 23.9 - 05 - 15 - off
21:06 - 25.2 - 08 - 14 - on - bulk

Fuel Status (as of 18:00):

Diesel: Approximate Reading - 1/2

Propane Tank: Approximate Reading - 52% (520 gallons = 1968.4 L)

Gasoline:
Consumed Today: 6 gallons = 22.7 L
Quantity Remaining: 11 gallons = 41.6 L

Oil:
GenSet Quantity: 0 quarts
ATV Quantity: 11 quarts
V'ger Quantity: 10 quarts

Water Status:

Outside Potable Water Tank Level: 310 gallons = 1173.5 L
Trailer Potable Water Tank Level: 23 cm from the base
Water Meter Reading: 9012.5 gallons = 34115.9 L
Water Consumed: 65.9 gallons = 249.5 L
Grey Water Used: 19.3 gallons = 73.1 L
Flushes: 4
Showers: 0
Sponge Baths: 0

Tonight's Meter Readings:

Out to Toilet: 1987.9 (+19.3 since yesterday)
In to GreenHab: 13781.3 (+323 since yesterday)

GreenHab:

Crops Watered: yes
Crop Condition: Everything's in a good condition.

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 2 gallons = 7.6 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 3: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

CDR Frischauf and FE Hutsteiner test the aerobot drone which will provide areal reconaissance capabilities during the simulation.

Notes/Comments: We fixed small problems (e.g. setting ground idle of ATV3)and made short runs for checking and training with all 3. The rubber handles of ATV 1 are damaged and need to be replaced.

HVAC: Nothing new to report.

Mars Surface Suits: Out of sim
Computers/Networking Infrastructure: Nothing new.
Appliances: Nothing new.

Data Logger: Nothing new.
Upgrade Work: Nothing new.
Notes/Comments: We are Hutti and Joschi and this is our first (offline the third) report and we're looking forward to have a lot of fun with all that technical gadgets!!!

Commander's Check-In
Norbert Frischauf Reporting

Crew Status: Everyone is OK but tired as today was a very intense day with media representatives to make use of the excellent weather. Major concern of the moment is the weather forecast, which could possibly ruin some of our foreseen experiments for the next few days.

Major Anomalies: None (besides continuous Internet outages)

Brief Narrative of Today's Results: Our third day at the MDRS was mostly devoted to public outreach activities. Four more days until the real AustroMars mission will start. Media representatives came along with us on a dress rehearsal EVA and did some interviews. Wendy got fixed again (by Don and our Backup Flight Engineer) and the internet connection seems to be working better today. We also fixed the Webcam MDRS Hab Cam East, so it doesn't provide overexposed pictures. The artistic AustroMars experiment called "Fields of Mars" was started successfully.

EVA: EVA01 took place in the vicinity of the hab and then to the waypoint WPT 324 of Crew 47 (with the ATVs).

Plans for Tomorrow: Continue with the outreach activities for the Austrian Broadcasting Cooperation (ORF), further construction and tests of the AustroMars aerobot as well as the Rover. Additionally, we will work on the MedMars Telemetry construction, TV shots if the weather permits, Fix Wendy's broken battery clamp.

Report Transmission Schedule:

- Today's engineering report will be submittted around 20:00 via the web interface.
- The other reports (CDR, EVA) will be transmitted also around 20.00.

Miscellaneous: We had three visitors passing by, who just saw some of us in the space suits and became interested. We toured them through the surrondings and led them to our astronauts. In return the Austrian Broadcasting Cooperation (ORF) interviewed them to also get an outsider view.

Support Requested: None

Commander's Journal
Norbert Frischauf Reporting

Wendy got fixed again by Don Foutz and our Backup Flight Engineer Johannes Gross. The specific reason for the breakdown is not clear, but definitely the starter was broken (burnt). After replacing it with the starter of Casper (utilising some useful parts from Wendy) and powering the batteries, Wendy came alive again at 18:00. She is currently running to charge the Hab's batteries.

The Webcam "MDRS Hab Cam East" at the Musk observatory was fixed to avoid overexposure by making the opening smaller and hence reducing the incoming stray light.

While the backup-crew and the visitors had slept in the Habitat, four of the crew (CDR, XO, HSO and FE) moved overnight to the Whispering Sands Hotel in Hanksville. The two remaining crew members (MSP and MSL) drove to and slept in Salt Lake City to retrieve the AustroMars rover and buy additional supplies. This activity would take them the whole day, at the time that I write this report they are still on their way back to the Habitat (from SLC).

After a morning briefing, it was decided to adjust the flight plan to devote the day to our media representatives to make use of the likely great weather.

As such we adopted the EVA dress rehearsal to get the best out for the media representatives. After a one-hour donning of the space suits, we (CDR Frischauf, XO Soucek, FE Hutsteiner and HSO Groemer) stepped out of the Habitat and allowed for some film shooting by the Austrian Broadcasting Corporation (ORF).

Although we had full sunlight, the integrated brand new cooling vests (donated from Draeger system), let us live easier through the heat. The system is using phase shift materials, a fairly new technique which utilises crystals that melt above 36° Celsius and by doing so lower the body core temperature by a few degrees, therefore reducing the heat load significantly. The only minor downside is an extra weight of a few kilograms and a limited duty cycle of about 2-3 hours, but still we found it worth using it.

This dress rehearsal EVA took us close to Way point 324, about 5 minutes away by ATV, which is probably the most lifeless area really close to the Hab. The purpose of this pre-mission EVA was to get used to the flight hardware and especially our new medical monitoring equipment.

Our objective of giving the media teams a few good shots was accomplished, when we simulated a medical situation with an injured crew member, were we could also practise drag-techniques.

In the afternoon the AustroMars artist Helene Keller set up her experiment called "Fields of Mars". In a trench to the west of the MDRS something like 30 balloons were set-up to represent plants - a beautiful sight, not only for us, but also for three visitors with Jeeps, who just happened to pass by. We toured them through the surroundings and had them interface with our astronauts. The Austrian Broadcasting Cooperation (ORF) on their part interviewed them to also get an outsider view (which was very positive).

The late afternoon saw the repair of Wendy by Don Foutz and our Backup Flight Engineer Johannes Gross. After replacing Wendy's broken starter with the starter of Casper (utilising some still useful parts from Wendy) and powering the batteries, Wendy came alive again at 18:00. She is currently running to charge the Hab's batteries. We have fixed the Webcam MDRS Hab Cam East also, so it doesn't sends overexposed pictures, by adding some black tape to avoid excessive incoming stray light.

The day was completed with some interviews for the Austrian Broadcasting Corporation (ORF) and our first experiment, related to stress monitoring via a web-based survey and saliva samples.

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Casper: not used

Wendy Hobbs Meter: 3250.3 hrs
Voltage: 0 VAC
Frequency: 60 Hz
Oil Level: full
Oil Pressure: 30 PSI
Water Drained: no

Notes/Comments: At app 2 PM Don arrived to fix the starterproblem. We used the broken starter from Casper and the broken one from Wendy and made one working starter. Thanks to Don Wendy started again at 6 PM!!! One of Wendy's battery clamps is broken, we need a new one. Temporarily it's fixed.

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
23:57 - 24.2 - 05 - 14 - off
06:33 - 23.1 - 04 - 12 - off
06:47 - 24.5 - 05 - 12 - on - bulk
09:28 - 26.1 - 05 - 12 - on - bulk
09:37 - 24.1 - 07 - 12 - off
12:30 - 23.1 - 08 - 14 - off
13:40 - 21.8 - 07 - 15 - off
16:40 - 23.3 - 09 - 21 - on - bulk
18:15 - 26.1 - 06 - 19 - on - bulk

Fuel Status (as of 19:03):

Diesel: Approximate Reading - 3/8

Propane Tank: Approximate Reading - 52% (520 gallons = 1968.4 L)

Gasoline:
Consumed Today: 4 gallons = 15.1 L
Quantity Remaining: 7 gallons = 26.5 L
Notes/Comments: Need the empty gasoline containers to be filled

Oil:
GenSet Quantity: 0 quarts
ATV Quantity: 11 quarts
V'ger Quantity: 10 quarts

Water Status:

Outside Potable Water Tank Level: 300 gallons = 1135.6 L
Trailer Potable Water Tank Level: 16 cm from the base
Water Meter Reading: 9039.4 gallons = 34217.7 L
Water Consumed: 26.9 gallons = 101.8 L
Grey Water Used: 21.5 gallons = 81.4 L
Flushes: 6
Showers: 0
Sponge Baths: 0

Tonight's Meter Readings:
Out to Toilet: 2009.4 (+21.5 since yesterday)
In to GreenHab: 13781.4 (+0 since yesterday)

Notes/Comments: For powersaving reasons we switched of the pump, it was always enough greywater there, we checked temporarily.

GreenHab:

Crops Watered: yes
Crop Condition: Everything's in a good condition.

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Kawasaki ATV 3: Used - yes
Oil Checked: yes
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

HVAC: Nothing new to report.

Mars Surface Suits: Out of sim

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Notes/Comments: Don talked to Wendy and now she is cooperating with us!! Conclusion: We need gasoline, drinking water and a clamp for Wendy's battery! So it was a good day!!

EVA Dress Rehearsal Report Gernot Groemer Reporting

Today's first EVA took us close to Waypoint 324, about 5 minutes away by ATV, which is probably the most lifeless area really close to the Hab. The

Back-up Planetary Sciences Rene Vidalli enjoys a minute for himself during the preparatory week.

purpose of this pre-mission EVA was to get used to the flight hardware, especially our new medical monitoring equipment and have the four of us (CDR Frischauf, XO Soucek, FE Hutsteiner and yours truly HSO Groemer) give the media teams a good few shots, especially when it came down to simulate a medical situation with an injured CDR, so we could also practise drag-techniques with the team.

It was getting fairly hot, making the helmet sometimes feel like being in a microwave, but this time we had a new gadget on our side: between the flight overalls and EVA-suits, we all were wearing the brand new cooling vests, graciously donated from Draeger system. These cooling vests are using phase shift materials, which is a fairly new technique which is comprised of crystals which melt above 36° Celsius and in doing so lower the body core temperature by a few degrees, thus reducing the heat load significantly. The only minor downside is an extra weight of a few kilogramms and a limited duty cycle of about 2-3 hours, but still it is worth while using it.

In addition, we are using new gloves similar to dry-suit diving gloves which have a better joint between the EVA-overall and the gloves themselves which simulate real spacesuit-gloves currently being used in the Russian spacesuits superbly.

Given the beautiful pictures and four happy faces after our first out-of-sim preparatory test-EVA, it was a wonderful 3hour-EVA around noon. (No detailed timing information is provided, as this was still out-of-sim).

April 4th 2006

Commander's Check-In
Norbert Frischauf Reporting

Crew Physical Status: Everyone is doing OK

Brief Narrative of Today's Results: Our fourth day at the MDRS, again mostly devoted to public outreach activities. Three more days until the real AustroMars mission will start. Media representatives came along with us on a second dress rehearsal EVA, which was devoted to a Search and Rescue exercise.

Wendy is doing fine, also the internet connection seems to be working better today (maybe because the Wildblue representative will come tomorrow!) We have integrated the WebCam into the AustroMars Aerobot and tested it successfully, albeit we could not fly it because of rather stormy conditions. The AustroMars Rover has finally arrived, and we are awaiting for further procedures to start it up.

EVA: EVA02 took place into the north-easterly vicinity of waypoint WPT 011 of Crew 47 (with the ATVs), into a small canyon. A Search and Rescue dress rehearsal was conducted there.

Plans for Tomorrow: Continue with further tests of the AustroMars aerobot; set-up of the WLAN infrastructure; set-up and start-up of the AustroMars Rover test sequence.

Report Transmission Schedule:

- Today's engineering report will be submitted around 20:00 via the web interface.
- The other reports (CDR, EVA) will be transmitted also around 20:30.

Miscellaneous: We had another two visitors passing by. It seems that we start to become a tourist attraction of some sort!

Support Requested: None

Storing package material in the observatory turns out to be a tedious task in the desert wind.

Commander's Journal
Norbert Frischauf Reporting

Today everyone is in rather great mood as we have accomplished quite a bit. Stress level was quite high, as we wanted to make use of the still reasonable weather, which seems to degrade by the hour, therefore the activities were undertaken with great pace and effort (BTW: it just started raining)

Successful Search and Rescue dress rehearsal, which took place in the north-easterly vicinity of waypoint WPT 011 of Crew 47 within a small canyon. After successful testing, the media representatives made a lot of photo and movie shots.

The second big activity of today was the construction of the AustroMars aerobot.The webcam (type: "Black Widow") was integrated and tested successfully, unfortunately we could not test fly the aerobot because of very strong winds.

Both the PsychoMars and MedMars experiment were initiated to have a base line sample.

Most of the day was devoted to the Search and Rescue dress rehearsal, which took place in the north-easterly vicinity of waypoint WPT 011 of Crew 47 within a small canyon. A Search and Resuce dress rehearsal was conducted there, whereby simulated patients were lifted from the canyon ground. To save on time, the Mountain Rescue Equipment (MRE) was installed prior to the EVA. However, the EVA crew tested various ways of using the MRE with the space suits, focussing on lifting a patient and a rescuer from the canyon ground (altitude 13m). The results were OK, despite the soft consistency of the soil, which made it difficult to fix the MRE. After successful testing, the media representatives made a lot of photo and movie shots.

The AustroMars flight crew poses with the TV crew Dr. Guenther Loeffelmann and Alexander Tomsits from the Austrian Broadcasting Cooperation.

The second big activity of today was the construction of the AustroMars aerobot.The webcam (type: "Black Widow") was integrated and tested successfully, unfortunately we could not test fly the aerobot because of very strong winds. We will try that tomorrow if the weather allows for it. Currently it's raining, which of course compresses our preparation activities even further- still the crew's mood is fine, despite the ever building up stress factor.

The evening saw the initiation of both PsychoMars and MedMars experiment. Weight, body fat and body water content were measured of each of the flight crew members to establish a baseline, which will be used as a reference in the simulation afterwards to track any changes.

Foreseen Activites for Tomorrow: Additional AustroMars Aerobot testflights; MedMars Monitoring construction; Start-up of AustroMars Rover; first "real" SAR-EVA (Mountain Rescue Equipment to be set up in space suits as well)

Good evening to all of you - best wishes.

Engineering Report Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Casper: not used

Wendy Hobbs Meter: 3260.2 hrs
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: full
Oil Pressure: 30 PSI
Water Drained: no

Notes/Comments: Battery clamp still needs to be renewed, it's still a

Alexander Tomsits shooting a scene for the AustroMars documentary in the lower deck.

temporary solution!

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
00:40 - 24.5 - 09 - 19 - off
07:50 - 24.0 - 04 - 17 - off
11:04 - 22.9 - 09 - 18 - off
13:09 - 26.2 - 08 - 21 - on - bulk
16:00 - 27.6 - 09 - 24 - on - bulk
18:46 - 24.1 - 13 - 24 - off

Fuel Status (as of 19:00):

Diesel: Approximate Reading - 3/8

Propane Tank: Approximate Reading - 51% (510 gallons = 1930.6 L)

Gasoline:
Consumed Today: 6 gallons = 22.7 L
Quantity Remaining: 1 gallon = 3.8 L

Oil:
GenSet Quantity: 0 quarts
ATV Quantity: 10.5 quarts
V'ger Quantity: 10 quarts

Water Status:

Outside Potable Water Tank Level: 350 gallons = 1324.9 L
Trailer Potable Water Tank Level: 1 cm from the base
Water Meter Reading: 9080.7 gallons = 34374.1 L
Water Consumed: 41.3 gallons = 156.3 L
Grey Water Used: 42.2 gallons = 159.7 L
Flushes: 9
Showers: 2
Sponge Baths: 0

Tonight's Meter Readings:
Out to Toilet: 2051.2 (+42,2 since yesterday)
In to GreenHab: 13884.7.4 (+103.3 since yesterday)

GreenHab:

Crops Watered: yes
Crop Condition: Everything's in a good condition.

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 12 gallons = 45.4 L
Tire Status: good

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 2 gallons = 7.6 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 2 gallons = 7.6 L
Tire Status: good

Kawasaki ATV 3: Used - yes
Oil Checked: yes
Fuel Consumed: 2 gallons = 7.6 L
Tire Status: good

HVAC: Nothing new to report.

Mars Surface Suits: Out of sim

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Notes/Comments: Wendy ran well today. Sandwich built a shoebox and a wardrobe in the first floor next to the stairs.

EVA Dress Rehearsal Report
Crew 48 Reporting

Location: Waypoint NE in the vicinity of WPT011 of Crew 47

Main Duty: Mountain rescue equipment set-up and testing; media activities

Crew XO: A. Soucek
Crew FE: Ch. Hutsteiner
Crew MSP: Ch. Kandler
OSS: R. Vidalli
EVA Support Team: M. Spiss (Crew MSL)
HabCom: G. Groemer (Crew HSO)

Suits Used: #1, #4, #5, #6

Technical Equipment Used: 3 ATVs, mountain rescue equipment from Tyrolian Mountain Rescue (Austria)

Description of EVA: MSP and MSL scouted for ideal place to mount the mountain rescue equipment (MRE) during the morning; place needed to be a small canyon with the possibility to lift simulated patients from the canyon ground; such a place was found near WPT011. To save time, MRE was installed prior to EVA. During EVA, the EVA crew tested various ways of using the MRE, with a focus on lifting a patient and a rescuer from the canyon ground (altitude 13m). Results were good. Biggest difficulty to overcome was soft consistency of soil which made it difficult to fix the MRE. After successful testing, media partners used occasion to shoot pictures. No special occurrences.

April 5th 2006

C o m m a n d e r ' s   C h e c k - I n
N o r b e r t   F r i s c h a u f   R e p o r t i n g

Crew Physical Status: One crew member had a bit of temperature overnight but is on the way to recovery (no fever at lunch time anymore), the rest of the crew is doing fine.

Brief Narrative of Today's Results: Our fifth day at the MDRS, mostly devoted to internal activities, due to bad weather (rain and storm). The AustroMars Rover was successfully started up (after lengthy activities), tomorrow we will try to make all rover systems run.

EVA: None

Plans for Tomorrow: Continue with further tests of the AustroMars aerobot; set-up of the WLAN infrastructure set-up and continue with start-up of the AustroMars Rover test sequence.

Report Transmission Schedule:

- Today's engineering report will be submitted around 20:30 via the web interface.
- The CDR report will be transmitted at 21:00.

Miscellaneous: WildBlue was not installed, we are eagerly waiting for the additional bandwidth to enable video transmissions out of the Hab.

Support Requested: None

More to follow.

CDR Frischauf and HSO Groemer checking the power supply of the rover “Sisi“ in the MDRS laboratory area.

C o m m a n d e r ' s   J o u r n a l   N o r b e r t   F r i s c h a u f   R e p o r t i n g

Water on Mars? No problem! As the AustroMars flight crew arrived around 9:00 at the Habitat, it was rather clear that this day would be centered around internal activities. Winds were rather stormy - the Mars Society flag waved heavily in the winds - and on top it started to rain heavily from time to time.

Luckily we had enough to do inside the hab; while cleaning may not be the most interesting activity after all, it is absolutely essential when living so close together. Beside house keeping, which - has a very positive side effect - led to an excellent display of Martian cuisine, we did a lot of preparatory activities, centrecenterede MedMars Monitoring experiment as well as the AustroMars Rover.

The MedMars Experiment objective is to obtain medical data during the EVA, by measuring body core temperature, heart beat rate, as well as humidity and temperature in the astronaut's helmet.

The AustroMars Rover - friendly dubbed "Sisi", the only female crew member of AustroMars. - was another center of attention of today. In a 6.5 hour continuous teleconference with the engineers and rover specialists at the AustroMars Mission Control Center (MCC) in Salzburg, "Sisi" was put into action. Not an easy task, as the Rover is supposed to drive through the Utah landscape, entirely remote controlled from the MCC, via satellite link.

Sisi is the outcome of a one-year school project with an Austrian technical college and was constructed with the help of experts from the Austrian Space Forum and the European Space Agency. The AustroMars mission will be the ultimate baptism of fire for Sisi's performance - and today we wanted to make sure that the whole-year effort of the school pupils will achieve the well deserved results. It was not easy: WLAN outages, power problems and software troubles let us live through an emotional roller coaster between depression and euphoria, but at the end, Sisi performed well (for a beginning). Telemetry was there, camera pictures as well, and the solar panels provided for enough power. Tomorrow we will have to fix the "minor" issue of getting Sisi to accept drive commands, but after today we are very optimistic that we can tweak the rover's on-board data handling system to enable that as well.

The day was finally concluded with a dress rehearsal of the EVA suit donning procedure, which is beefed up to a normal one, because of our MedMars equipment. After all these tasks the crew is rather exhausted, but we will enjoy our fifth day at the MDRS with a nice common dinner, knowing that some of the excellent food from lunch is still left over...

Signing off for today

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Casper: not used

Wendy Hobbs Meter: 3269.7 hrs
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: 7/8
Oil Pressure: 35 PSI
Water Drained: no

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
21:19 - 26.6 - 09 - 24 - on - bulk
00:20 - 24.7 - 07 - 22 - off
07:59 - 23.3 - 05 - 19 - off
11:02 - 26.7 - 09 - 21 - on - float
13:01 - 24.1 - 09 - 15 - off
17:00 - 26.9 - 12 - 15 - on - bulk
20:03 - 23.4 - 11 - 15 - off

Fuel Status (as of 20:00):

Diesel: Approximate Reading - 3/8

Propane Tank: Approximate Reading - 51% (510 gallons = 1930.6 L)

Gasoline:
Consumed Today: 0 gallons = 0 L
Quantity Remaining: 1 gallon = 3.8 L

Oil:
GenSet Quantity: 0 quarts
ATV Quantity: 10.5 quarts

BU/L Johannes „Sandwich“ Nendwich writing his personal mission logbook.

V'ger Quantity: 10 quarts

Water Status:

Outside Potable Water Tank Level: 310 gallons = 1173.5 L
Trailer Potable Water Tank Level: 0 cm from the base
Water Meter Reading: 9135.1 gallons = 34580.0 L
Water Consumed: 54.4 gallons = 205.9 L
Grey Water Used: 24.3 gallons = 92.0 L
Flushes: 5
Showers: 2
Sponge Baths: 0

Tonight's Meter Readings:
Out to Toilet: 2075.5
In to GreenHab: 13930.7 (+46 since yesterday)

GreenHab:

Crops Watered: yes
Crop Condition: Everything's in a good condition.

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 12 gallons = 45.4 L
Tire Status: good

Kawasaki ATV 1: Used - no
Oil Checked: no
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Kawasaki ATV 2: Used - no
Oil Checked: no
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Kawasaki ATV 3: Used - no
Oil Checked: no
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

HVAC: Nothing new to report.

Mars Surface Suits: Out of sim

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Notes/Comments: Today was the first thunderstorm in the desert!! Normally not a problem when all the windows are tight, but the window over the command desk is leaky. Thanks to emily I found the foam to seal the window as soon as the weatherconditions will allow that!! Joschi and I started to mount a light that indicates the openingstatus of the main airlock! We will finish that work tomorrow!! Thats all for a busy indoor day!

April 6th 2006

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: crew member still on the way of recovery, light temperature after breakfast, therefore, as prevention procedure, crew member continued recovery at motel.

Brief Narrative of Today's Results: Various activities inside the hab, including preparation of laboratory area, clean-up of EVA room, installing of airlock light, finalisation of window sealing, installation of battery terminal and scouting for rover operation area (scouting from 1000 to 1100 with all 3 ATVs). On the AustroMars experiment side, the Rover testing preparation was still continued as some electrical problem was discovered this morning (Cdr N. Frischauf and Austrian rover team are working on overcoming the issue). Public outreach activity in the morning during a live telecon with the Austrian Secretary of State Mr. Eduard Mainoni while the latter one was visiting the MCC Salzburg.

EVA: 1. EVA Crew: G. Groemer (HSO, EVA Cdr), Ch. Kandler (MSP), A. Soucek (XO). Procedures testing for GeoMars in Hab vicinity, combined with media activities (foto shoot with New York reporter). Then, EVA crew returned to Hab, XO ended EVA, after safe closing of airlock HSO and MSP continued EVA with ATVs #2 and #3 to look for GeoMars sites app. 7 km from Hab down the lower road. EVA time 1630 to 1830 (2hrs; for XO 1630 to 1730 1hr). No anomalies, no special events, all equipment and suits nominal.

Plans for Tomorrow: finalise hab interior for mission start, procedure testing for all experiments, finalisation of OSS Procedure Document for submission, WLAN testing, Rover testing, SAR EVA.

Report Transmission Schedule:

- Today's engineering report will be submittted at 21:00 latest via the web interface due to high work load of flight engineers.
- The CDR report will be transmitted at 21:00.

Anomalies: 2.

1. Power generator Wendy breakdown: nominal switch-off yesterday evening, nominal start today at 0815, nominal switch-off at 1200. When attempting to start Wendy at 1600, this attempt and two more failed. After three start attempts strictly following the procs, no more attempt was undertaken according to procedure. ET was informed. Meanwhile two cars are running outside the hab and loading the hab batts, an idea agreed with by ET. Flight engineers suspect that water is in the fuel as white smoke was visible during start attempts. They are asking if a water drain shall be performed and if so, to receive exact procedures.
2. ATV # 1 problem: During rover scouting in the morning, "check belt" light flashed, and afterwards ATV could not be restarted except manually (which was necessary to return). ATV # 1 was then not used any more for afternoon EVA. ATV manual give hints on problem but engineers ask for permission to open ATV and check drive belt before proceeding.

Miscellaneous: WildBlue was still not installed, but should be done tomorrow.

Support Requested: ATV #1 green light for following ATV manual instructions or otherwise procedures to continue. No response email was received following the support request email sent at 1440.

More to follow.

Alexander Soucek
Commander, MDRS Crew 48 "AustroMars," on behalf of CDR

Commander's Journal
Norbert Frischauf Reporting

AustroMars Day 6: Spotlight on Alexander and Sisi

CDR Frischauf working on Sisi's power system with the support of the MCC engineering back seat team.

For Alexander, our first officer, this was definitely one of the most remarkable days, as he celebrated his 28th birthday, not in a classical way with family and friends, but three times with a bunch of Mars addicted space professionals and enthusiasts - his fellow AustroMars crewmates. And if that was not enough: he even celebrated it three times! First – as a surprise – at Blondies, when Blondie offered him an extra sweet dish with a little candle in it.

Then at the press conference, when the Austrian state secretary for science and innovation congratulated him deliberately and finally in the evening when he returned from another dress rehearsal EVA and his MDRS crew mates sang the birthday song for him. Loud but so enthusiastic, that every Martian in the close vicinity would have felt compelled to chime in.

The second major character of today was Sisi, our Mars Rover and the only female crew member in the AustroMars team. The rover is dubbed Sisi, in a somewhat funny reflection on empress Sisi, the wife of the Austrian emporer Franz-Joseph. Why would someone name a rover like an empress? Well, first of all Sisi was at her time reknown to be one of the most attractive woman – we believe that our rover is rather pretty too. Secondly Sisi was always on the move – we hope for the same for our rover, and that it will always find its way back to the base. Thirdly Sisi was all but an easy character – our rover is in no way different. Today I might have gotten some grey hair in trying to sort out a hardware problem with the power supply electronics. After communicating for several hours with the rover experts in Austria, we have at least identified the faulty module. Let's keep our fingers crossed that Sisi will be a good girl, and we can have her roam the Utah desert as of tomorrow...

Our other activies were centred on scouting out a terrain where our rover can conduct its first field test. Of course housekeeping was high-ranking on our daily activity list again, cleaning, fixing – all that it takes to keep the Habitat in good shape. As such we have fixed a window sealing, installed some battery terminals and continued with other activities in the lab area.

As it was lady's day, Wendy - our power generator - made also an appearance and stopped working. We hope that she will behave well again as of tomorrow, but that is something that has to be sorted out among the crew, the Mars Society's Engineering Team and our AustroMars flight engineers.

The day was finally concluded with a very nice dinner at a steak restaurant, which includes everyone from the crew beside of our photographer Andreas and me. Andreas will sort out his 2000 (!) photos that he has shot in the last 6 days, while I will keep on working with Sisi.

Signing off for today

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Casper: not used

Wendy Hobbs Meter: 3276 hrs
Voltage: 0 VAC
Frequency: 0 Hz
Oil Level: 3/4
Oil Pressure: 0 PSI
Water Drained: no

Notes/Comments: Wendy ran in the morning wonderful. Stopped her at noon. In the afternoon changed the battery terminal with the new one from Don, works perfect. But when we tried to start her again she said no. After 3 attempts without success we let her. We started Coleman but he delivered too much voltage (138V), so we're now loading the hab batteries with two cars!!

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
23:27 - 27,4 - 14 - 14 - on - bulk
08:30 - 26.2 - 06 - 12 - on - bulk
12:00 - 24.3 - 10 - 14 - off
16:30 - 22.3 - 07 - 15 - off (cars loading)
18:20 - 23.4 - 07 - 15 - 0ff (cars loading)

XO Soucek celebrates with the crew his birthday during breakfast in Hanksville.

Fuel Status (as of 18:30):

Diesel: Approximate Reading - 3/8

Propane Tank: Approximate Reading - 51% (510 gallons = 1930.6 L)

Gasoline:
Consumed Today: 9 gallons = 34.1 L
Quantity Remaining: 22 gallons = 83.3 L
Notes/Comments: We used 6 gallons for the Minivan which is loading the Hab battery!

Oil:
GenSet Quantity: 0 quarts
ATV Quantity: 10.5 quarts
V'ger Quantity: 10 quarts

Water Status:

Outside Potable Water Tank Level: 280 gallons = 1059.9 L
Trailer Potable Water Tank Level: 0 cm from the base
Water Meter Reading: 9165.7 gallons = 34695.8 L
Water Consumed: 30.6 gallons = 115.8 L
Grey Water Used: 28 gallons = 106.0 L
Flushes: 5

Showers: 0
Sponge Baths: 0

Tonight's Meter Readings:
Out to Toilet: 2103.5
In to GreenHab: 13954.2 (+23.5 since yesterday)
Notes/Comments: Today no showers and less water consumption due to power savings, all waterpumps are switched off!

GreenHab:

Crops Watered: yes
Crop Condition: Everything's in a good condition.

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 6 gallons = 22.7 L
Tire Status: good

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 3: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Notes/Comments: On ATV 1 the "check belt" light was flashing. Afterwards the ATV wasn't able to start again. According to the manual this light illuminates every 100 hours. When was the last 100 hour service? Or when there is a problem with the drive belt! So we have to check the drive belt. Shall we do this? Because we have to remove some cowling. I sent at 2:40 pm an email but got no response!

HVAC: Nothing new to report.

Mars Surface Suits: Out of sim, one EVA with suits Nr. 1,4 and 6. PLSS Nr.1,2 and 6. Helmet Nr. 3,4 and 5

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Notes/Comments: Except to play with Wendy, Charles, ATV 1 and the cars, we sealed the window over the command desk from outside and now it should be tight. Also we finished the installation of the airlock light (Pictures will follow)! So, as you can imagine it was a really boring day!

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: sick crew member fully recovered with MCC flight surgeon permission to resume all activities.

Brief Narrative of Today's Results: final preparation of Hab for commencement of simulation. Rover preparation was successfully finished, hardware and software are running and the rover made its first movements outside. This was possible due to the immense work of CDR Frischauf and the Rover Team in Austria who spent more than 20 hours since April 5 to cancel out deficiencies. Part of the crew set up the WLAN some 600m down SE in direction WPT "Hab View". The WildBlue Antenna was installed. The Switch-x software for outreach activities in Austria was installed and tested. Our "part-time crew" (TV team, newspaper contest winners, artist) left early afternoon, leaving just Crew and OSS at Hab site. OSS procedures during Simulation were finalised together with Mission Control in Denver and MCC Salzburg. There was a Public outreach activity in the morning during a second live telecon, this time with the Gouvernor of the Federal State of Salzburg, Ms. Gabriele Burgstaller, during the MCC-organised "Mars Party" in Salzburg, involving dozens of guests, families of the crew, VIP, etc.

EVA: none. (SAR EVA had to be cancelled due to continuing anomalies with the power generator [Wendy] on which crew efforts are still focusing).

Plans for Tomorrow: Start of simulation at 0500.

Report Transmission Schedule:

- Today's engineering report will be submitted at 2000.
- The CDR report will be transmitted at 2030.

Anomalies: 1. The Power generator Wendy is again broken: Wendy was started this morning at 0800 without problems, after an extensive and tiring work night involving the entire crew until 3a.m.; from 0030 to 0730 Coleman was running and the power consumption in the hab was reduced to a minimum, resulting in a ghostly atmosphere with only torches and the green airlock light for several hours of nighttime activity. Many thanks at this point to Paul Graham who assisted the crew the entire night via Skype chat. However, after having been successfully re-activated this morning, Wendy broke down at 1500 completely unexpected during activity. The crew hopes that all efforts were not in vain, and currently efforts concentrate on how to bring Wendy back to life in time for Mission start, which will be a challenge.

Miscellaneous: nothing.

Support Requested: Urgent support needed to solve power generator problem substantially in order to allow for a successful start of the mission!

Alexander Soucek
Executive Officer, MDRS Crew 48 "AustroMars," on behalf of CDR

The full desert crew of the AustroMars project: Don Foutz (right in NASA jacket), TV crew, both winners of the Kronenzeitung contest (Stefan Stanger and Ingrid Koehrer), Tobias Micke (Kronenzeitung), Helene Keller (artist “fields of Mars) and the flight crew. Missing: Andreas Koehler, the project photographer who is taking the picture): 17 people.

Commander's Journal
Norbert Frischauf Reporting

AustroMars Day 7: Sisi roams the plains of Mars (finally)!

Boy was that a day! It felt like almost like the perfect emotional rollercoaster, as we started to realise with an ever increasing pace that tomorrow the real AustroMars mission will finally start.

In the morning there was this press conference with the Gouvernor of the Austrian federal state of Salzburg, Ms. Gabi Burgstaller. Starting in a friendly atmosphere this event turned into a very emotional one, as friends and family of some crew members said good bye. One could feel the emotions on the other side in the Mission Control Center in Salzburg and this sparked the idea of realism, not only in our minds but also in our hearts.

The next highlight were the first steps of Sisi. After long hours of works during two days and nights, consultations with our Rover experts in Austria, we indentified the error in the rover's power supply. Once we had fixed it, Sisi came alive – step by step of course, as we wanted to make sure that she was doing alright with all of her subsystems. When she finally started to roll on the Martian desert plains it felt like Christmas and Easter – all at once. Two years of hard work had finally substantiated to what we had hoped for!

Now, we are set up for our mission. Minor issues with the experiments are still to be solved but we will do so during the simulation, just as one would expect from real Astronauts en-route to Mars.

So finally the descent engine is all set up to fire, the AustroMars Martian de-orbit countdown sequence is in its final stage!

Signing off for today

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

E n g i n e e r i n g R e p o r t
C h r i s t i a n H u t s t e i n e r & J o s c h i G r o s s R e p o r t i n g


Andreas Koehler in his usual position: hiding under a camouflage cover he awaits the analogue astronauts.

Generator/Electricity:

Casper: not used

Wendy Hobbs Meter: 3276 hrs
Voltage: 0 VAC
Frequency: 0 Hz
Oil Level: full
Oil Pressure: 0 PSI
Water Drained: yes

Notes/Comments: Seems like the starter broke again. The newly attached battery terminal was arcing across.

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
09:17 - 26.8 - 11 - 14 - on -float
12:05 - 23.4 - 20 - 15 - off
18:40 - 23.1 - 11 - 22 - on - bulk

Notes/Comments: like mentioned in the email

Fuel Status (as of 19:27):

Diesel: Approximate Reading - 3/8

Propane Tank: Approximate Reading - 50% (500 gallons = 1892.7 L)

Gasoline:
Consumed Today: 12 gallons = 45.4 L
Quantity Remaining: 10 gallons = 37.9 L

Notes/Comments: We used 5 gallons for the Minivan which was loading the Hab battery, 1 for ATVs and 4 for Colemann.

Oil:
GenSet Quantity: 0 quarts
ATV Quantity: 10 quarts
V'ger Quantity: 9 quarts

Water Status:

Outside Potable Water Tank Level: 250 gallons = 946.4 L
Trailer Potable Water Tank Level: 0 cm from the base
Water Meter Reading: 9194.9 gallons = 34806.4 L
Water Consumed: 29.8 gallons = 112.8 L
Grey Water Used: 24.5 gallons = 92.7 L
Flushes: 5
Showers: 2
Sponge Baths: 0

Tonight's Meter Readings:
Out to Toilet: 2128
In to GreenHab: 14277.2 (+323 since yesterday)

GreenHab:

Crops Watered: yes
Crop Condition: Everything's in a good condition.

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 5 gallons = 18.9 L
Tire Status: good

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 0.3 gallon = 1.1 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 0.3 gallon = 1.1 L
Tire Status: good

Kawasaki ATV 3: Used - yes
Oil Checked: yes
Fuel Consumed: 0.3 gallon = 1.1 L
Tire Status: good

Notes/Comments: ATV 1 is fixed and fully useable

HVAC: Nothing new to report.

Mars Surface Suits: Nothing new.

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Notes/Comments: Troubles with Wendy as mentioned in the email. We're now running on Coleman but thats no good solution because he's to weak to deliver the hab when using on full power!

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: Everyone tired but fully ok.

Brief Narrative of Today's Results: This morning the AustroMars mission officially started at 0500 with EVA crew #1 (Frischauf, Groemer, Soucek) being deployed northerly of WPT 359. After a walk through the dawning of the day, the crew reached Repeater Hill just in time to see a magnificent sunrise behin the Hab. Following some minutes of calm and enjoying, the crew inspected the outside of the hab and then entered the main airlock for a 10min re-pressurization. After completed EVA, EVA Crew #2 was cleared to leave the descent vehicle at landing site and approach the hab, where the crew (Spiss, Kandler, Hutsteiner) arrived shortly after 10 a.m. The rest of the day was extremely busy with establishing power and communication, storing equipment, declaring Hab ground safe, etc. Various experiments started today already, including: Myograph, fluid balancing, installing of Object tracker experiment, medical routine measurements (weight, blood pressure, body fat and body water), saliva sample, skin probe sample. Even lunch and dinner were successfully prepared strictly sticking to the diat plan made by the Innsbruck General Hospital. An intensive first day on Mars comes to its end.

EVA: 2. Both EVAs were needed for officially starting the AustroMars mission in a realistic way. The entire crew landed on Mars some Kilometers off the Hab site and then approached the Hab in two groups of three. Both EVAs started close to WPT359 and led westwards towards the Hab via Repeater Hill. EVA Crew #1 (Frischauf, Grömer, Soucek) started at 0620 and ended at 0850 (including simulated airlock anomaly). EVA Crew #2 (Spiss, Kandler, Hutsteiner) started at 0915 and ended at 1015 (including real anomaly, see below). Anomaly happened with backpack #3 during EVA 2, 20min after start. Reason: The fan stopped working and therefore no air was supplied any more inside the helmet of Ch. Kandler. The EVA was continued by attaching one of the two air tubes of Backpack #2 to helmet of Kandler. Reason of anomaly is most probably insufficient charging of backpack #3, which will be validated tomorrow.

Plans for Tomorrow: See MCC-confirmed flightplan for AustroMars mission day 2 (SOL2).

Report Transmission Schedule:

- Today's engineering report will be submitted at 2050.
- The CDR report will be transmitted at 2100.

Anomalies: 2.

- EVA suit backpack #3 (see above).
- Power generator Wendy is still broken. The crew "survived" the day with Coleman occasionally working and occasionally not, making the day a rollercoaster ride of power / no power. Since dinner, crew is working with torches in the dark hab on laptop batteries. On site Support and MDRS are probably doing their best (crew has no direct contact due to high-fidelity Sim protocol) and crew would like to thank them for their efforts. At least the last days made the AustroMars crew perfectionists in improvising. Simulated power cuts are definitely not needed any more...

Miscellaneous: Apart of the power issue, the first day of the AustroMars mission (SOL1) was a big success, and a stunning sunrise behind the hab helped to change from prep week mode to a true simulation feeling. Since this morning, we are not in Utah any more, but the plains of Mars look very similar indeed.

Support Requested: Constant energy.

More to follow.

Alexander Soucek
Executive officer, MDRS Crew 48 "AustroMars", on behalf of CDR

Commander's Journal
Norbert Frischauf Reporting

AustroMars Mission Sol 1: *"Mars De-Orbit Burn complete - landing sequence initiated..."*

"MCC Salzburg - AustroMars Crew here, the Mars Descent/Ascent Vehicle dubbed "Fast and Furious" has landed!"

This sentence was spoken out at 5:30 Utah time. The sun was still way down the horizon. Only an eerie light told us of the beginning day. Us that was Gernot Grömer, the Health and Safety Officer, Alexander Soucek, the First Officer and myself, Norbert Frischauf. While we were standing there in our EVA space suits in the dawn of this cloudless and cold Saturday, we realised that we had finally reached Mars - after 2 years of preparation! It sure was one of the most emotional moments of my life. Looking at each other we bashed our fists together - like basketball or volleyball players do - to freeze the moment in our minds and hearts and then we turned around and started our march to the MDRS habitat. Pre-checked GPS waypoints guided our way, as we stepped through the Martian plains, completely alone in the slowly brightening day. A day, which beared two names: Day 8 and also Sol 1, to reflect the fact that we had landed on Mars.

After being deployed at an unknown location near the MDRS, the search for the habitat was successful. The first half of the crew has safely arrived at the station (CDR, XO, HSO)

Sparkling Venus in the east was a magnificent site, but most of the time we did not see her, as our way lead us to the west, up on Repeater Hill. There, the three of us arrived just about in time to see a sunrise that none of us will ever forget. Bathed in orange-golden sunlight the Habitat presented itself to our feet and soon after we were on our way to the airlock. Going downhill was a rather easy task and 15 minutes later we opened the MDRS' airlock. Being aware of all the hard work that has brought us here I felt inclined to say the following words when I entered the airlock, "This may be only three persons entering the MDRS habitat, but they carry with them the wishes and hopes of 130 volunteers, who have deliberately invested two years of hard work to ensure that the AustroMars mission will become a huge success. We will do all we can to make sure that this hard work will come to fruition!"

Silence on the radio. Even if this would have been a real Mars mission there would have been not instant reply, so far is Mars away that any message will need at least 5 minutes to reach the Earth. For us - being in a high-fidelity simulation - this physical constraint is law as well! Any question/comment sent to the Mission Control Center (MCC) in Salzburg will require 10 minutes of patience on our side. This feature of our mission was something we did thoroughly enjoy throughout the whole day when we checked out the Habitat and prepared the first experiments. Among them, body fluid measurements, micro-biological sampling of the human skin flora, saliva sample taking, routine medical examinations and the final check-out of the AustroMars Rover "Sisi."

Of course there were some minor technical hick-ups, which were all overcome. EVA Crew number 2, with Christian Hutsteiner, the Flight Engineer, Christoph Kandler, Mission Specialist for planetary Sciences and Markus Spiss, Mission Specialist for Life Sciences, experienced a power breakdown of the air circulation of backpack number 3. The solution of this problem was by all means real astronaut like: C. Hutsteiner connected one of his intact air hoses to the helmet of C. Kandler and provided him enough oxygen that the three could safely reach the Habitat.

The most imminent issue were the permanent power outages, caused by the faulty power generator Wendy and its backup system. Our flight engineer watched the power situation very carefully and it was not only for once that he forced us to switch off most of our equipment to save on power. At these times of the day I felt like being a crew member of Apollo-13, but at least we were not stranded in interplanetary space, but could feel safe and rather comfortable in the MDRS Habitat.

There were a few other bugs, which are - on their own - to minor to be mentioned and although in sum they are sometimes annoying, the whole AustroMars team is aware that the root causes and the solution of these anomalies are the icing on the cake as they provide us the necessary feedback and learning experience, which is so desperately needed for planning and successfully conducting a future human Mars mission.

With this knowledge in our minds it is not so difficult to conduct all the scientific experiments which require us to take urine, saliva and blood samples in hourly intervals, to fill out numerous pages of questionnaires and to live through days of sleep deprivation. This is tiring, not only physically but also mentally and we shall see how the crew will perform in the two weeks to come.

However, having seen how we all have fulfilled our tasks and overcome all obstacles on this very first day - or should I say sol - of the AustroMars mission, I am very confident that AustroMars with its 17 experiments out of 10 disciplines will be able to make a difference, helping defining the stage for the next level of future analogue missions. If we can achieve this, then all the hard work hard work of 130 volunteers will have truly come to fruition!

Signing off for today

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Casper: not used

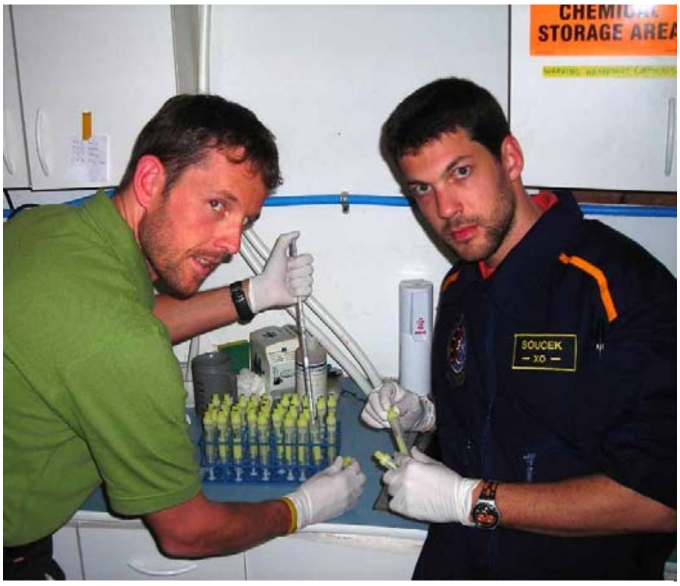
Wendy: not used

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
10:32 - 25,2 - 06 - 17 - on - bulk
12:00 - 24,0 - 09 - 17 - off
16:28 - 18,9 - 07 - 21 - off
17:25 - 25,1 - 11 - 21 - on - bulk

Notes/Comments: During the day several powerlosts because coleman weren´t able to charge the habbatteries and we were not able to go with the powerload below 7 Amps. Nevertheless after restarting, Coleman is doing well at the end.

Fuel Status (as of 20:52):

Diesel: Approximate Reading - 3/8



MSL and XO are preparing urine sample vials fort he neopterin test battery.

Propane Tank: Approximate Reading - 49% (490 gallons = 1854.8 L)

Gasoline:
Consumed Today: 8 gallons = 30.3 L
Quantity Remaining: 2 gallons = 7.6 L
Notes/Comments: Coleman needed another sip.

Oil:
GenSet Quantity: 9.5 quarts
ATV Quantity: 10 quarts
V'ger Quantity: 9 quarts

Water Status:

Outside Potable Water Tank Level: 220 gallons = 832.8 L
Trailer Potable Water Tank Level: 0 cm from the base
Water Meter Reading: 9217.1 gallons = 34890.4 L
Water Consumed: 22.2 gallons = 84.0 L
Grey Water Used: 9.8 gallons = 37.1 L
Flushes: 2
Showers: 0
Sponge Baths: 0

Tonight's Meter Readings:
Out to Toilet: 2137.2
In to GreenHab: 14281.1 (+4.1 since yesterday)
Notes/Comments: Due to power lost no showers. We checked GreenHab and the watertanks have enough water!

GreenHab:

Crops Watered: yes
Crop Condition: Everything's in a good condition.

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 1: Used - no
Oil Checked: no
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Kawasaki ATV 2: Used - no
Oil Checked: no
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Kawasaki ATV 3: Used - no
Oil Checked: no
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

HVAC: Nothing new to report.

Mars Surface Suits: PLSS Nr. 1, 2, 3. Suits Nr. 1, 4, 6. Helmets Nr. 1, 3, 4 used for EVA from the Mars Descend/Ascend Vehicle "The fast and furious" to the Hab!

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Notes/Comments: First day in Full Sim. The powersituation is not really satisfying us, but we have no choice!

April 9th 2006

C o m m a n d e r ' s   C h e c k - I n
A l e x a n d e r   S o u c e k   R e p o r t i n g

Crew Physical Status: Everyone in perfect shape.

Brief Narrative of Today's Results: During the first official night on the Red Planet, everyone recovered from the previous day's early morning landing. Flight Plan Day 2 chased the crew out of beds at 0600. After breakfast and power check, N. Frischauf (CDR) and Christian Hutsteiner (FE) prepared for the first regular EVA, which served as engineering EVA checking the outside of the Hab, the ATVs, the Greenhab (outside), etc., leading to ground operational declaration. No anomalies reported. During this EVA, Frischauf and Hutsteiner also took a camera with them, and the real-time videos received were stunning. This simple technique will be used from now on for all EVAs, serving as Outreach tool for the MCC in Salzburg. After lunch, the next EVA was prepared for taking Geology emergency samples, preparing for an eventual emergency return to Earth. This EVA (crew: HSO G. Groemer and FE Ch. Hutsteiner) suffered from some VOX (radio) problems due to distance. Therefore, HabCom decided to abort EVA. When the EVA crew came in sight and vox of the Hab, however, the EVA was continued in accordance with Mission Control as new EVA #5, in order to allow for finishing the geology experiments and sterile sample collection. Other activities of the day included Rover testing and work, the Myograph experiment, the PsychoMars questionnaires and saliva samples, and more. Again, cooking seemed to be the most challenging activity of the day... preparing proper food seems to be one entire big anomaly for the crew.

EVAs: 2. Find details in EVA reports. EVA #3. Crew: N. Frischauf (CDR, EVA CDR) and Ch. Hutsteiner (FE). HabCom G. Groemer (HSO). Engineering EVA to check out Hab and surrounding, including ATV testing. Everything nominal. EVA started at 0900 and ended at 1130. Good video coverage of the EVA, no anomalies. EVa Area in sight of Hab.

EVA #4/5 (combined): Ch. Hutsteiner (FE, EVA CDR) and G. Groemer (HSO). HabCom A. Soucek (XO). Geological sample EVA with one simulated (airlock) and one real (radio) anomaly, the latter one leading to abortion of EVA 4. Due to re-establishing radio and sight contact with crew, as well as significant remaining nominal EVA time, MCC agreed to re-issue EVA as "EVA 5", thus turning it into a double-EVA. Various samples were taken. Original target before LoC: WPT 334. EVA started at 1515 and ended at 1705.

Plans for Tomorrow: Revised Flight Plan of Day 3 will be received by MCC Salzburg later this evening. Planned activites include BioMars EVA, Switch-x video conference with Autrian Broadcasting Cooperation and the first nighttime EVA for TeleMars.

Report Transmission Schedule:

- Today's engineering report has been transmitted.
- The CDR report will be transmitted at 20:00.

Anomalies: The usual (power)...

Miscellaneous: Simulated airlock valve anomaly (poor crew of EVA 4/5, waiting 20min in airlock), GreenHab weekly check nominal, good sarcasm and even more Sim feeling.

Support Requested: none, except... (power...).

More to follow.

Alexander Soucek
Commander, MDRS Crew 48 "AustroMars," on behalf of CDR

„Martian“ sunrise at the MDRS.

Commander's Journal
Norbert Frischauf Reporting

AustroMars Mission Sol 2: *"Engineering EVA complete - Ground declared operational!"*

"EVA Team this is HabCom, you are cleared to open the outer hatch of the airlock!"

With this words Christian Hutsteiner, the Flight Engineer, and myself, Norbert Frischauf, stepped out of the Habitat to begin our Engineering EVA (our Health and Safety Officer, Gernot Groemer, acted as Habitat Commander). The objective of this EVA is easily described: Check-out the outer shell of the Habitat and the surroundings for any imminent dangers that could endanger the mission.

To have an as thoroughly as possible look, Christian and I took a webcam with us that we both used like the EVA spacesuit cameras used in the Apollo programme to relay images back to the Habitat for a closer inspection of specific devices afterwards. What we deliberately looked at was the cabling and piping underneath the habitat, the sealing of the airlock, the support structure of the Greenhab as well as that of the radio telescope. Everything was considered to be in reasonable shape, beside of one pillar of the radio telescope, which had tilted and was therefore not vertically aligned anymore. The flight engineer and I had that fixed rather quickly by straightening the support cords and pulling the pole into an upright position again.

Finally we had accomplished our task at the telescope and so we went on to check out the ATVs and the range of the audio and the video equipment. Driving along Sagan road we found out that both voice and video have an approximate range of 500 – 600 m, an obtained knowledge that will suit us well in future EVAs.

When we entered the Habitat after a 2.5 hour EVA, both Christian and I where completely wet from sweat. Such was the effort required during the EVA that Christian had burnt 1800 cal, much more than during any average work-out. Interesting though that both of us did not really feel the effort when we were outside. Maybe one should recommend MDRS-like missions to everyone who doesn't like to work-out but wants to keep up in good shape nonetheless…

After we had finished the suit un-donning procedure, both the Flight Engineer and I checked the video from our EVA. As we found everything to be in reasonable shape, I declared "Ground operational" at 13:30.

Consequently, the afternoon saw another EVA, an emergency geology EVA. Although this sound dangerous, the opposite is the case. This EVA is done to ensure that there is at least some scientific return in case a major problem arises in the first few hours/days of the mission and the mission has to be aborted. If this would be the case then at least the geological samples of this first EVA would be returned to Earth to provide the long-awaited controlled sample to finally establish Martian ground-truth.

The EVA was performed by Gernot Groemer and Christian Hutsteiner, HabCom was Alexander Soucek, the First Officer of the AustroMars Mission. After some hick-ups with the communication line – the radio range was found to be much shorter than was required for this EVA - the EVA was aborted in the first instance. But when the EVA team came back into range again it was decided to adopt the itinery to the communication constraints and therefore the EVA could be finished successfully, with 3 geological samples being obtained in a fashion compatible to planetary protection requirements.

In the meantime, our Mission Specialist for planetary Sciences, Christoph Kandler was working on the itinery for tomorrow EVA, while Markus Spiss, the Mission Specialist for Life Sciences, worked on biological experiments and checked out the Greenhab. I was focussing once more on checking out the AutroMars Rover Sisi. Now, with the Rover hardware entirely fixed it is up to the software guys to establish the satellite connection and the Rover Control Interface on the Rover-PC, which is needed to have Sisi roam the plains of Mars. If all goes well, we expect our beauty to make her first autonomous "steps" tomorrow or on Tuesday, Sol 4. Once this happens another key experiment of AustroMars will have been successfully declared operational…

Signing off for today

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Casper Hobbs Meter: 0 hrs
Voltage: 120 VAC
Frequency: 0 Hz
Oil Level: full
Oil Pressure: 0 PSI
Water Drained: no

Notes/Comments: We use this part for the Honda (The artist formerly known as Coleman - TAFKAC) numbers.

Wendy: not used

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
19:24 - 25,3 - 10 - 21 - on - bulk

21:40 - 25,7 - 07 - 21 - on - bulk
22:12 - 25,9 - 07 - 21 - on - bulk
06:40 - 26,6 - 08 - 17 - on - float
07:25 - 24,3 - 06 - 15 - off
08:30 - 25,2 - 10 - 15 - on - bulk
13:45 - 25,6 - 10 - 22 - on - bulk
17:35 - 21,5 - 11 - 24 - off

Notes/Comments: Today no powerlosts but we have to safe power striktly.

Fuel Status (as of 18:46):

Diesel: Approximate Reading - 3/8

Propane Tank: Approximate Reading - 49% (490 gallons = 1854.8 L)

Gasoline:
Consumed Today: 8 gallons = 30.3 L
Quantity Remaining: 2 gallons = 7.6 L

Notes/Comments: Due to the fact we're still running Honda - gas consumption is quite high. The empty jugs are on the trailer. We'll get some gas by our own for this night.

Oil:
GenSet Quantity: 9.5 quarts
ATV Quantity: 10 quarts
V'ger Quantity: 9 quarts

Water Status:

Outside Potable Water Tank Level: 220 gallons = 832.8 L
Trailer Potable Water Tank Level: 0 cm from the base
Water Meter Reading: 9217.1 gallons = 34890.4 L
Water Consumed: 22.2 gallons = 84.0 L
Grey Water Used: 9.8 gallons = 37.1 L
Flushes: 2
Showers: 2
Sponge Baths: 0

Tonight's Meter Readings:
Out to Toilet: 2155.5
In to GreenHab: 14398.7 (+117.6 since yesterday)

GreenHab:

Crops Watered: yes
Crop Condition: Greenhab temp. 84°F,

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 1: Used - no
Oil Checked: no
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Kawasaki ATV 2: Used - no
Oil Checked: no

Fuel Consumed: 0.1 gallon = 0.4 L
Tire Status: good

Kawasaki ATV 3: Used - no
Oil Checked: no
Fuel Consumed: 0.1 gallon = 0.4 L
Tire Status: good

Notes/Comments: ATV 3 - ground idle was to low, turned it up to a proper setting. Seems that the ground idle is always going by itself down. We used the V'ger for transportation in the last days. It was refuelled today with 10 gal.

HVAC: Nothing new to report.

Mars Surface Suits: PLSS Nr. 1 & 6 Suits Nr. 1,5 & 4 Helmets Nr. 2 & 4 used for EVA´s 3 & 4/5. PLSS Nr. 2 the blower isn´t working, will check it later in the evening.

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Notes/Comments: The powerplugs over the science drawers are without power. Will check that as soon as I have time. There are all circuit breakers in the on position. The powersituation is unchanged! Remark: The "Coleman" as it was called during the last weeks is a long-run Honda Gasgenset.

Health & Safety Report
Gernot Groemer Reporting

Since todays EVAs we are doing limited measurements of vital parameters. Our engineering team back in Austria constructed small data devices which should be able to provide Heart rate, temperature of the body core and in the helmet as well as CO2 concentration. Unfortunately, due to a problem with the controllers we are only able to obtain the heart rate at this point until we have jury rigged replacement parts and get additional input from our MedMars engineering back-seat team.

On the upside, we have one operational clinical capnometer which is working just fine; during EVA 4/5 yours truly measured the expiratory CO2-content which varies from 31 mmHg during the cycling of the airlock at egress (= minimum physical stress) and 45 mmHg when rushing up a hill with a heart rate of 145 bpm. It seems, the airflow of our PLSS is sufficient for non-exhaustive activities. This leads to an engineering suggestion: for limited times, such as steep hill ascents etc..., the analog astronaut should be able to boost the fan power to allow a higher oxygen flow.

We are very happy about the cooling vests from Draeger with the phase change compartments which work flawlessly, although our longer EVA times in the near future might exceed the workload of the vests.

As for the crew: everyone is in excellent condition, maybe a little bit exhausted when returning from the EVA's, but otherwise we are enjoying regular sleep periods compared to the preparatory week.

On a side note, we all realize that we have small scratches and micro-wounds on our skin from the day-to-day work in the hab, but no infections so far.

EVA Report
Crew 48 Reporting

After this mornings engineering EVA, an "Emergency geological sampling EVA" was conducted by Flight Engineer Hutsteiner and Health Officer Groemer. This EVA is intended to provide a minimum set of geological samples in case the Earth Return Vehicle has to be used in the first few days due to technical problems. The EVA team went to waypoint 334, and then lost contact to the HabCom which has been routed through to Mission Control as a passive Skype-Broadcast. Mission control in Salzburg can listen in to EVA radio communications. Due to the loss of communication, MCC ordered an abort of EVA until visual contact between the Hab and the EVA-crew could be established again. Three samples were collected in total for further analysis in our brand-new glove-box.

Egress: 15:15
Ingress: 17:05
Maximum distance from the Hab: 900 m
EVA-CMDR: FE Hutsteiner
EVA-Team: HSO Groemer
Habcom/Suit-technician: XO Soucek

XO Soucek and MSP Kandler spotting the EVA-team through the stations western porthole.

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: Everyone in perfect shape.

Brief Narrative of Today's Results: This day was marked by two EVAs, the first one for BioMars sample return, the second one for WLAN installation and operation testing. The BioMars EVA resulted in six samples taken and brought back under sterile conditions; all samples were procured in the AustroMars Glovebox during the afternoon. Other activities of the day included saliva sampling, reports, work on broken PLSS #3, and the first test batteries for the FAMOS experiment. FAMOS worked perfectly. Mars reports clear sky and a temperature of -100degC, everything is running smoothly, the crew is in good condition and mood.

EVAs: 2. Find details in EVA reports. EVA #6. Crew: A. Soucek (XO, EVA CDR), M. Spiss (MSL) and Ch. Kandler (MSP). HabCom G. Groemer (HSO). Main activity was the first BioMars sample collection. Crew took six samples from different sites (6/1 to 6/6), starting at main target area around WPT 361 and working back along the Lovell Highway to Hab. One anomaly: Radio communication from helmet three did not work satisfactorily: whenever the button was released after pushing, the talk-mode did not end; only after several more pushes, the button released. Probably the switch contact is broken or needs to be refixed. EVA started at 0900 and ended 1145. Use of all three ATVs, overall distance 5km forth and back. Very windy. EVA #7: N. Frischauf (CDR, EVA CDR) and Ch. Kandler (MSP). HabCom Ch. Hutsteiner (FE). EVA started at 1605 and is still in progress at time of check-in report. Still strong winds reported. Find details in the EVA report of tomorrow.

Plans for Tomorrow: Revised Flight Plan of Day 4 will be received by MCC Salzburg later this evening. A second BioMars LiMa (Life on Mars) EVA is planned for four hours.

Report Transmission Schedule:

- Today's engineering report will be transmitted at 2000.
- The CDR report will be transmitted at 2100.

Anomalies: None except the Com switch in EVA helmet #3. Power seems to stabilise.

Miscellaneous: nothing

Support Requested: none.

More to follow.

Alexander Soucek
Commander, MDRS Crew 48 "AustroMars," on behalf of CDR

Commander's Journal
Norbert Frischauf Reporting

AustroMars Mission Sol 3:
"Looking for Life on Mars and WLAN Masts... "

This day can definitely be best described as the EVA day. In the morning, Alexander Soucek, the First Officer, Mission Specialist for planetary Sciences, Christoph Kandler and Markus Spiss, the Mission Specialist for Life Sciences, donned their space suits, started the ATVs and moved to the

South to start one of the most interesting experiments of AustroMars: LiMa or Life on Mars. The objective of LiMa is to optimize the procedures for finding and processing potential life bearing samples. This experiment therefore includes an extensive contamination protocol to enable the highest levels of planetary protection. As a side effect, Alexander, Christoph and Markus conducted the EVA with the longest range, at maximum they were something like 2.5 km away from the Habitat. This distance was only possible because they followed a strict communication and reporting procedure, which was vigilantly enforced by Gernot Groemer, the AustroMars Health and Safety Officer, who acted this time as HabCom. After a bit more than two hours the EVA was finished. The team had collected six samples, which were carefully stored, transported and processed. Now they are in the incubator to see whether there any bacteria or spores on them and what kind or type these are.

MSL Spiss is preparing a sterile sampling kit for cultivating germs in the stations glove box.

In the meantime, Christian Hutsteiner, our Flight Engineer and myself, Norbert Frischauf, we are cleaning the Habitat and continued to work on some experiments like the AustroMars Rover and the Track and Trace experiment, which will involve sterilised gowns to be worn over the space suit to quantify forward and backward contamination, an absolute novelty in Mars exploration (analogue) science. Another highlight of the morning was the videoconference with Alpha Austria, a science channel of the Austrian Broadcasting Cooperation. Both Christian and I, gave a 10 minutes briefing on our daily activities. This format will be continued throughout the whole mission to give spectators on Austria, Germany and Switzerland a chance to see what we are doing and why missions like AustroMars are so important.

After a delicious lunch - some Chinese potpourri, which was so not foreseen in the original diet plan, but excellent nonetheless - the second EVA was prepared. This time is was Christoph and myself, moving over to Phobos Peak, a place to the East-South-East of the Habitat. We erected to WLAN-masts on two hills, one equipped with a Yagi-Antenna, to bridge the 1.2 km to the Habitat, while the other two were 360Â° WLAN antennas for area coverage. By this way we hope to provide telecommand and control signals to Sisi (the rover), which is supposed to drive in this area.

During our EVA, Christian acted as HabCom, friendly asking every few minutes for our pulse rates (as this was part of a medical experiment of AustroMars) and reminding us to drink a lot. Even so one does not recognise, the water loss can be significant, no wonder if one moves more than 3000 steps as was measured at Christian. In the end we had erected the two masts and finished our EVA.

With a duration of nearly 3 hours the afternoon EVA was so far the longest one. Still there are many more to come since AustroMars has only yet begun.

Signing off for today.

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Wendy: not used

Casper Hobbs Meter: 61.7 hrs
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: full
Oil Pressure: 0 PSI
Water Drained: no

Notes/Comments: That's still the Honda. We changed oil today.

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
23:25 - 24,6 - 08 - 21 - off
06:38 - 26,8 - 11 - 19 - 0n - float
10:24 - 24,3 - 08 - 18 - off
17:09 - 26,0 - 11 - 21 - on - bulk
19:08 - 26,1 - 07 - 19 - on - bulk

Notes/Comments: In the morning the batteries were really full, and at this charging status the hold also very good without Honda!!

W-Lan field equipment, mostly designed for usage with Sisi.

Fuel Status (as of 19:21):
Diesel: Approximate Reading - full
Notes/Comments: Diesel was delivered today.

Propane Tank: Approximate Reading - 49% (490 gallons = 1854.8 L)
Gasoline:
Consumed Today: 13 gallons = 49.2 L
Quantity Remaining: 2 gallons = 7.6 L
Notes/Comments: We bought 15 gal yesterday by our own.

Oil:
GenSet Quantity: 8.5 quarts
ATV Quantity: 10 quarts
V'ger Quantity: 9 quarts

Water Status:
Outside Potable Water Tank Level: 220 gallons = 832.8 L
Trailer Potable Water Tank Level: 100 cm from the base
Water Meter Reading: 9301.9 gallons = 35211.4 L
Water Consumed: 51.7 gallons = 195.7 L
Grey Water Used: 39.8 gallons = 150.7 L
Flushes: 7
Showers: 2
Sponge Baths: 0

Tonight's Meter Readings:
Out to Toilet: 2195.3
In to GreenHab: 14487,6(+88,9 since yesterday)

GreenHab:
Crops Watered: yes
Crop Condition: They are in good condition

Transportation:
V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 0.3 gallon = 1.1 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 0.3 gallon = 1.1 L
Tire Status: good

Kawasaki ATV 3: Used - yes
Oil Checked: yes
Fuel Consumed: 0.3 gallon = 1.1 L
Tire Status: good

Notes/Comments: ATV 2: left rear tire had a little less air, EVA Team filled it and now it´s okay again.

HVAC: Nothing new to report.

Mars Surface Suits: PLSS Nr. 1,2 & 5 Suits Nr. 1,4 & 6 Helmets Nr. 2,3,4 & 5 used for EVA´s 6 & 7. PLSS Nr. 3: This was the PLSS which didn´t work correctly not PLSS Nr.2. I checkt Nr.3 today and the switch seems to be a little bit confused by the sand. Now it´s working without problems. We´ll keep an eye on it!

Computers/Networking Infrastructure: Nothing new.
Appliances: Nothing new.
Data Logger: Nothing new.
Upgrade Work: Nothing new.

Notes/Comments: That day was not so bad, so far! Hope it will stay so! No problems with Honda - but we still miss you Wendy!

Health & Safety Report
Gernot Groemer Reporting

Today we discovered a hidden passenger who made it all the way from Earth: right after the morning briefing, our MSP discovered a small spider crawling over the table of the command deck, followed by a second companion. We took images and relayed the images to medical control, as there is a potential danger in encounters with Hobo spiders.

Despite the continuous power problems at the station, two analogue astronauts survey the surrounding area of MDRS.

Our Flight surgeons took a look at the images and consulted a spider specialist in Graz and we got a confirmation that it is indeed the venomenous Hobo specimen. We are a little bit concerned, as both spiders were fairly young, which might indicate a nest somewhere in the Hab. Medical Control issued procedures how to deal with these bites and we are very happy that -just in case- we have the standard treatment options for anaphylactic cases in our medical cabinet.

Otherwise the crew is doing fine; the heart rate monitors have turned out to be a very interesting add-on to the monitoring of EVA activities, although we found out that the calorie readings derived from the weight and heart rate of the analogue-astronaut are not reliable during the time in the airlock, which is at least 10 minutes for the cycling of the decompression chamber both ways each, as the receivers are not coded and, as such, are interfering with each other. Hence it was determined my medical control that the measurements shall be started as soon as the EVA crew has cleared the outer hatch.

Another issue is that due to a misunderstanding we discovered that some of the food which was supposed to arrive in Hanksville actually stayed back on Earth. So we had to make an inventory of what we have, straight away. Our dietology team will re-assess the situation. Fortunately there is so much food left from previous crews which we originally decided to ignore but now consider it as "emergency rations". We are looking forward to the new menu plan, in the meantime we go with what we have.

April 11th 2006

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: Everyone in perfect shape, however a bit tired (physically...).

Brief Narrative of Today's Results: The crew is slowly getting used to wake up around 0600 (after yesterday's discovery of two Hobo spiders in the Hab, going-to-bed-procedures were slightly altered including now a bed-check using torches). Main activities during the morning included the second BioMars EVA covering a total distance of 16km and collecting 10 samples, media activities (switch-x videoconference system in superior quality), another Rover test (the crew does not give up and chases two electronic problems, one in the power distribution system, another in the Telecommand Unit) and EVA planning for tomorrow. The afternoon was intensively packed with diverse tests, including, as every day, the Myograph, FAMOS, Object Tracker, urine samples and others, as well as a new psychological test (CogHealth). Furthermore, primary cultures were procured from todays biological samples in the GloveBox. Power issues have stabilised. Everything is on track.

EVAs: 1. EVA #8. Crew: A. Soucek (XO, EVA CDR), M. Spiss (MSL) and Ch. Kandler (MSP). HabCom Ch. Hutsteiner (FE). Main activity was the second BioMars "LiMa" (Life on Mars experiment) sample collection. Crew took ten samples (8/1/1-3, 8/2/1-3, 8/3/1-3 and 8/4) from four different sites, ending at WPT 14252500N 523000E at 1356m alt. The maximum distance from the Hab was 6km, with a total distance of 16 km covered during this four hour EVA (making it the longest crew extra-vehicular activity so far). At return of EVA crew, A. Soucek and M. Spiss were commanded by HabCom / MCC to extend EVA for another 30min and check radio connection at Repeater Hill. EVA started at 0902, ended for Ch. Kandler at 1219 and for rest of EVA crew at 1247. All three ATVs used. When returning to hab, check belt light of ATV#2 activated, OSS will take care. No anomalies.

Plans for Tomorrow: Revised Flight Plan of Day 5 will be received by MCC Salzburg later this evening. First MedMars EVA is planned.

Report Transmission Schedule:

- Today's engineering report will be transmitted at 2000.
- The CDR report will be transmitted at 2000.

Anomalies: none.

Miscellaneous: Crew shot a Yuris Night video to greet all participants of tomorrow's world space parties.

Support Requested: none.

More to follow.

Alexander Soucek
Commander, MDRS Crew 48 "AustroMars," on behalf of CDR

Commander's Journal
Norbert Frischauf Reporting

AustroMars Mission Sol 4:
"How many experiments can an A(u)stronaut conduct in 24 hours?"

Ever wondered how many different activities one can pack into 24 hours? Would you be surprised if I tell you that it can easily be more than 20? If you don't believe me then I invite you to have a look at the AustroMars flight plan. This document outlays in 15 minutes slots how each crew member of AustroMars should spend his day. For our Mission Specialist for Life Sciences, Markus Spiss, for example, the day started already at 6:00 and is supposed to finish around 22:30. At 6:45 the first medical data gathering was due (to please our flight surgeon), at 7:15 the FAMOS experiment – to measure sleepiness – followed. After some tab washing, Markus was sent on the second LiMa EVA, together with Christoph Kandler, the Mission Specialist for planetary Sciences, and Alexander Soucek, the First Officer, who acted this time as EVA commander. Christian Hutsteiner, our Flight Engineer, was the HabCom and had an interesting task, as this EVA was a long-range one, leading the group more than 8 km away from the Habitat. The duration was accordingly, all in all the EVA team spent 3 hours 45 minutes outside. LiMa or Life on Mars is set to optimise the procedures for finding and processing potential life bearing samples. This experiment therefore includes an extensive contamination protocol to enable the highest levels of planetary protection.

CDR Frischauf is preparing to work in the glovebox.

Coming back from the EVA, it was time for another FAMOS session for Markus, Christoph and Alexander, the latter two topped this even by another sleepiness experiment based on pupil measurements via a pupillomyograph.

After lunch Markus and Alexander were ordered to conserve and process the biological samples obtained during the LiMa EVA, followed by another FAMOS measurement (and the pupillomyograph for Alexander). The afternoon was finally concluded for Markus by its Greenhab duties, which involves taking care of the plants, measuring pH values of the recycled water, etc. Now, at the time, when I write my report, Markus and Gernot Grömer, the AustroMars Health and Safety Officer, are archiving the MedMars for a later scientific examination at the university and the medical university of Innsbruck and several medical laboratories all over in Austria.

Before Markus goes to dinner he – as well as the complete crew – has to do a saliva sample and once dinner is finished, another medical data gathering is due. Still there is more to come: reports have to be filed and the CogHealth screening is to be undertaken. For sure the nicest slot in the flight plan of today is the movie, foreseen at 20:45. But then the day is still not over, as there is another FAMOS run before Markus goes to bed. Oh, and I forgot that he still has to do the "traditional" urine sampling as well, like the rest of the crew.

While I have deliberately pointed out Markus' daily agenda, the ones of the other crew members are nearly as packed, only the focus is a little bit different. So was my morning centred a bit more on public outreach activities, when I did the usual video broadcast for the Austrian Broadcasting Corporation – this time together with Gernot, the HSO. Afterwards there were three more video sessions, one for later presentations and then two more for Yuri's Night, a world-wide party event, set up to celebrate the first manned space flight of Yuri Gagarin on April 12, 1961.

Of course I am aware that the flight plan is carefully designed by several persons in the AustroMars Mission Control Center in Salzburg, and that is tries to satisfy both the scientists, the engineers, the media, the public – and – the crew. Not an easy task if 17 scientific experiments out of more than 10 disciplines need to be conducted in nothing more than 14 days.

If I wouldn't know the people in the MCC better, I would feel uncomfortable looking at this package, but so I am confident that the people on the other side of the control loop will make their best efforts to ease up our life as much as possible, even if we are a(u)stronauts and supposed to function under a hell of stress in a day which would have to last for at least 26 hours to pack all the intended experiments in…

Signing off for today

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Wendy: not used

Honda Gas Hobbs Meter: 81.1 hrs
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: full

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
22:48 - 24,3 - 06 - 19 - off
06:55 - 26,6 - 06 - 15 - on - float
10:00 - 26,6 - 10 - 15 - on - float
17:44 - 25,8 - 08 - 19 - on - bulk

Notes/Comments: The spare nuclear generator is working well!

FE Hutsteiner is waiving good-bye to the departing EVA-team which is awaiting the decompression sequence in the stations main airlock.

Fuel Status (as of 18:46):

Diesel: Approximate Reading - full

Propane Tank: Approximate Reading - 49% (490 gallons = 1854.8 L)

Gasoline:
Consumed Today: 8 gallons = 30.3 L
Quantity Remaining: 2 gallons = 7.6 L
Notes/Comments: We bought 10 gal yesterday by our own.

Oil:
GenSet Quantity: 9.5 quarts
ATV Quantity: 10 quarts
V'ger Quantity: 9 quarts

Water Status:

Outside Potable Water Tank Level: 220 gallons = 832.8 L
Trailer Potable Water Tank Level: 0 cm from the base
Water Meter Reading: 9217.1 gallons = 34890.4 L
Water Consumed: 22.2 gallons = 84.0 L
Grey Water Used: 9.8 gallons = 37.1 L
Flushes: 7
Showers: 2
Sponge Baths: 2

Tonight's Meter Readings:

Out to Toilet: 2242.6
In to GreenHab: 14510.5(+22.9 since yesterday)

GreenHab:

Crops Watered: yes
Crop Condition: They are in good condition

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 1: Used - no
Oil Checked: no
Fuel Consumed: 0.5 gallon = 1.9 L
Tire Status: good

Kawasaki ATV 2: Used - no
Oil Checked: no
Fuel Consumed: 0.5 gallon = 1.9 L
Tire Status: good

Kawasaki ATV 3: Used - no
Oil Checked: no
Fuel Consumed: 0.5 gallon = 1.9 L
Tire Status: good

Notes/Comments: At ATV 2 the check belt light illuminated! Seems that it's the same as with ATV 1 5 days ago, the 100 hour service!

HVAC: Nothing new to report.

Mars Surface Suits: PLSS Nr. 1,2 & 6 Suits Nr. 4,5 & 6 Helmets Nr. 2,4 & 5 used for EVA 8.

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Notes/Comments: A nice day on Mars, wish everybody a nice evening!! True, I want to follow this statement.

XO Soucek activating the Fatigue Monitoring System – a test which is soon to become a daily routine.

Health & Safety Report
Gernot Groemer Reporting

We are still taking the 1000 mg of Vitamin C to prevent us from catching a cold as directed by medical control. The crew seems to get used fairly well to the plethora of test batteries such as getting blood pressure, body water content, weight, body fat content and all the psychological tests including the saliva sampling, the neurological batteries testing for alertness with three tests ranging from CogHealth from the Univ. of Texas at Galveston, the Fatigue Monitoring System of the Object Tracker company and the Pupillomyograph tests from the University of Innsbruck.

In addition, our Mission Specialist Life Sciences, Markus Spiss, has cultivated various agar cultures from spots within the hab including the glovebox, the toilet facilities, the command deck, laboratory areas as well as specified spots on the bodies of each crew member. Pretty much any spot showed microbiological activity, so we took pure cultures and grew them for 72 hours. The samples will be frozen and later be analyzed in the home laboratories in our base institutions.

Otherwise, the crew is doing very well; the continued EVA's put quite a physical load on each of us, resulting in minor back pain, as the analogue-suits do not allow for movements releasing some tension from the muscles like with ordinary hiking backpacks. One more thing on a side note: obviously the Hab is not really built for people of our size, especially as one of our crewmembers who prefers to stay anonmyous (it is the Commander, remark of author :)), bumped his head at the stairwell ceiling between the laboratory and command deck (well and other places as well.. he states, he's used to it.).

No traces of Hobo spiders, by the way, so I guess (or better: I hope), these two were in only ones in the close vicinity.

Signing off, yours truly

Gernot Groemer, HSO

Commander's Check-In
Alexander Soucek Reporting

"In all ages and epochs people have experienced the greatest happiness in embarking upon new voyages of discovery..."
- Y. A. Gagarin

Crew Physical Status: Entire crew in good shape, sleep budget not the best.

Brief Narrative of Today's Results: Today was again a day full of work, with two EVAs and a new experiment from the BioMars package. The day started with the third LiMa (Life on Mars) EVA in three days, again collecting samples from two WPTs, and, filling the last 30min, trying to fly the Aerobot, a flying device with mounted optical MiniCam for local area reconnaissance. Due to heavy winds, however, this testing had to be postponed. Breakfast and lunch were framed like every day by various tests (FAMOS, Myograph, medical measurements). In the afternoon, the second EVA crew of the day prepared for a novelty in the history of the MDRS: For the first time, sterile suits were used on top of the EVA suits to measure (quantify) contamination during EVA, in general and locally on different areas of the suit (also, micro spherules were applied on one normal EVA suit to quantify cross-contamination). This exensive experiment required two hours for suit-donning, including two assistents in sterile TYVEK suits. Difficulties were discovered only from a technical point of view (attachment of sample bags and fragility of sterile silver-gold suits).

Nevertheless this first AustroMars Track and Trace EVA added a unique new feature to the list of MDRS experiments and discoveries; the sample patches will be procured and examined in the coming days, and the crew eagerly awaits the second attempt tomorrow, combined with a MedMars rescue operation simulation - a challenge, that's for sure. After a new round of skin and saliva samples early evening, the crew prepared for the first relaxing evening of the mission: to celebrate Yuris night on this very special 12th April 2006, 45 years after the door to human endeavours in space was first opened.

EVAs: 2. Find details in EVA reports, (below).

EVA #9/10: G. Groemer (HSO, EVA CDR), M. Spiss (MSL) and Ch. Hutsteiner (FE). HabCom A. Soucek (XO). Main activity was the third BioMars sample collection. Crew took two samples from different sites (9/1 and 9/2), both app. 600m southeast from the Hab in vox and sight contact during the entire EVA. Continuous vox coverage also for MCC Salzburg, were two dozen people listened to the crew radio commands. EVA started at 0915 and ended at 1215. The last 45min were operated as EVA #10 as the crew took the ATVs and went to the AustroMars WLAN Area to take power boxes to the Hab which need to be modified. No anomlies during EVA.

EVA #11: Ch. Kandler (MSL, EVA CDR), Ch. Hutsteiner (FE) and A. Soucek (XO). HabCom G. Groemer (HSO). First BioMars Track and Trace experiment sequence, including sterile suit-donning procedures (taking up almost two hours). Testing of exterior suits and sample patches in proximity to the hab. Slight difficulties with strong wind. Then continued test using the ATVs app. 500m northwest of the Hab. EVA started at 1625 and ended at 1816. No anomalies.

Plans for Tomorrow: Revised Flight Plan of Day 6 will be received by MCC Salzburg later this evening. The most challenging event will certainly be the four-crew MedMars / Track and Trace EVA. Less interesting from a scientific point of view: Tomorrow morning the crew will enjoy one of the mission's rare spare time slots. We are sure we can avoid being bored during spare time by continuing the extensive AustroMars media outreach work in cooperation with our MCC...!

Report Transmission Schedule:

- Today's engineering report will be transmitted at 2000.
- The CDR report will be transmitted at 2100.

Anomalies: None.

Miscellaneous: "COMRADE KOSMONAUT": During EVA 9/10, crew and MCC (via passive vox) celebrated the first human space flight by various tributes to Yuri A. Gagarin, including radio transmission of his original pre-launch message.

Support Requested: none.

More to follow.

Alexander Soucek
Commander, MDRS Crew 48
"AustroMars," on behalf of CDR

Commander's Journal
Norbert Frischauf Reporting

AustroMars Mission Sol 5:
"Bacteria Day and Yuri's Night"

CDR Frischauf is inspecting the aerobot after retrieval from a field test.

If I had to describe this day in two words, I would most likely choose "bacteria day", as today's EVA's were all centred on biological experiments. Already in the morning, Gernot Grömer, the AustroMars Health and Safety Officer, Markus Spiss, our Mission Specialist for Life Sciences, and Christian Hutsteiner, the Flight Engineer, were going on the third LiMa (Life on Mars) EVA. This time Gernot was the EVA commander, while Alexander Soucek, the First Officer, acted as the HabCom. As LiMa is set to optimise the procedures for finding and processing potential life bearing samples, this experiment includes an extensive contamination protocol to enable the highest levels of planetary protection. Consequently the probes were always contained in sterile containers, carefully moved into the lab area of the MDRS and processed accordingly afterwards, by making use of a glove box.

Because this EVA was not intended to be a long range one, but took place in the vicinity of the Habitat, lasting 3 hours and 20 minutes, we used the occasion to test the AustroMars Aerobot. This system is a remote controlled and motorised aircraft, equipped with a camera to provide for excellent images. Resembling a some-what motorised paraglider, the Aerobot features an electric propulsion system, which can support a 10 minutes flight, depending on wind strength. We intend to use the AustroMars Aerobot in a exploration cascade as an intermediate reconnaissance system, situated between the satellite imagery and the AustroMars Rover, as its resolution and coverage lies exactly in between of those systems. Since I (Norbert Frischauf) was occupied in testing out the Rover, Christian had the pleasure of testing out the Aerobot. So far Christian and I are foreseen as Aerobot pilots, as we two are pilots in our daily lives as well. Christian flies helicopters at the Austrian air force and I am an acrobatic soaring plane pilot. Although we have successfully tested the Aerobot in the AustroMars preparation week, today we had no luck. At the first launch an unpleasant gust, had the Aerobot crash so quickly that Christian could not react, while at the second test, the propeller stopped just at the time when the Aerobot was starting to become airborne. Consequently the result was the same one as at the first launch. Because gravity did its best to prove its existence, a part of the Aerobot's structure broke loose and so we had to abandon all test flights for today to fix the damage (which was done in the afternoon).

After lunch the second EVA was due, again focussing on biological effects, but this time not so much on the search for life, but rather on the issue of contamination. The experiment is called "Track and Trace" and is set up to quantify backward and forward contamination. Measuring the backward contamination or the transport of material from outside the Airlock into the Habitat, was done by two astronauts wearing sterile covers over their space suits on which specific plates were mounted to collect samples outside of the Habitat and such to obtain data how much outside material is transported back into the Airlock and/or the Habitat. Contrary, the forward contamination experiment was done with a normal looking space suit, on which fluorescent micro spherules of different colour were applied to the left and the right arm. In addition specific places of the space suit were covered with special collectors, which were to accumulate some of these micro spherules to check for cross and forward contamination, which was happening while doing normal activities on the Martian surface. Christoph Kandler, the Mission Specialist for planetary Sciences, was the astronaut who conducted the forward contamination experiment, while Alexander and Christian wore the sterile space suit covers. During the EVA, Alexander acted as EVA commander while Gernot lead the experiment as HabCom. It is the first time that such an experiment to quantify contamination is undertaken and for sure Track and Trace was one of the toughest experiments so far, because the sterile covers pose a thermal challenge on the astronauts. Collecting geological samples proved to be a sweat driving exercise. In a sense of good luck however, the suit donning procedure had already taken 2 hours – although two other crew members dressed in TYVEK suits had helped the astronauts - so the EVA was cut to an acceptable minimum of 2 hours.

Bacteria day was finally concluded by some biological sample taking of hair and skin of the crew and now it is about time to come to the historical part of day: Yuri's Night!

As today is the 45th anniversary of Yuri Gagarin's spaceflight, space enthusiasts and professionals celebrate this great achievement with parties all over the globe. And of course AustroMars participates as well! In the morning EVA, Alexander had the great idea to surprise the EVA team by playing the Russian anthem adding a statement of Yuri Gagarin on his remarkable flight. For a moment the whole AustroMars world was united, as all of us here at the MDRS heard the words, as well as the MCC in Salzburg, since we transmit our EVA communication via Voice over IP directly to Austria. A lot of people had gathered at that time in the MCC and they all were extremely surprised, impressed and touched. Now, at the time when I write this report, with our daily work being finished it is time to lean back and to do the most obvious thing: join the world-wide Yuri's Night party here at the MDRS! After all the experiences we had so far, we will do so in the spirit that space flight is a world-wide endeavour and one of the best tools to ensure that countries and people can work together on critical technologies in a peaceful manner. The International Space Station is a first important step on this way, but when I look outside onto this Mars-like landscape I do hope that it will not take another 45 years for humanity to finally leave its cradle and to set foot on Mars…

Signing off for today

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Wendy: not used

Casper Hobbs Meter: 97.1 hrs
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: full
Oil Pressure: 0 PSI
Water Drained: no

Notes/Comments: Honda

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
23:10 - 25,8 - 08 - 19 - on - bulk
06:40 - 26,7 - 07 - 21 - on - float
08:30 - 25,7 - 09 - 17 - on - bulk
13:00 - 27,4 - 09 - 19 - on - bulk
19:05 - 26,6 - 09 - 22 - on - float

Notes/Comments: Wendy is alive!! And Yuri's night, what a great day!

Fuel Status (as of 21:35):

Diesel: Approximate Reading - full

Propane Tank: Approximate Reading - 49% (490 gallons = 1854.8 L)

Gasoline:
Consumed Today: 11 gallons = 41.6 L
Quantity Remaining: 14 gallons = 53.0 L

Oil:
GenSet Quantity: 8.5 quarts
ATV Quantity: 10 quarts
V'ger Quantity: 9 quarts

Water Status:

Outside Potable Water Tank Level: 550 gallons = 2082.0 L
Trailer Potable Water Tank Level: 15 cm from the base
Water Meter Reading: 0 gallons = 0 L
Water Consumed: 0 gallons = 0 L
Grey Water Used: 0 gallons = 0 L
Flushes: 9
Showers: 2
Sponge Baths: 2

MSL Spiss and HSO Groemer prepare XO Soucek for the first backward-contamination EVA during the mission.

Tonight's Meter Readings:
Out to Toilet: 2288,4
In to GreenHab: 14578,4 (+69,9 since yesterday)

GreenHab:

Crops Watered: yes
Crop Condition: They are in good condition

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 4 gallons = 15.1 L
Tire Status: good

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 0.6 gallon = 2.3 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 0.6 gallon = 2.3 L
Tire Status: good

Kawasaki ATV 3: Used - yes

Oil Checked: yes
Fuel Consumed: 0.3 gallon = 1.1 L
Tire Status: good

HVAC: Nothing new to report.

Mars Surface Suits: PLSS Nr. 1,2,5 & 6 Suits Nr. 1,4,5 & 6. Helmets Nr. 2,3 &4 used for EVA 9, 10 & 11.
Computers/Networking Infrastructure: Nothing new.
Appliances: Nothing new.
Data Logger: Nothing new.
Upgrade Work: Nothing new.
Notes/Comments: We're happy the Wendy is back on our side. We wish the whole space community a happy Yuri's night!!

Health & Safety Report
Gernot Groemer Reporting

The moment I sent out the HSO report yesterday about the absence of Hobo spiders, another specimen crawled across in the command deck. Fortunately, we found a can of anti-spider spray, which we intend to use in cracks and potential hiding areas.

Otherwise, we commenced the first "Track and Trace" experiment during EVA 11 dealing with the forward and backward contamination issue which turns out to become a more and more serious discussion topic in the scientific community. That meant actually "making our hands dirty", to be more precise, squeezing two analog astronauts into two mylar-foil based suits which were applied over the existing suits.

Although most of the sunlight gets reflected by the BioMars-suits outer layer, there is still internal heat building up from the body warmth of the analogue astronauts making every BioMars EVA a physical challenge.

It has been a major concern, that the thermal regulation of the subjects bodies might fail, so the original plan was to monitor the body core temperature. Due to a technical glitch in the hardware, this equipment was not available. As we were also using the Draeger Phase Change Material vests, and we were conducting the EVA in close range to the Hab, were monitoring the Heart rates and made sure, the crew was properly hydrated.

Surprisingly, both test persons, the XO and the FE were fairly happy with the thermal properties, it was even hotter with the suits inside the hab than it was outside, so no problem. At this point I should say a big thank you to Austrian Aerospace which generously provided us with the space-qualified thermal layer protective sheets which comprised the outermost layer of the BioMars suit and did their part in preventing us from a heat stroke.

Healthwise there were no major incidences to report. We all feel the lack of sleep these days and so we are logically very pleased that Mission Control has allocated another hour of extra sleep to our tight and cramped flight plans (which, since yesterday, has inofficially been dubbed as "flight plan") to at least after 5 days of tedious work, we get the chance for a luxurious 8 hours sleep.

Good night to Earth.

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: good.

Brief Narrative of Today's Results: Mission feedback and wrap-up session in the morning. Medical rescue operations EVA in the afternoon. All other experiments performed as usual.

EVA: 1. See EVA Report

Plans for Tomorrow: See finalised version of Flight Plan for Day 7 to be sent by MCC Salzburg.

Report Transmission Schedule:

1. Commander's Check-in: 18:30
2. Commander's Report: 20:00
3. XO Report: 20:00
4. HSO Report: 19:00
5. Engineering Report: 19:00
6. MSL Report: 20:00
7. MSP Report: 21:00
8. EVA Report: 21:00
9. Photographs: 21:00

Alexander Soucek
Commander, MDRS Crew 48 "AustroMars," on behalf of CDR

Commander's Journal
Norbert Frischauf Reporting

AustroMars Mission Sol 6:
"First Aid on Mars"

Even on a remote and rather friendly place like Mars, accidents are likely to happen. One small step and an unwary astronaut can easily tumble, breaking his arm or leg or receiving even worse damage. This and the procedures for first aid and safe transportation of the patient was exactly what we wanted to simulate in today's MedMars EVA. To make the scenario as real as possible, two astronauts – EVA Team 1 with Gernot Groemer, our Health and Safety Officer, acting as EVA Commander, and Alexander Soucek, the First Officer, went onto a geological sample excursion (dubbed "GeoMars") in the close vicinity of the Habitat. Something like 400 m away in easterly direction, EVA team 1 obtained the first geological sample. After a careful sealing for later processing, the team moved on and then - the simulated - disaster struck: Alexander slipped and fell unluckily against a stone, presumably breaking his right ankle joint. Gernot came quickly to his rescue. Realising that Alexander had (simulated) pain and could not stand up any more, Gernot contacted HabCom, which was at that time myself, supported by Christoph Kandler, the AustroMars Mission Specialist for planetary Sciences. After careful consulting, the HSO declared a level 3 emergency, asking for a 2 men rescue team (EVA Team 2) to come to the accident site as quickly as possible for support. We informed MCC Salzburg and ordered Christian Hutsteiner, the Flight Engineer, as well as Markus Spiss, our Mission Specialist for Life Sciences, to don their space suits as fast as possible to come to their help.

In the record time of approximately 20 minutes, EVA Team 2 had finished donning their suits and stepped into the airlock. In the meantime, Gernot had stabilised Alexander, who was lying unpleasantly on a little hill and has given him some medicaments (simulated) to ease the pain and stabilise the blood pressure. 10 minutes later, EVA Team 2 was on its way, taking with them a splint and a camera to monitor all the steps of the first aid procedure for the medical doctors in Austria.

Alexander did his best to simulate an injured patient. Every time he started to whine it felt not at all as a simulation anymore and then both Christoph and I, monitoring and co-coordinating the rescue mission from inside the Habitat, hoped that the rescue EVA team would start to run to reach them faster. As human as this is, it is of course of no good as no one would want to risk the health of the rescue team as well.

Finally EVA Team 2 had reached Alexander and Gernot and started the first aid. Stripping of the right legging of Alex' space suit they could stabilise his foot ankle and once this was finished transportation of the patient started. Luckily the accident had happened not so far away from the MDRS, so the transport took only but a few minutes. Still everyone said afterwards that it required a lot of effort to transport the patient and even Alex was exhausted, claiming that holding fast to the spacesuits of his rescue team was everything but easy. The effort required is most likely best visible from the energy consumption of Markus. Although he was only one hour outside he burnt 729 calories.

Once Alexander was inside, the simulation did not end. He was stripped of his space suit and laid back in the lab area, where Gernot and Markus applied a cast to his (simulated) broken ankle joint. At the time that I write this report, Alexander is still wearing the cast to see how much he is immobilised. All that was photographed and videotaped to be later studied in detail by several medical doctors back in Austria. And the doctors are not the only spectators, we covered the whole experiment as well for the Austrian Broadcasting Cooperation, which will most likely include it in their AustroMars documentary.

In general this experiment had worked very well. The minor flaw that the camera had not worked properly at the first instance was quickly recovered by doing a second bandaging simulation at a closer distance to the MDRS. The positive side effect of this was that the procedure was done a second time, proving its worth then as well.

All in all it was a very successful day. We have managed to stick to the flight plan and fulfilled today's objectives. Now, at the 6th day into the mission, our daily routines are starting to become a real part of our daily live. No one really recognises anymore all the medical tests we have to take during the day, I suppose we might even miss some of these experiments once we leave MDRS again – well almost. Yesterday's Yuri's Night was a real blast for the crew's morale. Having six Austrians sitting together, joking and singing loudly Austropop songs of the eighties and nineties is something I will never ever forget for the rest of my life. If there is one magic about the MDRS - beside of simulating a Martian space flight - it is the feeling of fellow- and friendship that can rarely be experienced at such an intensity like at this place in the middle of nowhere…

Signing off for today.

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Executive Officer's Report
Alexander Soucek Reporting

Official name of the day: "Bureaucracy day." Today was a intensive but interesting day for the crew in various senses. The long-awaited spare time slot in the morning, needed after a very nice Yuris night celebration, turned into a mission feedback and discussion session upon requests from MDRS and our MCC who both requested alternated procedures on reporting and had some more questions concerning the scientific output so far. Needless to say that pure science is done after the mission; during the mission, the main goal is data collection, sample procurement, pre-science activities and extensive procedures testing. During the last days, the crew of AustroMars has also spent many hours to bring the station into perfect conditions (power, extensive - Hab cleaning, ATVs, working on suit improvements, installing of airlock light, etc.) for new crews to come.

With such an extensive workload, and in the middle of a truly ambitioned science, engineering and outreach mission, yesterdays message of the main power generator finally functioning properly was received with relief. Today, just 24 hours after the first ever performed comparative and quantitative forward-backward contamination experiment at MDRS, the crew undertook the first emergency rescue EVA of the mission. In the vicinity of the hab, an accident was simulated with one astronaut breaking his right ankle. Both the rescue ops as well as the post-rescue ops were performed and also filmed to allow for post-EVA evaluation. A plaster was applied by the mission medical experts, HSO and MSL. Having had the honour of being the patient, I am still sitting with a 60cm plaster on my right leg.

This morning we had two internet videoconference sessions using switch-X. Those 5min slots are recorded by the Austrian Broadcasting Corporation and aired on the ORF Alpha science website, bringing the work and life at MDRS, but most important of all the rationale behind analogue Mars missions, to the general public. These videos receive extraordinary publicity (as the entire mission), and we are glad that, beside dry science, AustroMars can convey the importance and usefulness of the programme to outsiders. Information and fascination are as important as rocket fuel in order to persue the exploration of space.

As this evening is filled with nine different reports to be handed in to various receivers, we have to delay some of the planned lab activities to tomorrow.

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Casper: not used

Wendy Hobbs Meter: 3295.4 hrs
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: full
Oil Pressure: 30 PSI
Water Drained: no

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
08:30 - 27,5 - 09 - 19 - on - bulk
11:10 - 24,9 - 07 - 21 - off
12:10 - 24,8 - 07 - 21 - off
13:10 - 24,6 - 06 - 22 - off
16:10 - 22,1 - 07 - 24 - off
17:10 - 22,3 - 09 - 25 - off

Fuel Status (as of 19:30):

Diesel: Approximate Reading - full

Propane Tank: Approximate Reading - 49% (490 gallons = 1854.8 L)

Gasoline:
Consumed Today: 1 gallon = 3.8 L
Quantity Remaining: 13 gallons = 49.2 L

Oil:
GenSet Quantity: 8.5 quarts
ATV Quantity: 10 quarts
V'ger Quantity: 9 quarts

MSL Markus Spiss assists HSO Gernot Groemer in applying a cast on the „broken“ leg of their XO.

Water Status:

Outside Potable Water Tank Level: 510 gallons = 1930.6 L

Trailer Potable Water Tank Level: 15 cm from the base
Water Meter Reading: 0 gallons = 0 L
Water Consumed: 0 gallons = 0 L
Grey Water Used: 0 gallons = 0 L
Flushes: 10
Showers: 2
Sponge Baths: 2

Tonight's Meter Readings:
Out to Toilet: 2332,0
In to GreenHab: 14578,4 (0 since yesterday)
Notes/Comments: I'm actually checking the GreenHab, seems there is something with tank No. 5, maybe the electrical giver has a problem! A situation report will follow.

GreenHab:

Crops Watered: yes

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 1: Used - no
Oil Checked: no
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Kawasaki ATV 2: Used - no
Oil Checked: no
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Kawasaki ATV 3: Used - no
Oil Checked: no
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Notes/Comments: The drive belt was checked today, and was found in good condition (moving range 25 mm).

HVAC: Nothing new to report.

Mars Surface Suits: PLSS Nr. 1,2,5 & 6 Suits Nr. 1,4,5 & S1. Helmets Nr. 2,3,5 &4 used for EVA 12. First report of Suit S1 will follow.

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Health & Safety Report
Gernot Groemer Reporting
HSO - Personal Martian Report:

- In addition to the HSO report, written at 20:00

- In addition to the EVA report, written just before
- In addition to the MedMars experiment report, to be written after that report

Today's focus was clearly the medical EVA, which originally started as an official geology excursion, but soon, after one hour of sample taking, turned "surprisingly" into a medical situation, as the XO "fell down" and broke an ankle. We activated the back-up team at the Hab, two more members of the flight crew to do an emergency donning, which takes only 20 minutes until egress from airlock (on the downside, there is no water attached, no medical monitoring attached and no pre-flight ultrasonic measurement, no aspirin taken before depressurization, no weight measurements, no triple-check of the air supply and similar things).

The rescue team also brought splinting material and drugs: but how can you administer a drug without puncturing the outer hull of the space suit? Our first idea was, to add the drug into the airstream, as there are already experimental analgesics which can be dispersed via the airstream of the intake manifolds. However, this turned out to be very difficult, as the activation mechanism is very hard to use with the pressurized gloves. Instead, we attached the placebo (lemon syrup) into the fluid intake, so by pressing the drug capsule against the plathapus joint, the fluid was easily dripping down the tube into the mouthpiece of the patient.

I hadn't told him, what I was using as a drug, I just mumbled something about "dear-XO, this-time-you'll-have-to-put-some-trust-in-your-paramedic", until I saw his corner of the mouth involuntarily go upwards and then a big smile on his face: the drug had reached its recipient.

Getting him up was comparably easy, but carrying with two mountaineering rescue slopes was a tedious and extremely exhaustive task: I doubt that the astronauts on a crewed Martian surface mission will have the muscular strength to carry another fully-suited patient, but at least we could show that without hardly any additional equipment it could be done – and that is exactly what we are doing here for some of our experiments: prove of concept.

Details about the medical experiment are currently written into the science reports which will be collected and studied later on in more detail as soon as time permits (post-flight).

HSO Report:

Hydration is a real challenge out here at the station: the crew is working hard, and sometimes, the EVA activities can cause a lot of physical stress, but at the same time the high spirits keep you from realising you're thirsty. Therefore it is one of the main activities of the HSO to make sure the Crew is hydrating enough. In addition, we are still keeping a close track on the fluid balancing, marking every milliliter of liquid that enters of leaves our bodies. In the morning, post-EVA and before bedtime, everyone takes urine samples to be analyzed later on in our labs back home in Austria: The research is -amongst other- focusing on stress hormones and other markers.

Performing basic first aid under simulated Martian conditions is a very challenging task.

One of the station specific challenges from the safety point of view are the many wooden components, e.g. from the stairs to the tables etc. Most of us have already had their share of small wooden pieces punctuating the skin. Usually this poses no threat to one's health as long as there is an active Tetanus vaccination in place. But here, a reduced immune response due to stress and a microbiologically challenging environment raise the chance of getting small infections, so we have to keep these micro wounds very clean.

After yesterday's Yuri's Night "party" (which was a fantastic dinner with a lot of fun, great music at the command deck), we received our share of sleep and the crew spirit was considerably higher in the morning. Otherwise nothing else to report in detail.

Signing off yours truly,
Gernot Groemer, HSO

EVA Report
Norbert Frischauf & Gernot Groemer Reporting

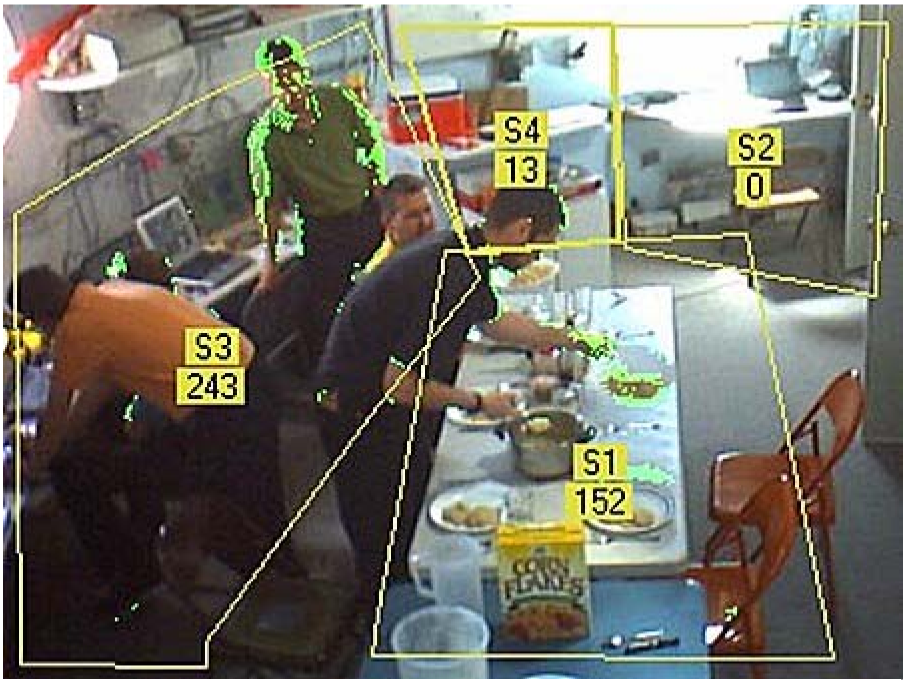
EVA Number: 12
EVA Name: GeoMars/MedMars

Objectives: Acquire some geological samples in the near vicinity of the Habitat at coordinates UTM NAT27 14250685 N and 518751 E by EVA Team 1. Afterwards an accident is to be simulated. A rescue EVA Team (EVA Team 2) is to be called in. First aid and transportation of the wounded astronaut are to be practiced.
EVA Commander: G. Groemer
EVA Navigator: G. Groemer
EVA Crew: A. Soucek / C. Hutsteiner, M. Spiss
Hab Comm: N. Frischauf
Planned Route: MDRS to UTM NAD27 14250685 N and 518751 E

Timeline:
Don Suits: 14:30 (Team 1 - Groemer and Soucek):
Don Suits: 15:00 (Team 2 - Hutsteiner and Spiss)
Enter Airlock: 14:48 / 15:45
Egress: 14: 58 / 15:55
Ingress: 16:35
Enter Hab: 16:45

New Waypoints Established by EVA Crew: None

Samples: Geological Sample 12-1
Sample Number: 12-1
GPS-Coordinates: UTM NAD27 14250685 N and 518751 E
Time: 15:00
Photos: 3



A screenshot from the object tracker software indicating areas of activities which will later be used to analyze workflow patterns.

Narrative: This EVA was originally intended as a geological excursion to take more samples from a site where white piles indicated gypsum abundances south of Phobos Hill. After taking that sample, XO Soucek –in a "intended" mission anomaly - fell down and injured his right ankle. A level 3 emergency (means: abort EVA; secure equipment and crew, return to station) was declared and telemedical support initiated by the Habcom to the Flight surgeon team at Mission Control. Two additional Crewmembers donned their suits in an emergency procedure which allows for a suit-up in about 20 minutes (instead of 60 minutes). The medevac team arrived about 30 minutes later on-scene, bringing a) equipment to stabilize the injured leg and b) to administer a liquid "analgesic" (lemon juice) into the drinking water system of the patient. In an exhausted excerise, two EVA-teammembers carried the patient back to the hab, cycling him through the airlock and provide further medical treatment including the application of a cast.

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: very good.

Brief Narrative of Today's Results: Extensive documentation of samples and data collected so far. Housekeeping procedures. Daily tests (FAMOS, Myograph, Object Tracker, saliva and urine, medical basic data); third part of the PsychoMars questionnaire battery. Greenhouse work. Fixing of WebCams.

EVA: none.

Plans for Tomorrow: See finalised version of Flight Plan for Day 8 to be sent by MCC Salzburg.

Report Transmission Schedule:

1. Commander's Check-in: 18:30
2. Commander's Report: 20:00
3. XO Report: handed in.
4. HSO Report: 20:00
5. Engineering Report: 20:00 depending on Greenhouse pump work
6. MSL Report: 20:00 depending on Greenhouse pump work
7. MSP Report: 21:00
8. EVA Report: none
9. Photographs: 21:00

Miscellaneous: nothing.

Support Requested: none at present

More to follow.

Alexander Soucek
Commander, MDRS Crew 48 "AustroMars," on behalf of CDR

Commander's Journal
Norbert Frischauf Reporting

AustroMars Mission Sol 7:
"The Right Stuff"

Today, as we have nearly reached the halftime of the AustroMars mission, our Mission Control Center (MCC) in Salzburg decided that we should have a little bit of rest. Therefore our flight plan was set up that we would have spare time in the morning and would not conduct any EVA to reload our internal batteries. Also it was decided we would have time devoted this evening to watch a movie, for which the crew had quickly made up its mind that this one should be “The right Stuff”, by Philip Kaufman.

Spare time in the AustroMars slang does of course not mean that we would have free time, but rather that we could work on our scientific reports, do some housekeeping, conduct a video conference and take care of the burning issue of the missing water flow into the GreenHab. Here – after some extensive checking and testing - a broken grey water sump pump was identified as the root cause of the problem.

So, Markus Spiss, our Mission Specialist for Life Sciences and Christian Hutsteiner, the Flight Engineer, continued where they had stopped yesterday night: repairing or exchanging the grey water pump and checking the water quality indicators of the GreenHab. The first measure was to add water (several litres) into the nearly empty tank number 5 to make sure that the bacteria in this tank would not decay. Next on the list was to find a spare pump. After some search, Markus and Christian found an old pump which had the problem that its electrical contacts were not properly cased, so one could not use it as a submerged pump. Nonetheless it was identified as a good interim solution to pump the grey water from the grey water tank into the GreenHab system. Piping was adapted to fit to the GreenHab water pipes, the pump was plugged onto the electric grid and it started to pump! To avoid any problems with the electric contacts, Christian and Markus devised a solution where only the lower part of the pump would be exposed to the grey water, leaving the pump contacts out of the water. This solution worked and so we had at least an interim solution for this anomaly at hand. Interim only, as the pump has to be manually adjusted permanently to stay close to the grey water level, to pump effectively but not get submerged at the same time.

Dissatisfied with this solution, Christian and Markus got into contact with the MDRS Engineering Team to learn that there is a 12V bilge pump available that could be used as well, but which was not broken and could therefore be submerged. After 3 hours of hard work, the two succeeded and the new 12V bilge pump was installed. Now we have to wait for a timer that has to be installed as well to limit the pumping time of the new sump pump. If the pumping time is not constricted, the sump pump would pump so much that the GreenHab tanks could overflow in the worst case. Until the timer is there, we will therefore manually switch on and off the new sump pump.

While Christian and Markus were busy in implementing the sump pump, the rest of the crew was concentrating on housekeeping, writing reports and checking emails. Both Markus and Christoph Kandler, the AustroMars Mission Specialist for planetary Sciences, used the extra time to conduct an extensive documentation of samples and data that had been collected so far. Gernot Grömer, the Health and Safety Officer, whirled through the laboratory area to clean gloves and rooms, while Alexander Soucek, the First Officer and I (Norbert Frischauf) used the time to improve communication with the MCC, Principle Investigators and the media.

Even though we had a more relaxed sol today, the scientific programme demanded its tribute and ordered us to collect saliva and urine samples, measure blood pressure, weight and body water, do sleepiness tests (FAMOS and Pupillomyograph) and to conduct an extensive psychological survey in the afternoon.

Now, at the time when I write the report, the crew is pretty much relaxed and in good mood. The break was a really good thing and proved its worthiness, especially after the last few days, with their very compressed and demanding activities. It is great to see how this six men grew together over the last 6 sols. By now I would say that the AustroMars crew resembles more a family than a group, an observation that was wonderfully backed up when our Flight Engineer entered the Habitat with a big smile, looking around at each of us, proudly declaring that the new bilge pump is installed and works. Spontaneously everyone in the Habitat applauded, acknowledging the hard work that Christian and Markus had devoted to this effort.

In a few hours, once we have finished writing our reports and had dinner together, we will watch the movie. I will then again look around and I am pretty sure that I will be reaffirmed in one thing: This group of people, backed up by 4 more on-site, 30 more in the MCC and several others back in Europe, possesses quite a lot of that was is supposed to be “The right Stuff”…

Signing off for today

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Executive Officer's Report
Alexander Soucek Reporting

Official name of the day: "Dung day"

A screenshot from the Pupillograph device. Note that he test subject is about to fall asleep.

A day without simulated anomalies (at order of the crew psychologists) and without real EVAs -- bound to be boring, one might think. Nevertheless, two activities filled this day with action. Action of a different kind, one should add. The first activity covering the day was reporting, reporting and reporting. The crew had to catch up with a lot of issues that had been put on hold during the last few days. I must say that, with a cup of instant coffee, and just having completed all of my psychological tests for the afternoon, it is enjoyable.

It is a very interesting observation, and this is not meant sarcastically, how fast administrative issues start to take up your time. In "real life" I work as a lawyer at the European Space Agency ESA in Rome, surrounded by scientists and engineers, who complain all the time about bureaucracy (and us, the legal experts...). I did not really feel very sorry for my friends, but now I start to understand. On the other hand, science without documentation is a waste. And the more complex a mission is, the more we have to take care to update all people involved and to bring home a well-structured "package" of results. We are getting there!

And so we are documenting today.

Outside we have a Martian sandstorm as well. And for all who don't believe it... Go a bit closer to your screen or paper and look at my letters -- they are covered with fine sand. But if you REALLY want to know, I'll tell you the story behind today's storm. AustroMars is powered by our Mission Control Center in Salzburg, Austria, and by our On Site Support (OSS), three brave and crazy guys making the impossible possible on a constant basis. In real life, they don't exist, of course, because we are on Mars, hence OSS are our "ghosts of Mars". Ghosts are mostly invisible, but sometimes... sometimes ghosts have simply to put WLAN equipment under the MDRS hab. Hence the sandstorm. Take precautionary measures, cover windows, etc. The illusion of isolation is an important psychological aspect of any high fidelity analogue Mars surface mission.

Besides, we really have a strong storm outside and wait for reported thunderstorms tonight.

A day full of peace and sand at MDRS. But no. Today was "dung day", and this is unfortunately not meant metaphorically. The Greenhab greywater pump decided to quit working. Just like that. Our Flight Engineer Christian Hutsteiner and our Mission Specialist for Life Sciences, Markus Spiss, spent the morning diving through brown water in a search for the cause of the problem. And when they found it, they fortunatley were able to fix it. Just between us, Crew 48 was not permitted to go to the toilet for quite some hours. This little story reminds me of the complexity of toilets onboard spacecrafts, e.g. the Space Shuttle. You would think it is a simple thing, such a toilet, but it can be very tricky at times. FE and MSL are the heros of today. For various reasons we should grant them an extra shower.

The team spirit is good among all of us, we had a good night's sleep, we know our blood pressure, we gave our saliva and urine samples for the benefit of science, we answered hundreds of questions from the PsychoMars questionnaires and we are drinking water -- so much water like never before. Our Flight Surgeon at MCC told us to watch out for a good daily fluid balance. Compliance with a mysterious connection to the Greenhab pump problem... We worked on the Bio samples taken during the last EVAs, the geological samples, and concluded a detailed report on the first use of our sterile external EVA suits used for the "Track and Trace" contamination quantification experiment.

And for tonight... The flight plan foresees a movie evening, and guess what we have decided on -- THE RIGHT STUFF. Of course. A perfect world, if only... if only the flight plan would not foresee something else before that... cooking. Note to self: with the First Officer on galley duty, I'd better start to think about the menu.

Good morning Salzburg, good night Mars.

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Casper: not used

Wendy Hobbs Meter: 3308.6 hrs
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: full
Oil Pressure: 30 PSI
Water Drained: no

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
20:48 - 27,0 - 10 - 26 - on -bulk
10:13 - 21,3 - 20 - 21 - off
10:25 - 21,7 - 13 - 21 - off
10:55 - 24,4 - 13 - 24 - on - bulk
15:00 - 26,6 - 12 - 24 - on - float
18:10 - 26,6 - 09 - 24 - on - float

Fuel Status (as of 18:56):

Diesel: Approximate Reading - 7/8

Propane Tank: Approximate Reading - 49% (490 gallons = 1854.8 L)

Gasoline:
Consumed Today: 0.5 gallon = 1.9 L
Quantity Remaining: 12.5 gallons = 47.3 L

Oil:
GenSet Quantity: 8 quarts
ATV Quantity: 10 quarts
V'ger Quantity: 8 quarts

Water Status:

Outside Potable Water Tank Level: 500 gallons = 1892.7 L
Trailer Potable Water Tank Level: 0 cm from the base
Water Meter Reading: 0 gallons = 0 L
Water Consumed: 0 gallons = 0 L
Grey Water Used: 0 gallons = 0 L
Flushes: 2
Showers: 2
Sponge Baths: 2

Tonight's Meter Readings:
Out to Toilet: 2346,2

In to GreenHab: 14698,6 (+ 120,2 since yesterday)
Notes/Comments: Today (since yesterday 19:00) we used more freshwater because we filled some of the water into the greenhab to substitude some of the missing greywater, also we used freshwater for the manual flushing of the toilet. In the afternoon I installed the 12VDC RuleMate 1100 pump with big support from our MSL. Exact datas I will send in an extra email. Now the toilet works again on greywater. Hipieh!!

GreenHab:

Crops Watered: yes
Crop Condition: Pretty well!

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 0.2 gallon = 0.8 L
Tire Status: good

Kawasaki ATV 2: Used - no
Oil Checked: yes
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Kawasaki ATV 3: Used - yes
Oil Checked: yes
Fuel Consumed: 0.3 gallon = 1.1 L
Tire Status: good

HVAC: Nothing new to report.
Mars Surface Suits: Nothng new.
Computers/Networking Infrastructure: Nothing new.
Appliances: Nothing new.
Data Logger: Nothing new.
Upgrade Work: Nothing new.

Notes/Comments: The whole day was under the motto greywater sump pump! After an interim solution to fill up the greenhab with greywater, we fixed the sump pump problem in the afternoon with the installation of a new DC pump. Also the third indoor webcam is back online!! So this day goes to an end and hopefully my skills won´t be needed until tomorrow!

Health & Safety Report
Gernot Groemer Reporting

As this was a day without any EVA or dangerous EVA business, the probability for medical incidences was truly low. The crew is in good health and has even managed to improve their fluid intake to above 2 litres per day as a consequence of a constant reminder from our beloved flight surgeons in the Mission Control Center.

Today's main and only health concern is the amount of time Hutti (C. Hutsteiner, FE) and Markus (M. Spiss, MSL) are spending in the Greenhab due to a water pump failure. It is on the one hand very impressive to observe these masters of improvisation when they build a nuclear reactor from a piece of a wood and a wire, but on the other hand they are working in a septic environment. Thanks to the training of our MSL, the risk of cross-contaminating the crew with the plethora of bacteria cultures flourishing in the Greenhab is rather low, but still we have to observe a number of basic rules.

Amongst them is a strict wash&desinfect-your-hands-afterwards policy and the rule that the people working in the Greenhab shall not prepare the food for that day. (On a side note, Markus made a remark, that by working in the Greenhab he would be able to avoid any cooking duty was commented by a strange "we'll-see"-look by the rest of the crew ;-))

On a real mission it is also to be expected, that astronauts might deal with septic environments: the experiences on space station MIR have shown us, that even a "sterile" masterpiece of engineering floating in orbit is not protected from very earthly germs which also pose a threat to computer equipment.

Learning to live with these blind passengers is also something we do here at the station therefore adding a biological component to the research going on here. Hence, we are also very much looking forward to the incubator operations, as our MSL has put several sterile agar plates across the hab to study the microbiological burden on men and machinery. In a few days we'll know more...

Signing off, yours truly
Gernot Groemer, HSO

HSO Personal Report

Finally, after 6 days of mission operations, we got a free 4 hours spare time slot for (nearly) each of us, which was spent in various ways. I for myself enjoyed writing the first private email to my girlfriend, having a short one-way communication with the MCC (which finally got the absolutely cool offical MCC-AustroMars Polo shirts - they really look great from what we can tell via the web cams). A group of visitors among others from the Salzburg amateur astronomical society were present, and I even saw my father pop up in the web cam of the MCC - and, best of all, I was told that my girlfriend would be on MCC duty during the upcoming weekend. Unfortunately, in the low-profile shifts, when we are sleeping between 07:00 and 13:00 MCC time, when only the Flight Director, CapCom, Flight Surgeon are on duty and the rest of the team, including the back-seat teams are on stand-by (but it is very, very nice and comforting to know that people are watching who you know very well).
Another very nice thing was to take a closer look to the web casts of the TV productions which have been aired so far: we didn't expect so much publicity over such a long period of time. Yes, we are running a web-log on the internet-sites of the Austrian broadcasting corporation, but our (nearly) daily video logs are being put on the web as video -on demand on the Bayern Alpha website, a tech-science and cultural TV channel, airing in Germany, Austria and Switzerland. In addition four provinces of Austria (Tirol, Vienna, Styria and Salzburg) have shown several-minutes contributions in their news, most of which we can see via web cast a few hours afterwards. The funniest part is always reading the web entries of people commenting the video-messages.
We heard that the Salzburg AustroMars-related Yuri's Night Party attracted 100 people, which is a nice success, given the rather (size-wise) moderate location. Besides this, we did some clean-up in the Hab, fixing many small things which were not vital to mission success and there were postponed, but having a working power supply for ones own laptop definitely makes our lives easier.

HSO Gernot Groemer taking another Pupillograph measurement. These data quantified the perceived lack of sleep already during the mission.

Signing off, yours truly

Gernot Groemer, HSO

B i o M a r s   S u i t   R e p o r t
A l e x a n d e r   S o u c e k   R e p o r t i n g

First use of BioMars Experimental Sterile External Suits

Background:

BioMars consists of two experiments, "LiMa" (Life on Mars) and "Track and Trace". The latter one is the first ever conducted quantitative backward forward contamination experiment at MDRS. Various experimental set-ups test the quantity of organic material being carried from the station onto Martian surface as well as from the surface back into the station; additionally, the cross distribution change of material on the EVA suits during EVA activity is measured. Whereas the forward contamination and suit cross-distribution is measured with fluorescent micro spherules, the backward contamination is quantified using sterile cellulose patches attached to sterile external suits. This report describes the first testing of the BioMars backward contamination quantification method, i.e. the first test use of sterile external suits.

The fligth crew during lunch.

First Application:

The AustroMars crew flight plan foresaw the first usage of the BioMars suits for Wednesday, 12th April, afternoon, during EVA # 11. Three crew members were assigned for this EVA: Ch. Kandler, EVA Commander, as only "normally dressed" analogue astronaut, and Ch. Hutsteiner and A. Soucek testing the suits.

The procedure started with a normal suit-donning of the MDRS EVA suits, enriched by the AustroMars medical telemetry devices (heart rate and CO2 measurements). The PLSS was mounted, but not the helmet yet.

After procedure up to PLSS mounting, the two suit-donning assistants G. Grömer and M. Spiss, both in semi-sterile TYVAK suits, prepared the sterile external suits. The team of BioMars around B. Sattler, S. Klammer and F. Selch had constructed, sterilized and packed nine suits in total in Austria, and shipped them to the USA together with 600kg equipment of all other AustroMars experiments. The suit consists of a pair of trousers, a jacket and a PLSS cover, all in substance ABC protection suits1 of the Austrian army covered with silver Mylar foil. The outside of the foil was sterilised, and the parts were separately packed in sterile plastic bags for transportation and storage. For the first test EVA, two packages were used (# 1 and 4). The two assistants had to prepare one test subject at a time, as the procedure of suit-donning was more complex than expected.

First, the crew member had to put on the trouser without touching it and without the trouser being touched by anything else than the glove-covered hands of the assistants – and without touching the ground. What sound easy in terms of every-day life turns out to be quite complex with a space suit and in the narrow environment of an airlock and a 3m² EVA prep room filled with four people. It has to be added that the analogue airlock environment is not sterile; hence the care applied may seem illogical to outsiders. However, one task beside the actual quantification was to test the suit and suit-donning procedure as such. Insofar it made sense to stick to the sterile procedures as close as possible.

After the trousers, the jacket was put upon the test subject, even more complex. It turned out that the large hole on the back, foreseen for the PLSS, could not be used as planned, because the jacket could not be put over the PLSS easily. Therefore the assistants had to cut the lower backside strip of the jacket (and close it again after having slipped the jacket over upper body, head and PLSS of test subject).

Jacket Donning:

When these procedures were finished, a 'nice' side effect could be felt by the crew member wearing the new exterior cover: heat. A. Soucek, who was dressed first, had to wait almost 40min fully suited in the airlock, which was a challenge for his blood circulation. Although not moving, his heart rate was constantly above 100.2

Finally, the PLSS cover was attached by the assistants, who had to come up with some improvised solutions in order to figure out the best and most efficient way to do so. This sub-part of the donning sequence took another 15min approximately.

It has to be said, however, that HR measurements are to be judged carefully as the proximity of various test subjects may give wrong measurements.

Then, the helmet was attached to the PLSS system, closed and fixed. All in all, the procedure for one test subject had lasted 45min (Note: for just one!).

After test subject one had been fully prepared, the sequence was started was subject 2 (Ch. Hutsteiner). Here, a slight learning curve could be seen already (e.g handling of jacket and PLSS cover). Nevertheless, things remained complicate due to restricted space.

The attached helmet and the running air supply system had a cooling effect and helped A. Soucek to wait for Ch. Hutsteiner to be fully dressed. However, the road to enjoy cooling was longer than expected: Concentrating on other mattes, no one had thought of the fans on the left side of the PLSS and so the PLSS was fully covered by the Mylar foil without leaving any hole for air supply. The observation was, however, that still some air went through the foil (or other little holes) as a stream of air could be felt inside the helmet, even though much weaker than usual. Originally, A. Soucek thought of the overheating as reason for less felt air, but luckily M. Spiss discovered this "trifle" half way through the suit-donning of test subject 2.

Airlock Depressurization Procedure:

The inner hatch was closed at 16:25, starting EVA # 11. The airlock sequence went nominal, but the heat augmented another factor, as three people stood next to each other on 2,5m² for 10min. Both test subjects were a bit worried about the coming activities under the afternoon desert sun, but interestingly, when the outer hatch was opened, the situation improved – it became cooler under the suits!

The first suit problems started during the airlock procedure: Whenever Ch. Hutsteiner moved his arms, the attached patches fell off. Collecting them again and attaching them back onto the sterile suit was a challenge for his colleagues due to the EVA gloves. After each successful "rescue operation", it took just one minute until the same patches fell off again. When the outer hatch was opened and Ch. Hutsteiner stepped into the wind, he lost another patch which could not be collected (it was blown away).

The Suit Testing During EVA:

One immediate observation was that the arm length of the external suit was not sufficient. The sleeve got stuck at the O-rings of the normal EVA suit, thus the arms could not be fully stretched. Also, the usual movement with the right hand to the VOX button attached at the left side of the helmet proved to be impossible. Instead, the test subjects had to do this with their left arm, which lead to wonderful acrobatics.
The medical telemetry box usually attached to the left arm was not used during this EVA, except for Ch. Kandler. It was not sterile, and the question was whether the signal from the chest belt would have been transmitted properly through the Mylar foil.
Another problem concerned the water supply: The Plathapus water supply bag could not be used, as the Mylar foil covered the PLSS. This, however, is easy to change for the next test. Due to this fact, Ch. Kandler had to give water at regular intervals to his colleagues.
Opposite to the expectations, the moving ability was quite good (except the arm problem). However, actions like bending or quick movements were not possible. The experienced moving capability could be best compared with a diver in old times, walking on the bottom of the sea with plummet and attached to a rope. The care in walking and acting might be as well explained by the first-time experience and the psychological barrier not to destroy the "fragile" suit3 by fast movements.

In order to test the suit extensively, the crew took the ATVs to drive in the vicinity of the hab. Again,

opposite to expectations, the handling of the ATV was easy and worked well. The sitting position was not much different to normal EVAs, however the non-sufficient arm length could be felt at times. The head wind was a problem for the exterior suit when driving a bit faster, as the wind immediately started to tear off loose parts of the suit.
Patches falling off continued to be a problem especially for Ch. Hutsteiner. The reason for this divergence between the two sterile external suits has not been found yet. The patches were not applied by the same assistant for each of the two test subjects. Also, after falling off once, the same patch kept falling off again. Maybe the punctual force possible to apply with the EVA gloves is not high enough.
In fact, the suit is less fragile than seems, as the basis is an ABC protection dress; the silver Mylar foil is only a second layer attached to the main suit.
The biggest "enemy" during EVA # 11 was the strong wind. Needless to say that especially the PLSS cover (as separate foil) was at risk. Accordingly, until the end of the EVA, most of it was destroyed.

End of EVA & Additional Observations:

EVA # 11 ended at 1815. The entire water supply of Ch. Kandler was used up, the test subjects were quite exhausted, although the EVA itself was not stressful and also one of the shortest EVAs so far. It was extremely important to have one crew member without sterile exterior suit among the EVA team, to help in various situations (re-attaching patches, checking suit exterior, checking med telemetry, etc.). The problem with patches falling off should be easy to solve by enlarging the adhesive part and paying more attention to fixing the patches properly during suit-donning procedures.

All in all: EVA Crew # 11 and assistants could successfully perform the first testing of the sterile external suits. There is room for improvement, and we are looking forward to the second test EVA.

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: excellent, a bit exhausted, but in very good mood.

Brief Narrative of Today's Results: Three EVAs today involving five crew members. First EVA for radiation shelter management (filling of sandbacks, medical measurements), second EVA for GeoMars (sample collection), third EVA for repairing and testing Repeater Hill station and testing Aerobot; various Hab activities including the bi-weekly safety check (smoke and CO detectors, fire extinguishers, airlocks), greenhab and housekeeping. Successful test of Aerobot in the afternoon. Crew feedback session with MCC in the evening.

EVA: 3. See EVA Reports

Plans for Tomorrow: See finalised version of Flight Plan for Day 9 to be sent by MCC Salzburg. Long-range GeoMars EVA planned (using ATVs).

Report Transmission Schedule:

1. Commander's Check-in: 18:30
2. Commander's Report: 20:30
3. XO Report: 20:00
4. HSO Report: handed in.
5. Engineering Report: 20:00 (See Misc. below)
6. MSL Report: 21:00
7. MSP Report: 21:00
8. EVA Report: 21:00
9. Photographs: 21:00

Miscellaneous: Online ER form was not accessible at 17:30

Support Requested: Left back tire of ATV2 had once again not enough air, although it was re-filled two days ago. This is the third time we encounter this problem, so we suspect that there might be a small leakage.

More to follow.

Alexander Soucek
Commander, MDRS Crew 48 "AustroMars," on behalf of CDR

Commander's Journal
Norbert Frischauf Reporting

AustroMars Mission Sol 8:
"Sand, Stones and Wings"

Halftime at AustroMars. After our recharging day yesterday, we were set back to full speed by our Mission Control Center (MCC) in Salzburg.

This could easily be seen by the fact that we had three EVAs .Well, I should say at that point that the MCC had only planned for two EVAs, but we requested a third one, as we wanted to make use of a few synergies.

But one after the other…

Sol 8 of the AustroMars mission saw in the morning an EVA devoted to Radiation shelter activities. Gernot Grömer, the Health and Safety Officer – acting as EVA Commander - and Christoph Kandler, the AustroMars Mission Specialist for planetary Sciences, were sent off to an area 500m South of WPT 322 at the Lovell Highway (ca. 2.5 km south of the MDRS). There they were ordered to dug a hole with a shovel and to fill sand bags to assess how much a space suit would hinder an astronaut doing this kind of work. Although this activity sounds a bit like "Drilling at the army" there is a real sense to it. In case there is a strong solar storm coming towards Mars, the hull of the Habitat might not provide enough of shelter for its inhabitants and so additional protective measures would have to be undertaken to reduce the radiation levels that the astronauts inside the station would get exposed to. A relatively easy method – at least in theory – would be to pile sand bags around the Habitat to create an additional protective shell, especially around the very vulnerable areas like the station's windows.

Although not as effective as lead, sand has still a good stopping coefficient and has the big advantage that it is not as massive as the greyish metal. But don't be deceived: although lighter than lead, a sand bag can still be very heavy. Today's sand bag had the enormous weight of 46 kg! Sure on Mars this weight would be reduced to a bearable weight of around 20 kg, but in the AustroMars mission a 46 kg sand bag was found to be at the limit of what an astronaut in an analogue space suit could still handle. Making some rough calculations at the end of this exercise, we learned some interesting facts. The most important is surely that erecting a 2 m high and 50 cm deep protective wall around the MDRS would call for more or less one week of work (!) for two people working exclusively on such a radiation protection measure!

When Gernot and Christoph came back at lunch time, Christoph had to hurry up with his meal, as he was supposed to go with me (Norbert Friscauf) on another EVA immediately therafter. Alexander Soucek, the First Officer, acted as HabCom in the GeoMars EVA, in which Christoph and I were ordered to take geological samples at three pre-defined waypoints.

Coming out of the Habitat, we started our EVA by activating the AustroMars Rover "Sisi", which had been put into sunlight to re-charge its batteries. Afterwards, Christoph and I left for the first waypoint (WPT 322) at an incision of Lovell Highway, something like 2 km South of the MDRS. Here, big boulders lie shattered on rounded hills in a scene that has always triggered in my mind the idea of giants' children playing around with – for them - little domino stones. This is for sure one of my most favourite areas, I have therefore given it in my mind the name "Boulderdash". A bit to the West of this area, Christoph and I took our first two samples on top of a hill, exactly at the pre-defined coordinates. Seeing an interesting eroded area with big sandstones nearby, we decided to move there and take another sample of one of these stones.

Having finished our first waypoint, we continued northwards on Lovell Highway and moved westerly on Brahe Road, before we drove southbound to reach our second waypoint (WPT 031). Boy, was that an interesting area. I claim for myself that I am interested in everything (well maybe not in knitting), but even if I would have been a hardcore-I-don't-like-geology type of person, I would have been impressed by this landscape. We found molluscs and sandstones, gypsum and selenite crystals and we had not to be convinced to take a lot of samples there. According to our Principle Investigators' wish list, we conducted a drill with a depth of 55cm and packed the drilling core samples afterwards.

Because the features of a spot nearby, centred around a soft widening creek were so intriguing - brash lying beside of molluscs, sandstones, gypsum and selenite cristalls, sometimes extremely clearly separated from each other in this creek - we decided to establish a new waypoint, as we will most likely come back to that spot again. In an old tradition we named the waypoint in such a way that it includes something personal and as Christoph was so kind to offer me the naming privilege (this time), I selected the name "Carina's Quarry". I choose this name because of the stones and the brash and also because my daughter Carina is celebrating her 8th birthday today. And as a side story it should mention that she still likes to play with stones…

Although we could have spent hours at that location – it was extremely interesting – we had to go back to the MDRS, which we reached at 17:10.

CDR Frischauf with Rover Sisi.

In the meantime, Markus Spiss, our Mission Specialist for Life Sciences and Christian Hutsteiner, the Flight Engineer, conducted EVA number 3 of today. Their objective was more engineering related: testing the communications devices on Repeater Hill and test-flying the AustroMars Aerobot. Whereas we don't know yet whether their effort on the communications device were successful – we hope they are, as then we can hopefully extend our communications range significantly – they have definitely been successful in test-flying the Aerobot.

Although the wind was quite strong they managed to get the Aerobot safely airborne at the second try and could fly it for several minutes. As we want to use the Aerobot for reconnaissance, it has a pretty good on-board camera installed, which transmits its images directly onto a PC. Unluckily the camera fastenings opened and so the camera did not provide any reasonable pictures. Still we were lucky that we did not loose the camera, as the camera cable held it fast. All in all I would rate this test flight as a successful one: the Aerobot has proven its airworthiness, even though Christian had to control it with his thick space suit gloves and we will for sure find a solution how to fix the camera. This is definitely not an anomaly that will stop us!

Looking back on the whole day, I would say that this was one of the most remarkable days at the MDRS so far. Most of us have swapped knowledge patterns – if not before, then at least today. Gernot, an astronomer and paramedic did some ground digging work, pretty close to engineering today, while I, having been exposed mostly to engineering work in the last week, had the pleasure of conducting some real hardcore-science on today's EVA. Similar things are true for most of us. Only Christian, our pilot could make use of his predominant knowledge today, but then on the other hand he flies usually Black Hawk Helicopters and not fragile, little aerobots.

Obviously MDRS is a great test-bed, not only for experiments and the associated ideas and strategies, but also for its inhabitants. An old proverb states, "The more you invest, the more you gain!" I would definitely undersign that this proverb is also – or even particularly – true for the MDRS.

Signing off for today

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Executive Officer's Report
Alexander Soucek Reporting

Name of the Day: "Radio and Speck day"

What a thunderstorm last night! What a wind! It's a unique sensation lying in the bed in total darkness and getting the impression that the Hab moves. Of course it doesn't move, at least not much, but sometimes it swings a bit. It reminds me of my trips on tall ships I've been doing with my dad. They are slowly rolling from one side to another, and you're falling asleep in your hammock.

The comparison between a sailing ship and our stay at MDRS comes to my mind quite often. The felt isolation, the strong interaction between the crew, the confinement, the restrictions on water and power, the toilet requiring "treatment with care", the portholes allowing a look outside, the life according to plans and procedures with every crew member being assigned to different tasks and duties... I am a passionate sailor (despite my nationality) and I like observing these similarities. There is one major difference, however: Outside, we have an atmosphere made up of CO2, an average temperature of -80 degrees Celsius, and opening the airlock hatch is absolutely deadly. We are on Mars, not in the Caribbean.

The day started calmly for me. After having done my scientific duties as test subject for our medical and psychological experiments (FAMOS - fatigue monitoring, and the Myograph, an instrument measuring the variation of the pupil's diameter and hence your tiredness), I helped the first EVA crew donning their suits and then embarked on an expedition through our Hab, searching for smoke and CO detectors - a bi-weekly safety check. With the MDRS manual in one hand, the camera in the second, I paid a visit to each of these devices, pressing various buttons and shocking my colleagues with shrill alarm sounds. Everything was in good status.

Funny enough, in the middle of my "real life" safety check, our Mission Control Centre sent a simulated radiation warning. The time chosen was perfect: Two astronauts on EVA using the All Terrain Vehicles, the rest sleepy (as it was still early morning) and absorbed by scientific reporting or engineering work. What now? The moment of breathlessness was brief. According to the warning, the magnetic storm had just passed Earth. At an estimated travel speed of 400 to 600 km/s, the bow shock would reach Mars, based on our Opposition-class mission, earliest in 23 hours. I don't know whether MCC had calculated correctly and gave us an early warning or made some mistake here. The radiation protection protocol will now have to be activated tomorrow afternoon, and we saved the day!

I like being HabCom from time to time. Of course, exploring the landscape outside is more exciting. But HabCom is a responsible role, you are the "relay" station vis-à-vis Mission Control and the overall responsible for the crew outside. You follow their way on the map, stay in close contact with them, and make certain decision for them. This afternoon, I suddenly had the pleasure of being a double HabCom, for EVA crews # 14 and 15. Both crews were outside at once, the first one on scientific mission collecting geological samples, the second one to check out the radio relay station on Radio Ridge, and try to act as "human" relay station. The last days we suffered quite some "loss of signal" events during EVAs. Not thinking of anything bad to come, I made my daily cup of instant coffee (thinking for a brief but intensive moment of a real Italian "espresso", a short superb shot of caffeine), sat down in front of my laptop and prepared for some paper work to do. But then it started: "HabCom from EVA fourteen, copy." "Copy, EVA fourteen, this is HabCom." "HabCom from EVA fifteen, do you copy us?" "EVA fifteen from EVA fourteen, we hear you loud and clear!" "Well, one moment guys, this is HabCom. EVA fifteen, stand-by. EVA fourteen, status and heart rates, please." "HabCom from EVA fourteen, we could not understand the last part, did you say EVA fourteen or fifteen?" "EVA fourteen from EVA fifteen, he said fourteen."

I was glad when my two crews safely arrived back at the Hab three hours later. I had the radio constantly in my flight suit's breast pocket (when I was not talking, but writing down four different heart rates in real time); funny enough, that's the place where I usually also keep my camera, to have it with me at any point in time. Can you image how often I grabbed the camera and said loudly into the LCD screen: "EVA fifteen, heart rate please!"

Even though I was the only crew member not on EVA today, I feel somewhat exhausted tonight. But behind me I can smell the culmination of the day: fresh Austrian Speck. It was not easy to find it in the USA (from where we launched to Mars). It reminds us of home, and you cannot imagine how much one misses such little things. Tomorrow we have Easter Sunday, an occasion for big family gatherings and "Easter dinners" back home in good old Europe: Speck, horseradish, hard-boiled eggs, sausages, cheese, tomatoes, a good beer (special Easter brew). Well, from all that we just have the Speck. Speck and water and bred. But one does not need more. It is amazing how much you start to appreciate little rituals, special food, a piece of music you used to listen to in your childhood - all six of us experience these sentimental moments here, and we've just been one week on Mars. It's an interesting psychological observation.

I am sure the first heroes boldly flying to the Red Planet will need a small stuffed animal or a piece of Speck. Not in front of the media, not on launch day, but at some point during the endless journey through vast, dark space. Definitely.

Good morning Salzburg, good evening Mars.

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Honda: not used

Wendy Hobbs Meter: 3319.4 hrs
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: 7/8
Oil Pressure: 35 PSI
Water Drained: No

Notes/Comments: The waste barrel for the leaking diesel from Wendy is almost full!

Xantrex Inverter/Dynasty Batteries:
Tim - Voltage (Temp Comp) - Load - Temp - Generator Running?
23:50 - 26,6 - 07 - 21 - on - float
07:30 - 21,3 - 08 - 17 - off
12:00 - 26,7 - 14 - 18 - on - float
16:45 - 23,7 - 10 - 21 - off
18:10 - 21,6 - 09 - 22 - off
Fuel Status (as of 18:56):

Diesel: Approximate Reading - 7/8

Propane Tank: Approximate Reading - 49% (490 gallons = 1854.8 L)

Gasoline:
Consumed Today: 1.5 gallon
Quantity Remaining: 11 gallons

Oil:
GenSet Quantity: 8 quarts
ATV Quantity: 8 quarts
V'ger Quantity: 8 quarts

Water Status:

Outside Potable Water Tank Level: 450 gallons
Trailer Potable Water Tank Level: 0 cm from the base
Water Meter Reading: 9532,5 gallons
Water Consumed: 47,8 gallons
Grey Water Used: 30 gallons
Flushes: 7
Showers: 2
Sponge Baths: 2

Tonight's Meter Readings:
Out to Toilet: 2376,2
In to GreenHab: 14812,9 (+ 214,3 since yesterday)
Notes/Comments: The sump pump ran for 4h15min, didn´t find any DC timer! Will start tomorrow to separate the runningtime of the pump.

GreenHab:

Crops Watered: yes
Crop Condition: Pretty well!

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: n/a
Tire Status: good

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 0.75 gallon
Tire Status: good

Kawasaki ATV 2: Used - no
Oil Checked: yes
Fuel Consumed: 0 gallons = 0 L
Tire Status: rear left flat

Kawasaki ATV 3: Used - yes
Oil Checked: yes
Fuel Consumed: 0.75 gallon
Tire Status: good

HVAC: Nothing new to report.

Mars Surface Suits: Used Suit No. 1,4,5 & 6 PLSS No. 1,2,5 & 6 Helmets No. 2,3,4 & 5 for EVAs No. 13, 14 & 15

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Notes/Comments: Check in the afternoon the relaystation at the "repeater hill" radio ridge, found out that when you send on the microphone at the command desk on channel 7-01 we can receive on the handheld radio on channel 7-00. Will check later the vice versa procedure. All the other stuff worked well today!

Health & Safety Report
Gernot Groemer Reporting

During todays EVA-13 we did an exercise in exploration management, mainly filling sandbags for a radiation shelter. As this was supposed to put some physical load on the two of us we decided to take our capnometer with us. Staring at 09:45 your truly HSO had a heart reate of 97 bpm which is normal given the heat load and the 20 kg personal life support system excluding any special equipment. The CO2-level was at 30 mmHg which is pretty much physiological, during the exercise this value rose to 38 mmHg, which is no problem at all for a healthy male; as the shoveling was not exhautive enough for our taste, we spontaneously decided to walk one of the surrounding hills, whcih included a steep uprise of a 25 m high "peak" (well, peak has a different meaning in Austria (add at least 2 zeros behind the 25 m of the hill we were going for), but for Utah its O.K.). The CO2 peaked at 54 mmHg which is already a little bit borderline, but still within the range of what a healthy human can take for short periods. The more detailed measurements will be described in the scientific reports.

The point was that for a real Mars expedition it might make sense to include a "airstream boost" into the life support system which can -at least temporarily- deliver a much higher oxygen flow than normally needed, as there is a wide range of oxygen needs for humans under various physical loads.

Other than that, the crew is in a very healthy condition and enjoying the sojourn at the station - we have a limited amount of daily routine coming up, e.g. the crew voluntarily (!) is measuring their body fat, weight, blood pressure and body water data in the morning before breakfast.

Today, the major safety systems such as Carbon monoxide and smoke detectores and other equipment has undergone its bi-weekly inspection routine: All systems are operational, clean and now at the right place; details are in todays XO report.

Good Night, Earth
Gernot Groemer

HSO Personal Report

Our food shortage has been reduced, as we found additional "emergency rations" in the GreenHab probably put there by foreseeing mission planners 2 years ago, when the cargo ship was launched towards the Red Planet. Feeding people on such a mission is a non-trivial task, as one has to keep an eye not only on fluid balancing, but on all nutrients and keeping moral high within he crew, so little things like bringing traditional national food items is certainly a "must" on such expeditions. In our case - especially for people outside Austria - this means a chunk of home made bacon. We try to keep ourselves from cannibalizing it any minute but keep it for special moments, like the Easter weekend.

We have been looking forward to this bacon ("Speck", how it is called back home) for at least three days now and although its an everyday thing, it means something special to all of us as it means bringing a piece of home with us, just as we had this wonderful Yuris Night when we played Austrian pop music (dubbed as "Austropop") well into the night.

Tomorrow is going to be the birthday of our commanders daugther and - as some of us know her very well since the moment she was born (she is actually a "space child" in a special wayx, but that's something private only the Commander is allowed to tell, when you ask him in exchange for a glass of wine or two)- we're looking forwards to a video greeting during the midnight hour.

S-1 EVA Suit Report
Alexander Soucek Reporting

Report on the Utilization of EVA Suit S-1 during Crew 48 Mission

Background:

The utilization of EVA suit S-1 was scheduled for EVA # 12 during an emergency rescue operation simulation. The EVA crew consisted of G. Groemer, A. Soucek, M. Spiss and Ch. Hutsteiner. EVA started at 1450 and ended at 1650. All operations were performed in the vicinity of the Hab.

Suit-Donning of S-1:

The suit-donning was performed with the MDRS manual at hand. Crew 48 had not used the S-1 suit before and therefore relied on the short manual, which proofed to be helpful (especially the images showing donning procedure). The donning itself went fairly well, apart from short time delays due to familiarisation of the EVA crew with the new suit. The trouser-legs of S-1 were slightly shorter than those of the old suits, enough for reaching the shoes but not enough for covering them completely (comfortably) down to the ankle (at a body size of 184cm). Hence, the gaiters were useful to provide for a complete coverage / protection of the lower leg. At a closer look it turned out that the length of both trouser-legs had been extended already by attaching a 20cm piece of fabric, which allows for more flexibility in adjusting the actual length, as it is attached to the trouser with Velcro. This Velcro is a bit unpleasant when it has direct contact with the skin (or through a thin layer like a trouser, flight suit, long underwear) and therefore could graze the skin during longer EVAs. The problem was overcome by using long, thick socks and paying attention to slip the flight suit trouser-legs (second layer) in the shoes and fix them there.

Fixing the jacket and trouser with the white tube required several tries and was not fully satisfactory. The cord to attached the tube / ring firmly did not easily pass through the foreseen holes, as its ends were worn out (hence the diameters did not fully match, requiring some care and patience). Thanks to M. Spiss, who works at the Austrian Mountain Rescue Service and who is used to working with ropes and cords, this problem could be overcome after some minutes of trying.

Before mounting the PLSS, the crew had some doubts whether the tube just above the hip would cause any problems once the PLSS was on the back, as it passed between back and PLSS, being a potential dent. Surprisingly, nothing was felt by the test subject after finishing suit donning and throughout the EVA.

Use During EVA:

During EVA, the personal sensation of the crew member wearing S-1 was not substantially different compared to the other EVA suits worn previously. One reason is that the body parts being used most during EVA, being most sensitive and having close contact with parts of the suit, are the head, the hands and the feet - and all three were covered by suit parts used beforehand: the MDRS helmets, the AustroMars gloves and the normal MDRS EVA shoes (white shoes). This fact might have contributed to a similar sensation during EVA. Flexibility inside and with the suit was good.

Personal Opinion:

In my opinion, S-1 is a good and comfortable system. I have not discovered the major advantage this system has compared to the old one. One drawback (which might be due to the "first use" problem) is the slightly increased complexity during suit-donning, attaching and fixing the tube, whereas the old suit is easier to put on and close. This is admittedly just a minor detail, but nevertheless an observation I find worth telling. Also, the Velcro-solution to extend the length of the trouser-legs is not optimal. I don't know whether this was made on purpose (to be more flexible in terms of trouser-leg length) or not, but in any case it is not very stable. The thumb loop attached to the sleeves is nice in principle, but if you need to stretch your arm / hand (e.g. during glove donning) it hinders the movement. I did not use these loops in the end. All in all, I regard S-1 as comfortable suit with minor weak points. I doubt, however, that it makes the suit-donning procedure easier.

EVA Reports
Crew 48 Reporting

EVA-13 Report:
Gernot Groemer Reporting

EVA Name: Exploration management

Objectives: Test of feasibility of building components a radiation shelter from soil

EVA Commander: Gernot Groemer
EVA Navigator: Christoph Kandler
EVA Crew: Groemer, Kandler
Hab Comm: Norbert Frischauf

Planned Route: southwest of Hab along Lowell Highway

Timeline:
Don Suits: 08:30-09:20
Enter Airlock: 09:26
Egress: 09:36
Ingress: 11:39
Enter Hab: 11:49

HSO Groemer bandaging an „injured Flight Engineer“ and applying sterile staples on a forehead laceration.

New Waypoints Established by EVA Crew: none

Samples: one surface sample taken

- **Sample Number:** 13-1 A,B,C,D,E
- **GPS-Coordinates:** O 518898 N 14248673
- **Time:** 10:30
- **Photos:** 3

Narrative: This EVA was dedicated to exploration: in case of a radiation alarm, the crew might need a highly protective area, which could be composed of local soil to shield from the particle radiation. So our EVA took us along the southwest-route along Lowell Highway about 2,5 kilometres from the station. There we dug a hole with a shovel to see if the ability to move is severly impeded by the analogue space suits and filled several sand bags which can be piled up to create an additional outer wall at the Habitat. This worked out quite well as it has been also conducted by other crews previously.

The filling of a sandbag took typically 5 minutes each. We weighted one of the filled bags and came up with an total mass of 46 kg, which was the borderline weight, one person could lift in the spacesuit. The excavation speed was about 10 minutes for a hole of a size of 50 x 100 x 20 cm. Digging below 20 cm depth was virtually impossible: It had rained the night before and the soil was hard as argillaceous soil. So piling up a wall of say 2 meters height and 50 cm depth around the MDRS (given two astronauts working on the task) would take at least 80 manhours, in addition to that one has to take into account limited air supply, breaks (15 min break every 2 hrs) and time to pile up material (1 hr every 3 hrs of filling sandbags), plus arranging for all the bags (2 hrs), it will take about at least one work week for two people working exclusively on such a low-height, low-depth radiation protection.

The physical exhaustion was surprisingly low, as out heart rates did not exceed 150 for most of the time for the two of us, even under high workload, although we did not test the procedure for a longer time. Given the weakened muscles when the crew will arrive on Mars, the time requirement will have to be expanded.

After the construction work, we decided to take a walk onto a nearby hill in a distance of approximately 250 m and a height of 25 m according to the GPS unit to put a higher physical load on our bodies to check the CO_2 values in the expiratory airstream with our capnometer.

HSO Groemer is shoveling soil to fill sand bags for a future radiation protection wall. Note the capnometer (blue apparatur worn below the helmet).

EVA-14 Report:
Alexander Soucek, Norbert Frischauf and Christoph Kandler Reporting

EVA Name: GeoMars

Objectives: Acquire some geological samples at the following three waypoints: WPT 322 (UTM NAT27 14249250m N, 518000m E); WPT 231 (UTM NAT27 14254563m N, 517102m E) ; WPT 031 (UTM NAT27 14254106m N, 516925m E)

EVA Commander: N. Frischauf
EVA Navigator: C. Kandler
Hab Comm: A. Soucek

Planned Route: MDRS to WPT 322 – MDRS – WPT 231 – WPT 031 - MDRS

Timeline:
Don Suits: 14:00
Enter Airlock: 14:25
Egress: 14:35

Ingress: 16:15
Enter Hab: 16:25

New Waypoints Established by EVA Crew: One, UTM NAT27 12S: 14253989m N, 516999m E, Height: 1389m MSL; named "Carina's Quarry"

Samples:

- **Sample Number:** 14-1 / 14-2 / 14-3 // 14-4 / 14-5 / 14-6 / 14-7 / 14-8 **GPS-Coordinates:** 14249250m N, 518002m E / 14249241m N, 518002m E / 14249300m N, 518007m E // 14254108m N, 516925m E / 14254110m N, 516895m E / 14254076m N, 516932m E / 14254065m N, 516956m E / 14253989m N, 516999m E
- **Time:** 15:15 / 15:20 / 15:30 // 16:15 / 16:15 / 16:30 / 16:37 / 16:45
- **Photos:** 2 / 2 / 2 / 2 / 2 / 2 / 2 / 2

Narrative: Christoph and I started our EVA by activating the AustroMars Rover, afterwards leaving for the first waypoint (WPT 322). Here we took 2 samples on top of a hill, exactly at the pre-defined coordinates. Seeing an interesting eroded area with big sandstones nearby, we decided to move there and take another sample of one of these stones. Afterwards we moved northwards on Lovell Highway and moved westerly on Brahe Road until Waypoint Number 2. Due to the late arrival at this spot, we skipped waypoint number 2 (WPT 231), as we will come by this location more often in the next few days – also our geological principle investigators (back in Austria) had given waypoint number 3 a much priority.

Driving southbound we came to waypoint 3 (WPT 031) and because this was such an interesting geological area we took several samples there, such as molluscs and different sandstones. According to the PIs' wish, we conducted a drill with a depth of 55cm and packed the drilling core samples afterwards. Because the feaures at a spot nearby were very special; brash lying beside of molluscs, sandstones, gypsum and selenite cristalls, sometimes extremely clear separated from each other in a creek, we decided to establish a new waypoint, as we will most likely come back to that spot again. The waypoint was called "Carina's Quarry", because of the stones and the brash and also because the commander's daughter, named Carina, was celebrating her 8th birthday as of today.

Although we could have spent hours at that location – it was extremely interesting – we had to go back to the MDRS, which we reached at 17:10.

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: just perfect!

Brief Narrative of Today's Results: Today, three crew members attempted the first long-range GeoMars EVA to White Rock Canyon. They collected various important geological samples and applied drilling techniques. Meanwhile the remaining crew had to fight against the storm and was forced for a short moment to break simulation in order to climb to the roof and fix a part destroyed by the wind. The operation was successful, images and a report will be sent by MSL M. Spiss. The day ended with a simulated radiation warning and the crew spending two hours in the airlocks, our radiation shelter.

EVA: 1.

Plans for Tomorrow: See flight plan day 9 of MCC. In our simulation, a new age will start tonight. The crew prepares for a spectacular exploration on Mars. Details soon.

Report Transmission Schedule:

1. Commander's Check-in: 18:30
2. Commander's Report: 19:00
3. XO Report: 19:00
4. HSO Report: 19:00
5. Engineering Report: 19:00
6. MSL Report: handed in.
7. MSP Report: 19:00
8. EVA Report: handed in.
9. Photographs:19:30

Miscellaneous: nothing.

Support Requested: none.

More to follow.

Alexander Soucek
Commander, MDRS Crew 48 "AustroMars," on behalf of CDR

C o m m a n d e r ' s   J o u r n a l
N o r b e r t   F r i s c h a u f   R e p o r t i n g

AustroMars Mission Sol 9:
"Geology, Biology and Exploration after all"

Only five sols to go, it is incredible how quickly time can fly when one is in the MDRS. Today saw the first real planned anomaly by the Mission Control Center (MCC) in Salzburg, a solar radiation storm that forced us to take shelter in the airlocks in the afternoon. Sitting there for two hours, we thought on the whole mission and then we decided to give it in its last five sols a completely new spin.

But before that another EVA had to be undertaken, this time devoted to GeoMars and Track and Trace, an experiment centred on forward and backward contamination that is the transportation of biogenic material from Earth to Mars and vice-versa. HabCom for this EVA was assessment Christian Hutsteiner, our Flight Engineer, at least for the beginning and the end, as in the middle we had to repair the MDRS roof together with Markus Spiss, the AustroMars Mission Specialist for Life Sciences. A small part of the tent-like structure had gotten caught by the strong wind, most likely due to a broken upper ring on the shell. The danger was that the wind would slowly tear the whole roof apart, so quick action had to be taken to fix the material to the structure. This action was performed by our "special forces" team, Christian and Markus, whereby we could make good use of Markus' profession as mountaineer at the Tyrolean mountain rescue service, since he was pretty much exposed on the MDRS roof. The whole exercise lasted for about 1 hour and finished successfully thereafter.

In the meantime, the EVA had started, leading us (Gernot Grömer, the Health and Safety Officer -- acting as EVA Commander, Christoph Kandler, the AustroMars Mission Specialist for planetary Sciences and myself (Norbert Frischauf) to the south of the MDRS, driving along Lowell Highway to our first waypoint at the White Rock Canyon. While Christoph was taking samples, strongly supported by Gernot, whose spacesuit was adapted for forward contamination measurement by three patches prepared with micro-spherules, I could only participate in a limited way, as I was an experiment in itself -- the "Track and Trace backward contamination probe". As I stood there, acting mainly as photographer, I looked mostly like a silvery shining Michelin man or as an alien from the 70's. Covered in an all-body silvery gown over the analogue suit, I was mostly immobilised because of this sterile armament. All this was necessary to make sure that our scientists way back in Austria would afterwards be able to quantify backward contamination. To do so I had eight biological sample collection patches attached to my silvery space suit, which would during the whole duration of the EVA collect every bacteria, spore and fungus that would come along the way, hitting one of the patches.

When I said armament before I meant that literally, as moving in this suit was extremely difficult, especially because I wanted to make sure that both I would not loose any patches or tear the suit apart. Having learned from the first track and Trace EVA we fixed the bio-sample collectors with additional tape, to not loose any of them. This strategy worked and so when the EVA had finished I still had all the collectors on, Track and Trace was therefore from this perspective a major success, as was GeoMars itself, since we were able to obtain 7 samples, including one 55 cm deep drill. The biggest issue in the silvery space suit was the thermal balance, as there was nearly no ventilation inside, cooling was very minimised. It was somehow strange; outside was a strong storm and inside I couldn't feel anything beside that the wind was sometimes so strong that I was close to get blown away because of the bulky space suit.

While Christian was occupied fixing the roof, Alexander Soucek, the First Officer, acted as HabCom.

In the afternoon MCC ordered us into the airlocks to take shelter from a solar storm, which had been detected already yesterday passing by Earth and was supposed to hit us for approximately two hours in a somewhat weaker form.

There in the airlock we reflected on the AustroMars Mission. Looking on the things that went well and not so well, carefully the scientific results we have achieved so far, we thought that the last remaining 5 sols should be devoted primarily to the one goal, for that humans have gone to the Moon and will once set foot on Mars -- Exploration.

The target is already set. We have a clear strategy in mind. Now all that we need to define is the way. When I have finished this report, all six of us will get together to define roles, responsibilities and immediate actions to maximise our chances for success. This mission we have embarked upon for the last remaining sols is supposed to reaffirm the spirit of AustroMars once again.

Stay tuned...

Signing off for today

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Executive Officer's Report
Alexander Soucek Reporting

A day like... well, like what? Like an adventure which is about to start, and we are in the middle of it. It started with an earthly problem, when the strong desert storm destroyed a small part of the roof construction of the hab. With three crew members on EVA and one HabCom trying desperately to keep contact during this long-range geology expedition, the remaining two crew members had to climb to the roof during strong winds and fix the problem, a task they mastered perfectly (again, the Austrian Mountain rescue emergency training proved to be very valuable).

And then, the simulated storm came. A solar magnetic storm with the bow shock arriving at Mars at 1600 Sol time. We sealed the windows with water bags, took our sunglasses and flight suits and sat down in the airlocks. Two hours of waiting. And then, don't ask me why, "it" was here. A simple thought first. Then an idea. Now an adventure.

The last days were filled with tests and daily routine to an extent that we almost felt like being on Earth. Which is, of course, wrong: We are on Mars, and we have five days left to finish a mission which shall be remembered by all those who made it happen and put so much effort into it. Sitting in our airlocks which served as radiation protection while the radiation storm passed the Red Planet, we reflected on our wonderful experience so far, and we thought of the many more things to come. The samples still to take, the landscape to explore, the engineering solutions to test, the science to do.

Please excuse that I write shorter than usual. And please excuse the excitment you read between the lines, but we have just switched to exploration mode, like in good old Apollo days. I think this afternoon we have just rediscovered a spirit we have lost between all the routine.

Stand by as AustroMars, the crew and the "glorious men and women" of our Mission Control Center, dive into an adventure.

And most important of all: Stay tuned.

Good Morning Salzburg,
Good Night Mars.

FE Hutsteiner preparing CDR Frischauf for another BioMars EVA in the tightness of the main airlock.

E n g i n e e r i n g   R e p o r t
C h r i s t i a n   H u t s t e i n e r   &   J o s c h i   G r o s s   R e p o r t i n g

Generator/Electricity:

Casper: not used

Wendy Hobbs Meter: 3330.5 hrs
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: 7/8
Oil Pressure: 35 PSI
Water Drained: no

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
23:10 - 26,8 - 09 - 21 - on - float
07:30 - 26,1 - 09 - 18 - on - bulk
14:20 - 23,9 - 08 - 20 - off
18:20 - 21,9 - 09 - 24 - off

Fuel Status (as of 18:25):

Diesel: Approximate Reading - 7/8

Propane Tank: Approximate Reading - 49% (490 gallons = 1854.8 L)

Gasoline:
Consumed Today: 2 gallons = 7.6 L
Quantity Remaining: 9 gallons = 34.1 L

Oil:
GenSet Quantity: 8 quarts
ATV Quantity: 9 quarts
V'ger Quantity: 8 quarts
Notes/Comments: We found another quart for the ATVs in the V'ger.

Water Status:

Outside Potable Water Tank Level: 410 gallons = 1552.0 L
Trailer Potable Water Tank Level: 0 cm from the base
Water Meter Reading: 9572,1 gallons = 0 L
Water Consumed: 39,6 gallons
Grey Water Used: 25 gallons
Flushes: 7
Showers: 2
Sponge Baths: 2

Tonight's Meter Readings:
Out to Toilet: 2401,2
In to GreenHab: 14844,3 (+ 31,4 since yesterday)

GreenHab:

Crops Watered: yes
Crop Condition: Pretty well!

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 0 gallons = 0 L

Tire Status: good

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 0.8 gallon = 2.8 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 0.5 gallon = 1.9 L
Tire Status: good

Kawasaki ATV 3: Used - yes
Oil Checked: yes
Fuel Consumed: 0.8 gallon = 2.8 L
Tire Status: good

HVAC: Nothing new to report.
Mars Surface Suits: Used Suit No. 1,4 & 6. PLSS No. 2,1 & 6. Helmets No. 2,4 &5 on EVA 16

Computers/Networking Infrastructure: Nothing new.
Appliances: Nothing new.
Data Logger: Nothing new.
Upgrade Work: Nothing new.

Notes/Comments: Another boring day on Mars, the wind took a part of the awning. To prevent more damage we made a quick roof safety rescue mission over the roof window. The MSL, an experienced mountain rescuer, climbed out (while I secured him with a rope)and fixed the awning with a stapler, and the outbroken part of the side with screws. So it should hold for a while. But it should be fixed from the ground with a ladder when the wind calms down!!

Health & Safety Report
Gernot Groemer Reporting

No medical incidences to report. The crew is still in excellent health - we are now only 5 days and 19 hours away from the point where our Earth Return Vehicle will blast off and bring the crew safely back to our home planet. We just encountered a radiation alarm whch forced us into the radiation shelters in the airlocks for two hours without any further major incidence. Our protective measures included sealing the airlock windows with water bags to increase the absorptive mass, staying away at least 15 cm from the outer walls to have some nitrogen from the air between neutron sputtering surfaces and our bodies, shutting down non-life support electronics equipment to reduce the risk of single event upsets and static discharges.

MSL Spiss (checking data on the GPS device) and FE Hutsteiner waiting in the engineering airlock for the end of the radiation alarm.

Right after I had sent yesterdays HSO report we had a medical simulated incidence: our Flight Engineer "bumped" his head against the ceiling between the command and the laboratory deck - the wound was just simulated by artificial blood, but we decided to go for a real sim, by treating the patient full scale: this included providing first aid including putting sterile gauze on the wound, putting the patient on the ground, applying a cervical collar, taking vital parameters (blood pressure, heart rate, respiration frequency, general physical status, secondary injuries).

As a secondary treatment we brought our Flight Engineer to the upper deck, which is the cleanest place in the hab (except the laboratory areas), put on surgical coat, face- and headmask, dressed the wound with a surgical cover and applied surgical sterile staples in an artifical skin which has been radiation sterilized. The aim was to show, how much of a potential infection risk the crew faces when we treat open wounds under realistic conditions. We have put the artificial skin into the incubator and will see in a few days if there would have been an infection and if so, which germs would have caused it. (The incubator is used to simulate the temperature on the forehead of our poor patient.)

Otherwise -- after the two hours in the airlock -- the crew is extremely charged with the tasks at hand which will determine the daily life of the next five days.

From today on we will focus on what the simulation is all about: pure and undiluted exploration. More details are to follow, but will also include a lot of challenges from the HSO standpoint.

HSO Personal Report:

Todays radiation alarm also put the crew to the test, as we had to pack the six of us into the two airlocks (two into the engineering, four into the main airlock), seal the station, power down each and every non-critical system and sit and wait. Fortunately it is to be expected that during a real mission, the spaceweather forecast will have a prediction capability which is ranging into days, not only hours based upon a better understanding of the processes going on in and on the sun, as well as the behaviour of the interplanetary magnetic field which acts as a "highway" for the charged particles. Therefore we had a 22 hour warning before hand and could adjust our activities accordingly.

I had feared that the two hours in a packed airlock could pose a problem when four adults are packed together in such a way. But, on the contrary, things turned out completely different (as I always say: in this station? Anything is possible!). Everyone had taken a book with him, but we didn't even manage to open it, as this situation turned out to be the first time we actually had time to talk about the mission from a standpoint apart from the experiment, the tight flightplan or other mission specific requirements, but from a personal point of view - and most important, how to use the next 5 days before we return to Earth as well as possible and add an additional taste to the expedition by setting even more ambitious tasks. - Details are to follow soon.

The sails are set. Hold your breath for something big: Exploration at its best.

EVA Report
Christian Hutsteiner & Christoph Kandler Reporting

EVA Number: 16
EVA Name: GeoMars

Objectives: Acquire some geological samples at the following waypoints: WP 051 520315 E, 4247286 N WP 135 520426 E, 4247276 N WP 111 517882 E, 4248629 N WP 333 518500 E, 4250000 N. Test Track and Trace suits: CDR with TT1= backward contamination, HSO with TT2= forward contamination.

EVA Commander: G. Groemer / C. Kandler
EVA Navigator: C. Kandler
EVA Crew: G. Groemer, N. Frischauf, C. Kandler
Hab Comm: C. Hutsteiner

Planned Route: MDRS - WPT 051 - WPT 135 - WPT 111 - WPT 333 - MDRS

Timeline:
Don Suits: 08:35
Enter Airlock: 10:09

Egress: 10:19
Ingress: 13:34
Enter Hab: 13:44

New Waypoints Established by EVA Crew: None

- **Sample Numbers:** 16-1 // 16-2 / 16-3 // 16-4 / 16-5 // 16-6 / 16-7
- **GPS-Coordinates:** 520316m E 14247289m N // 520431m E 14247278m N / 520424m E 14247282m N // 517882m E 14248629m N / 517886m E 14248616m N (Sondenentnahme 50 cm Tiefe) // 518495m E 14250013m N / 518510m E 14250037m N

Time: 11:35 // 11:50 / 11:55 // 12:40 / 12:50 // 13:10 / 13:15

Photos: 2 // 2 / 2 // 2 / 2 // 2 / 2 /

CDR Frischauf, XO Soucek and HSO Groemer catching up with some reading during the radiation alarm.

Narrative: This EVA intended to serve two experiments: GeoMars and Track and Trace. While the first one meant that the EVA was to obtain specific samples on pre-defined waypoints, the later one implied that two EVA crew members were equipped with special EVA suits. G. Grömer wore a space suit that was set to measure forward contamination by three special patches prepared with micro-spherules, while N. Frischauf wore the sterilised silver-plated cover above the analogue space suit. On it were 8 biological sample collectors that were added on in the airlock only, to collect samples throughout the whole GeoMars EVA to quantify backward contamination. Having learned from the first track & trace EVA we fixed the bio-sample collectors with additional tapes, to not loose anyone. This strategy worked and so when the EVA had finished we still had all the collectors on, Track and Trace was therefore from this perspective a major success, as was GeoMars itself, since we were able to obtain 7 samples, including one 55 cm deep drill.

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: exhausted and excited.

Brief Narrative of Today's Results: With Sol 9, the crew of AustroMars added another aspect to its intensive program: From now on until the end of the mission, we have switched to "exploration mode", based on a simulated discovery of traces of methane and water vapour at Factory Butte. Various scenarios and activities are currently being worked out together with MCC Salzburg, including establishment of long-range communication with very simple means and others. Due to the high workload of the entire team, the crew's day started at 0500 sharply and included a long-range scouting EVA to Coal Mine Wash and an Engineering EVA to establish a new WLAN network. All scientific test series are continuing as usual, on top of the new scenario. The crew is extremely motivated and has therefore no problems with the prolonged daily schedules to come. Very strong winds in the entire area required careful working today, especially during EVAs. The long-range scouting EVA has marked about six new waypoints which will be detailed in the respective EVA report, and two new names for formations discovered on the way.

EVA: 2.
Plans for Tomorrow: See flight plan day 10 of MCC. Within the storyline of the crew's expedition to Factory Butte, tomorrow's schedule foresees an emergency rescue training EVA with equipment brought from Austria's Mountain Rescue Service. This has been tried once during the preparation week and shall now be tested under simulation conditions.

Report Transmission Schedule:
1. Commander's Check-in: 18:30
2. Commander's Report: 21:00
3. XO Report: 19:30
4. HSO Report: 19:30
5. Engineering Report: 20:00
6. MSL Report: none
7. MSP Report: none (identical with EVA report EVA #17)
8. EVA Report: 21:00
9. Photographs: 21:00

Miscellaneous: Very strong winds, but no further damages on the hab structure reported. Crew secured outer hatch of main airlock after a strong gust had opened it (although it was firmly closed, as indicated by green airlock light). No damages, as outgoing EVA crew was in airlock at that time.

Anomalies: Short power cut between 1810 and 1830. No internet connection since 1500, restablished 1900.
Support Requested: none at present.

Alexander Soucek
Commander, MDRS Crew 48 "AustroMars," on behalf of CDR

Commander's Journal
Norbert Frischauf Reporting

AustroMars Mission Sol 10: "Operation Edelweiss"

Four sols to go and the AustroMars team here at the MDRS and back in Salzburg at the Mission Control Center has embarked on a new course: Exploration.

All was started by a reconnaissance probe, which has found water vapour and Methane at a presumed old volcano. Because of the high altitude, aerobots ae not able to go there and due to the steep terrain there is also no chance that our rover can get there as well. So it's up to us - the humans - to explore this spot and find out whether this methane is produced by geothermal activities or biochemical processes.

That's the mission scenario, which we will follow for the last 4 days at the MDRS. The presumed volcano is Factory Butte, a rather high and very steep mesa like mountain in the northwest of the Habitat. Getting there is already an endeavour, getting up on it is practical impossible. And trying to do that all in four days is simply extremely crazy for anyone but us - we consider it daring.

It's a fantastic goal that we aim for, we are aware of that. Nonetheless we think it is important, both for the AustroMars team as a whole but also for the analogue Mars exploration science, as we will try to push the limits of a what (analogue) Mars astronauts are supposedly be able to do. To do so we hat sit together, studied maps and engineering data and devised a strategy together with our MCC to get us there.

The strategy is centred on the utmost principles of the Mars Society and AustroMars: Safety - Science - Simulation. To make the endeavour as safe as possible we will conduct scouting missions to find the best way and we will try to make sure that we have communication for most of the way to be able to quickly react if necessary. Science will be done along the way, not as hitchhiker though, but as a prime passenger. And simulation will be kept as top principle as well. Spacesuits, ATVs, oxygen constraints, water bags, everything that is required for a long duration EVA - it will all be in.

And today we started the endeavour, nicknamed "Operation Edelweiss", with both a scouting EVA and an engineering one. The first EVA was conducted by Alexander Soucek, the First Officer, and Christoph Kandler, the AustroMars Mission Specialist for planetary Sciences. While Christoph, our satellite navigation specialist was looking for the best route to Factory Butte, carefully navigating the EVA team over plains and trough canyons, Alexander was acting as EVA commander, making sure that everything remained within safe boundaries. Gernot Grömer, our Health and Safety Officer, orchestrated the whole mission as HabCom, however due to long range nature of the EVA there was not too much of communication ongoing. While scouting was one of the objectives of this EVA, geology was another one as well. Christoph and Alexander took several samples along the route, which led them along Lovell Highway and Brahe Road into the direction of Coal Mine Wash.

Starting in the afternoon, Christian Hutsteiner, our Flight Engineer, and I (Norbert Frischauf) were working on the communication part of Operation Edelweiss. We erected two WLAN router masts, one at the Repeater Hill - despite the strong, gail-like, wind and one 1.5 km from there to the West in the plain before Skyline Rim. Compared to the exercise that Christoph and I had undertaken last week at Phobos Peak, it was much more difficult today, mostly because of the strong wind, but at the end also because of the falling temperatures, which made our finger tips completely insensitive at the worst. And this does not do you any good when you are trying to entangle ropes, screw parts together and use your laptop to test the WLAN.

At the end we had made it: we had set up to WLAN masts and in the next few days we will erect a few more to cover the whole distance from the MDRS to the Butte. In parallel, other scouting missions will try to find better and shorter routes was well. Latest when we are at the base of Factory Butte - our simulated volcano - we will make use of the special talents of Markus Spiss, the AustroMars Mission Specialist for Life Sciences. His profession as mountaineer at the Tyrolean mountain rescue service will then definitely pay off, and we shall see how far we will get.

On to Mars is one of the buzzwords here at the MDRS. While we all belief in this quote from the bottom of our hearts there is also another quote, which characterises Operation Edelweiss and AustroMars to a great extent - "The Sky is the Limit!"

We will see in the coming sols how are we will be able to push this limit: for us as well as for the whole (analogue) human exploration sciences.

Stay tuned.

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Executive Officer's Report
Alexander Soucek Reporting

Today I am happy. Not that I was not happy the last days, but three hours ago I came back from one of my most exciting EVAs during this mission, and the reader might remember our promising words of yesterday: The AustroMars mission is entering in a new phase... Let me tell you what happened.

Simulation scenario, Sunday, 16 April, evening: Sudden reports suggest the discovery of traces of methane and water vapour at Factory Butte. The crew of AustroMars has five days left until closing of station and return to Earth. Within these remaining days, the crew and all support teams of Mission Control have to do their uttermost to try to verify the discovery. It's a scenario with a realistic background (discovery of methane and water vapour traces by the PFS instrument of the European MARS EXPRESS probe) and useful output for the analogue Mars science and exploration testing: the attempt to make the maximum out of a given situation (dense prepared flightplan, limited resources and countdown to end of mission) with given restrictions and boundaries and a new type of flexible cooperation.

AustroMars wants to push to the limit how the rigid boundaries of a short-time surface mission can be bent to optimise output. All this happens without cutting a single minute of all our scientific and engineering experiments. And that meant for all of us to get out of the beds at five am. But what a surprise: We were not tired at all. Breakfast at 05:30, communication window with MCC, planning. And then, we embarked on our first long-range scouting and GeoMars EVA in direction of Coal Mine Wash river. After three days without EVA; I was eager to start and to explore new sites. And indeed, after 15 minutes driving on Lovell Highway I had to ask my companion, Christoph Kandler, to stop for a moment to enjoy the breathtaking view of Skyline Rim and Factory Butte. Formations nature has created during thousands of years, formations which the first human explorers on Mars will find one day during their extra-vehicular activities. I must admit that this was a special moment.

But there were more special moments to come as we continued the road. We set various new waypoints and also named to formations (details see EVA # 17 report). Exploration mode! Unfortunately we lost contact to the Hab very soon, but prior to departure we had agreed on an arrival time which we tried to meet as exact as possible. That meant to turn around at an moment when we would have loved to continue, but that's the life of an astronaut on duty. Apollo 10 came to my mind for a brief moment. Less than ten miles above the lunar surface...

We came home just some hours ago and have both lost more than two kg, despite sitting on ATVs most of the time. It was exhausting and rewarding. We didn't come back with empty hands, however: biological samples and various rock and soil samples filled our bags, which will be procured this evening still. And, as if all those new impressions wouldn't have been enough, we were greeted by the remaining crew with a surprise: As the Hab water consumption table of yesterday indicated, we hadn't used enough water, and so we all were granted an extra 10 second shower. 10 very relaxing seconds (actually, I made 15 out of them, but don't tell it to anybody!). For the first time I really felt the exhaustion after a long-range EVA, carrying the backpack for six hours on a shaking ATV.

But now I am satisfied. We will have dinner soon, and then we have a crew briefing session to plan the next steps. If we make it before 22:00, we might even watch a short Mars movie. But if not: I don't care. I have explored the highlands of Mars today, in reality.

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Wendy Hobbs Meter: 3340.2 hrs
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: full
Oil Pressure: 35 PSI
Water Drained: no

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
23:10 - 26.8 - 09 - 21 - on - float
07:30 - 26.1 - 09 - 18 - on - bulk
14:20 - 23.9 - 08 - 20 - off
18:20 - 21.9 - 09 - 24 - off

Fuel Status (as of 20:31):

Diesel: Approximate Reading - 7/8

Propane Tank: Approximate Reading - 49% (490 gallons = 1854.8 L)

Gasoline:
Consumed Today: 2 gallons = 7.6 L
Quantity Remaining: 7 gallons = 26.5 L

Oil:
GenSet Quantity: 7.5 quarts
ATV Quantity: 9 quarts
V'ger Quantity: 8 quarts

Water Status:

Outside Potable Water Tank Level: 410 gallons = 1552.0 L
Trailer Potable Water Tank Level: 0 cm from the base
Water Meter Reading: 0 gallons = 0 L
Water Consumed: 0 gallons = 0 L
Grey Water Used: 25 gallons = 94.6 L
Flushes: 7
Showers: 2
Sponge Baths: 2

Two analogue astronauts waiting for the recompression sequence to finish before entering the suit-room of the station.

Tonight's Meter Readings:
Out to Toilet: 2401.2
In to GreenHab: 14844.3 (+ 31.4 since yesterday)

GreenHab:

Crops Watered: yes
Crop Condition: Pretty well!

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 10 gallons = 37.9 L
Tire Status: good

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 3: Used - no

Oil Checked: no
Fuel Consumed: 0 gallons = 0 L
Tire Status: good

Notes/Comments: The right rear tire of ATV 3 was cut by a stone, Don patched it.

HVAC: Nothing new to report.

Mars Surface Suits: Used Suit No. 1, 4 & 6. PLSS No. 2, 1 & 6. Helmets No. 2, 4 & 5 on EVA 16

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Health & Safety Report
Gernot Groemer Reporting

Although we have only 4 days, 19 hours and 34 minutes left, the main part of the AustroMars mission is about to be launched: as indicated in the Commanders report yesterday evening, we are now trying to launch an exploratory campaign towards Factory Butte and do it the way we would do it on Mars: no pressurized Rover, no cheating, only using what we have.

The entire crew has been in close contact with a fully operational Mission Control Center which had informed all backseat teams and scientists about the new challange: this undertaking, now officially dubbed as "Operation Edelweiss" has also medical implications, as we are now going for long duration EVA's challenging food, water and air supply strategies, being in constant contact with specialists at MCC discussing safety issues to check for the optimum traverses for the EVA-teams and even "little" things of: how do you balance your fluid need on one hand and make sure the analogue astronauts do not feel a high urge to get rid of the fluid? Can we adjust the food intake in a way that there is no deficit during the EVA with the little stock we have left?

What kind of additional medical equipment do we need on the journeys to increase safety above the normal level as we might experience long duration losses of signal? The good news is, that I do not have to work on this all alone, but that there is a fantastic team in high-steam mode thinking about these challenges as well and has the manpower to work on the solutions. On the psychological side, setting such an ambitious goal has made a boost to crew morale and we were getting up at 5:00 in the morning to start the day (those who know us, know what kind of sacrifice for the benefit of science this means.

Magnificent desolation in the sunset of the Utah desert.

On the crew health side everything is fine, besides a minor possible latex allergy of one of our crew members, but using some 1% hydrocortisone did work well.

HSO Personal Report:

Compiling reports? Yes, that is also a tedious task which is required of the crews: in our case we try to keep it to a minimum, as we have such a large number of data collection activities for the experiments anyway, plus the task to do nearly daily video conferences with the press (today we had a 4 min contribution in the regional TV of Vienna's main broadcasting station only on the Sisi-rover - just to mention on what level of detail the media coverage is now - its not just about six people stepping out in a cool landscape in spacesuit simulators, it is already well beyond that.) Well, the reports are certainly an important issue, as they are the main source of information for engineer and scientists, but on the other hand one has to keep a delicate balance: we all here have the feeling that our time here is extremely precious - after all we were not to conduct all these wonderful experiments and make it all happen without the support of the other 120 people in the project, so we are a kind of an arrowhead, the small executing part of a larger team. Hence, we try to keep the writing to a minimum, and take as much data as possible.

It is a wonderful thing to see how the data are piling up, where we can guesstimate the first results as the first draft anaylsis start - science in progress is a wonderful thing to watch: like taking the pulse of a patient tells you something about his health, measuring new things means that nature might reveal something about her. If this is to be combined with the essence of exploration, like finding a hidden path on a pedestrian EVA to the top of a steep hill, then these are the moments people like us feel a rush of adrenaline and endorphines. - Operation Edelweiss has started.

Signing out yours truly
Gernot Groemer, HSO

E V A R e p o r t
A l e x a n d e r S o u c e k & N o r b e r t F r i s c h a u f
R e p o r t i n g

EVA Number: 18
EVA Name: WLAN Engineering
Objectives: Erect two WLAN communication masts, one at repeater hill, the other one at NAT27 UTM 14251258m N, 516598m E , between WPT 126 and WPT 028 in the lower blue hills.

EVA Commander: N. Frischauf
EVA Navigator: C. Hutsteiner
Hab Comm: A. Soucek
Planned Route: MDRS - Repeater Hill - MDRS

Timeline:
Don Suits: 14:30
Enter Airlock: 15:10
Egress: 15:20
Ingress: 19:50
Enter Hab: 20:00

Narrative: This EVA intended to erect to WLAN router masts, one at repeater hill, the other one at NAT27 UTM 14251258m N, 516598m E , between WPT 126 and WPT 028 in the lower blue hills. At the end the WLAN router at the later point worked fine (powered by solar arrays and an attached battery pack), while the one at repeater hill did not. The reason for this odd behaviour is yet unknown, but we assume it is related to a high voltage dropout along the long power line.

FE Hutsteiner planning tomorrows EVA.

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: very good.

Brief Narrative of Today's Results: Today's main activity was a five hour emergency rescue operation EVA to train the rescue of an astronaut out of a (small) canyon under sim conditions. For this, AustroMars brought extensive equipment from Austria's Mountain Rescue Association and MSL M. Spiss, a trained mountain rescuer and expert, conducted the test. Everything worked well and we proved, both from a medical, engineering and logistics point of view, that such rescue operations are feasible and, given the right equipment (in this case specially designed by Austria's Mountain rescue association, patented and worldwide in use), safe and effective.

The afternoon saw other engineering EVAs to Repeater Hill in order to work on the WLAN network as well as to test the Aerobot. Besides that, all scientific test were successfully performed as usual.

EVA: 3.

Plans for Tomorrow: See flight plan day 12 of MCC.

Report Transmission Schedule:

1. Commander's Check-in: 18:30
2. Commander's Report: 21:00
3. XO Report: 20:00
4. HSO Report: 20:00
5. Engineering Report: 20:00
6. MSL Report:
7. MSP Report:
8. EVA Report: 21:00
9. Photographs:21:00

Miscellaneous: As it was a calm sunny day, the hab roof did not disintegrate any more because of storm. Everything is in good status, except the nominal internet connection. For the moment, we run on WildBlue sat connection and it proves to be good, nevertheless the normal connection disabled by yesterdays storm will have to be reestablished. ATV3 is running again and in perfect shape.

Support Requested: Generator was down most of the day, at 1800 we were still running on battery, but apparently work is going on to fix the problem.

More to follow.

Alexander Soucek
Commander, MDRS Crew 48 "AustroMars," on behalf of CDR

Commander's Journal
Norbert Frischauf Reporting

AustroMars Mission Sol 11: "Alpine rescueing on Mars"

Imagine a Mars expedition on top of the Tharsis volcanoes or at the Vallis Marineris. What happens if one of the astronauts slips and breaks himself an arm or leg? How do you get him safely back to the base - especially if he has fallen into a steep canyon or a valley?

This question is one of the main questions of AustroMars and we intended to prove that alpine mountaineering expertise as readily available in Austria can help in such cases where the difference between life and death is dependent on speed and quality of transport.

In our scenario an astronaut had fallen 12 m from a cliff and had been badly injured, suffering thereafter from a serious head injury (suspected subarachnoidal hemorragia, a bleeding in the brain, which might cause a slow loss of consciousness or even loss of breathing). This type of injury was reflected in our scenario by the fact that the patient was consciousness at the beginning and could even support the rescue operations, but falling into unconsciousness later on (by the way poor simulated patient was Alexander Soucek, the First Officer of AustroMars). When Alexander (simulated) fell from the cliff in a geological expedition, he landed in a canyon, where he had to be lifted up by a quickly erected bipod. Once this was set up, Gernot Grömer, our Health and Safety Officer, was lowered down to the patient. Gernot conducted a first patient assessment and initiated a treatment (mostly psychological support). Afterwards, Gernot attached Alexander, who was still conscious and cooperative to a carabiner, so that he could be lifted up into safety by a one-to-four linkage. The comrades pulling the rope were Christoph Kandler, the AustroMars Mission Specialist for planetary Sciences, Christian Hutsteiner, our Flight Engineer and Markus Spiss, the AustroMars Mission Specialist for Life Sciences. Because of Markus' profession as mountaineer at the Tyrolean mountain rescue service, he orchestrated the whole rescue mission and acted also as EVA commander. Once Alexander was safe, Gernot followed and then the whole team built a stretcher and carried the patient to the ATV. Lying on the stomach, Alexander became unconscious (simulated only), but as his head was fixed by the ring there was no immediate danger of suffocation. Once at the ATV, the patient was fixed to prove that a safe transport would be possible.

While 5/6 of the AustroMars flight crew were involved in the rescue operation, I acted as HabCom and had plenty of work in the Habitat in trying to set up a working internet connection.

Because of its remote location, the MDRS relies on satellite communications for internet access. Most likely due to the heavy storm yesterday, the MDRS prime satellite dish on the roof of the Habitat got misaligned, so it didn't communicate with the satellite anymore - the whole internet was therefore lost. Thankfully we had our own temporary satellite communication system installed and so I whirled in the morning through the whole Habitat in trying to set up the connection in such a way that every notebook and computer could be online all the time again. This was not as easy as I had thought at the beginning because the satellite terminal did not accept a router on the other side but only a computer. So I had to open our PC, install a second network card that was luckily available to share the internet with all the other computers. A broken patch cable proved to add some more thrill to the whole exercise, but after 2.5 hours and a lot of help by the experts of our Mission Control Center in Salzburg I had succeeded at last. From there on we could again have a normal contact with our MCC again.

Once the rescue group was back again, Christian and I went to another short-duration engineering EVA to fix the problem with the defect WLAN router at repeater hill. Although we tried hard with DC/DC converters and voltage dividers we did not succeed at the end, so we took the WLAN router back into the MDRS for thorough checking. This WLAN was concluded with the test flight of the Aerobot. After two short flights, we had to cancel further trials, as a harder landing crashed a part of the structure (which we will fix overnight). A bigger concern is the missing camera signal from the black widow webcam, installed on the Aerobot. In the lab, shortly before the flight it had still worked, while outside it ceased operating - the reason for that (mis)behaviour is still unknown.

So many issues, so few time on ones hands and only so many spare parts. That's the typical set-up of dramas at the MDRS. When comparing our problems with the ones that the astronauts had on the way to the Moon, the MIR, still have on the ISS and are likely to have on future Mars missions, I consider the MDRS an excellent test-bed to prove what human intellect and successful working together of crew and MCC can accomplish. This is for sure one of the best lessons that one can learn at the MDRS.

Signing off for today

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Executive Officer's Report
Alexander Soucek Reporting

It seems that exiting days are chasing one another, and time starts to fly. The specially programmed countdown on our hab computers tells me right at this moment that we have 3 days, 19 hrs, 10 min and... 06 seconds (05, 04...) left before the crew returns from the first human surface mission on the Red Planet. Still we have the ambitious goal of finding out more about methane and water vapour phenomena around an aera near our landing point Hebes Chasma, a place mysteriously named "Factory Butte" by previous astronomers on Earth.

It is not easy going there, or anywhere near, not only because of chaotic terrain, which is manageable by an Austrian crew of trained mountaineers, but also because of laws and regulations from Mission Control from Earth. Astronauts stick to the rules, and so we will see what the next days bring. But, in order to use time effectively, meanwhile we are training various aspects needed in reality for such an undertaking, and therefore five analogue astronauts spent the morning with an experiment of a different kind: Imagine an astronaut slipping while climbing on the edge of a canyon, falling some 10 or 20 meters and breaking his legs. He has two more hours of Oxygen left. He can't or shouldn't move. In such a situation, there is only one solution: immediate, effective and safe action from experts. If I were the injured astronaut (and in fact I was!), one thing would give me comfort despite my pain: to see experts of the Austrian federal Mountain Rescue Association with world class equipment appearing 20 meters above my head.

Within 30 minutes, today's EVA crew managed to set up a special bipod and a puzzling system of ropes and to perform two rescue operations in full simulation mode. It was an interesting and certainly very valuable experience for future references. Needless to say that it looked spectacular, but important to note that safety was of uttermost importance, and we are lucky to have had an extensive training beforehand on the equipment, and, of course, Markus Spiss as crew member supervising the action - Markus is a mountain rescue expert many could learn from. To pull the injured astronaut up again is just one part of the story. But then: How to transport him back to the "safe haven", the Habitat? For demonstrating this, the crew rigged up two improvised stretchers. As I was commanded to fall down into a canyon, break my legs, hurt my back and be close to nausia, I had at least the priviledge to be carried for a significant distance by my fellow astronauts. What we have tested today will certainly be of benefit for future expeditions to come, and one day even on Mars. The ultra-light bi-pod structure and the fast assembly allow considering it for exploration missions in general (whether on Earth or Mars), and it was certainly the first time in history of the MDRS crews that such a setup was tested and successfully performed (the next AustroMars premiere, so to say).

I like those moments in which you are aware that you are entering new ground. And everything works, of course. Because, heroic phrases aside, you are hanging between heaven and Earth here, and it depends on the skills of the ones having set up the equipment whether you'll end up in the first (heaven) or on the latter (Earth). Then, it is one thing to train it in everyday life, another to do it with a (even simulated) space suit. A beautiful day is coming to an end. Outside it's very cold, and as we were running on battery and had to save power again, it became significantly cold during the night and this morning. It reminds me more of Mars like that.

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Casper: not used

Wendy Hobbs Meter: 3352.1 hrs [+11.9 hrs since yesterday]
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: full
Oil Pressure: 35 PSI
Water Drained: no

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?

06:50 - 20,9 - 13 - 11 - off
08:55 - 27,6 - 15 - 11 - on - bulk
14:30 - 23,8 - 11 - 14 - off
17:40 - 21,2 - 10 - 14 - off

Fuel Status (as of 20:30):

Diesel: Approximate Reading - 3/4
Notes/Comments: Unfortunately a bunch of Diesel was lost due to letting open the Diesel Valve of the big Diesel tank. Less than 60 gal (it was below 7/8 and it's above 3/4 now). Most of it was catched by a drip pan.

Propane Tank: Approximate Reading - 49% (490 gallons = 1854.8 L)

Gasoline:
Consumed Today: 5 gallons = 18.9 L
Quantity Remaining: 32 gallons = 121.1 L

Notes/Comments: 30 gal have been delivered (so there'll be an error)

Oil:
GenSet Quantity: 7.5 quarts
ATV Quantity: 9 quarts
V'ger Quantity: 8 quarts

Water Status:

Outside Potable Water Tank Level: 310 gallons = 1173.5 L
Trailer Potable Water Tank Level: 94 cm from the base
Potable Water Meter Reading: 310 gallons = 1173.5 L
Out to Toilet Meter Reading: 2454.2 gallons = 9290.1 L
In to GreenHab Meter Reading: 14969.9 gallons = 56667.1 L
Flushes: 4
Showers: 2
Sponge Baths: 2

GreenHab:

Crops Watered: yes **Crop Condition:** Pretty well!

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 5 gallons = 18.9 L
Tire Status: good
Odometer: 168471 miles

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 2 gallons = 7.6 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 2 gallons = 7.6 L
Tire Status: good

Kawasaki ATV 3: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Notes/Comments: Looks like the patched tire of ATV3 is ok. The 4WD - light of ATV 2 is constantly on during use. Last night we finally had time to completely clean out the V'ger - it's a pretty neat car right now.

HVAC: Nothing new to report.

Mars Surface Suits: Used Suit No. 1, 3, 4, 5 & 6. PLSS No. 1, 2, 3, 5 & 6. Helmets No. 1, 2, 3, 4 &5 on EVA 19, 20, 21. PLSS NO. 6 didn't work on the evening EVA. Maybe another switched trouble. Will look after it later.

Computers/Networking Infrastructure: Lost yesterday during the windstorm the internet connection (Hughes). Maybe the antenna needs to be readjusted. Running now on Wildblue!

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Notes/Comments: Except the internet and PLSS No. 6 nothing new!!

Health & Safety Report
Gernot Groemer Reporting

It looks a little bit scary if you would not be trained for that: trusting your life - not just in sim, but also in reality - to a set of ropes, carabiners, pro-traction units and a inverted "V" made of 2-3 meter long carbon fibre poles standing in the soil solid like a rock, called the "Biped". What's happening? Today we had our mountaineering rescue exercise involving 5 EVA crewmembers under the guidance of our MSL Markus Spiss, who is a certified mountain rescue instructor - anyone other we would not have trusted our lives when operating the "Biped", which is a state-of-the-art technology being used in alpine emergencies since two years and which has now found its way to the aerospace sector as of today.

Low tech for complex problems: a long rope tied into a rescue net in order to transport an injured astronaut without the need for a stretcher. This rehearsal was done shortly before the steep mountain rescue test.

Due to a scouting mission in the preparatory week we have found an excellent proving ground involving a 12 m high vertical wall going down in a fantastic canyon trench northeast of the research station: the assumption was that during a geological EVA one of the EVA crewmembers stumbles and slips down the wall and falls on sand-soft soil: the spacesuits personal life support system (the "backpack" - providing air, communication, water and power) protects the spine of the patient very well. I personally believe if the patient suffers a serious back injury, the PLSS would be dead as well, probably leading to a suffocation, so one can have a good chance of having only a minor back trauma as long as the PLSS is intact. The part of the body which is hardly protected is the neck, where the deceleration of the head might easily cause neck trauma. In our case we assumed further, that the patients head crushed against the backpart of the helmet leading to a skull trauma causing to a slowly develloping subarachnoidal hemorraghia (that is a bleeding in the brain and e.g. may lead to a slow loss of consciousness and lack of breathing in worst cases).

The usual procedure is to lower down the paramedic to the patient in the first minutes to start assessement and treatment on-site, whilst the rest of the Crew starts building up the Biped which is being used for lifting up the patient. Via a 1:4 cable winch, two people are able to easily pull up the 100+ kg patient, in this case our Executive Officer Alexander Soucek, and yours truly Health and Safety Officer as the EMT.

In addition to that, we had prepared a "net-stretcher", which is an absolutely light-weighted construction made out of a long rope which resembles a fishernet, where four people are able to easily carry a patient for several hundred meters with hardly any exhaustion (very, very much unlike our carrying ops two days ago in our other rescue exercise).

In summary, using mountaineering medical know-how is a huge advantage because there are so many similarities between Mars-analogue operations and high mountain rescue, like long response times, thermal problems shifting the prognosis of the patient, the need for light-weight and cleverly constructed hardware and many other border conditions. I am pretty confident that on a real Mars mission, climbing in steep terrain will be too dangerous, to be carried out on the first landings, but inevitably it will come, and the more astronauts spend taking geological surveys e.g. in the Vallis Marineris, the more likely they are to be subject to such accidents. Having a set of countermeasures and treatment experiences at hand may one day save lives on Mars - and that is reason for us enough to lower oneself down on a set of thin ropes down a steep canyon wall here at the Mars Desert Research Station.

Personal HSO Report:

Today - besides the great rescue exercise - was a day devoted to psychological sciences as we, four times during the mission, are being asked to spend about 2 hours in front of the computers filling out questionnaires about our social structure and personal well being. We are taking part in a study from Sheryl Bishop from the University of Texas at Galveston, but in addition the crew is also subject of study for a research project at the University of Innsbruck's Institute of Psychology, specialising on crowding and other stress issues. Plus, not being satisfied by being probed by two universities, we also take part in a study for the Fatigue Monitoring System which is tracking our eyeball movement, the Pupillograph from the Medical University of Innsbruck, plus filling out questionnaires about our sleepiness perceptions using the Stanford Sleepiness Scale.

Securing the bi-ped rescue equipment into the soil can be a tedious task on a hard ground.

In addition, we are expecting extensive post-flight debriefing interviews *sigh*. Yes, we are fully compliant and happy to be subject of research, and on some days I am quite astounded how many experiments one can carry out on a single human being - that must be just as the astronauts feel in biomedical research missions in the Shuttle or so. The good news is, that one learns a lot about himself: we are eager to learn about the results of these studies and how we are perceived by peoples outside. Above this, we are very grateful for the psychological support, the back-seat team at Mission Control gives us: it is not that we are not able to handle the confined space, the tight flight plan and such a fairly high pressure to perform well, also for the many people who made this mission possible, but mainly to make sure, that a professional relationsship between the flight crew, MCC and On-Site support and the back-seats is being kept. After all, we are humans, and humans make mistakes which lead to tensions, especially when there is a) no real-time communication and b) the flow of information is sparse, especially when there is a satellite outage as we are experiencing is regularily here at the station (so for AustroMars it really paid of to have a redundant satellite communication link, which is also having a fairly good link-rate).

Signing off for today, HSO

EVA Report
Alexander Soucek & Norbert Frischauf Reporting

EVA Number: 20
EVA Name: WLAN Engineering

Objectives: Correct the problem of the WLAN communication mast at repeater hill (non working WLAN router). Conduct a test flight of the aerobot - if the weather permits.

EVA Commander: N. Frischauf
EVA Navigator: C. Hutsteiner
Hab Comm: A. Soucek
Planned Route: MDRS - Repeater Hill - MDRS

Timeline:
Don Suits: 18:00
Enter Airlock: 18:15
Egress: 18:25
Ingress: 19:45
Enter Hab: 19:55

Narrative: This EVA intended to fix the problem with the WLAN router at repeater hill. Although we tried hard with DC/DC converters and voltage dividers we did not succeed at the end, so we took the WLAN router back into the MDRS for thorough checking. This EVA was concluded with the testflight of the aerobot. After two short flights, we had to cancel further trials, as a harder landing crashed a part of the structure (which we will fix overnight). A bigger concern is the missing camera signal from the "Black Widow" webcam, installed on the aerobot. In the lab, shortly before the flight it had still worked, while outside it ceased operating - the reason for that behaviour is still unknown.

Lowering an analogue astronaut down to an injured comrad. (Picture taken during the preparatory week).

April 19th 2006

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: Excellent, despite two crew members having a very light cold they caught during yesterday's EVA (after a day of rest and some Vitamin C they are doing fine again).

Brief Narrative of Today's Results: One long-range combined BioMars and GeoMars EVA, performed by the XO, the HSO and the FE, led to interesting areas around the waypoints 235 and 239. The EVA crew took a dozen new waypoints and samples. A sterile external suit was in use again, as well as micro spherules applied to special patches on a normal suit, to measure cross-contamination. While the three person EVA crew was on mission, Mission Control surprised the remaining analogue astronauts with a medical anomaly (CDR was seriously burned by a small explosion in the laboratory), which they mastered without major difficulties (even though HSO was on EVA) - thankfully the crew had an extensive first aid training beforehand. The day concludes with reporting and science test cycles.

EVA: 1.

Plans for Tomorrow: See flight plan day 13 of MCC. In the remaining two and a half days, the crew will perform some more BioMars and GeoMars EVAs, might experience another simulated anomaly, will conclude all scientific test cycles and will finalize all science data reports.

Report Transmission Schedule:

1. Commander's Check-in: 18:30
2. Commander's Report: 21:00
3. XO Report: 20:00
4. HSO Report: 19:00
5. Engineering Report: 19:00
6. EVA Report: 21:00
7. Photographs: 21:00

Miscellaneous: nothing.

Support Requested: none.

More to follow.

Alexander Soucek
Commander, MDRS Crew 48 "AustroMars," on behalf of CDR

Commander's Journal
Norbert Frischauf Reporting

AustroMars Mission Sol 12:
"A Long-Duration geological Scouting Mission"

Today was a real hay day for three of our crew members, when Gernot Groemer, our Health and Safety Officer, acting also as EVA Commander, Christian Hutsteiner, the Flight Engineer and Alexander Soucek, the First Officer of AustroMars, took off for a long-duration geological scouting mission into the direction of Coal-Mine wash. Two Experiments were particularly concerned, GeoMars, which is centered around collecting and classifying geological samples and Track and Trace, an experiment that focuses on forward and backward contamination, the transportation of biogenic material from Earth to Mars and vice-versa. I (Norbert Frischauf) had the honor of HabCom for this EVA, but as the EVA team was most of the time out of communication range, I could concentrate for most of the time on housekeeping and technical trouble shooting. With me in the MDRS were also Christoph Kandler, the AustroMars Mission Specialist for planetary Sciences and Markus Spiss, the AustroMars Mission Specialist for Life Sciences.

XO Soucek taking soil samples, although kneeing on the soil is rather difficult in the EVA suits.

As both of them had caught a minor cold at yesterday's EVA, the flight surgeons back at the Mission Control Center in Salzburg decided that it would be better if they take a “day off”. This of course did not mean that Christoph and Markus were lying in bed, but concentrating on their scientific work, which meant that they classified and stored samples, wrote reports and stayed in contact with the Principle Investigators back in Austria.

Based on the wish list of the PIs, the EVA team conducted their geological sample survey around the two waypoints WPT 235 and WPT 239. There and along the route to the waypoint the team collected seven samples, including one core drill of 40 cm depth. Apparently one sample is very extraordinary, with a yellowish color to it, where one immediately associates that this might be some form of sulphur - well, the scientists back home will definitely like that one a lot.

While looking for worthwhile samples, the EVA team did also a bit of scouting around, thereby identifying three peculiar places, which they added to the list of waypoints. As these waypoints are supposed to have a personal touch to them, they were consequently called “Olivia's Rock” (Olivia is Gernot's Sweetheart) , “Hutti's Dream” (Hutti is the nickname of Christian) and “AustroMars Gate”. Yes, it is AustroMars and not Alexander's Gate as Alexander had already the pleasure to define a new waypoint, which he gave the name “Melanie's Column“ (Alex' girlfriend). At the same scouting EVA it was also up to Christoph to define a waypoint, which was named “Paul's Sandpit” (Paul is Christoph's 18 months old son).

While the EVA team was on its mission, I had the pleasure to shock my two crew mates in the MDRS with a simulated anomaly. MCC ordered me to simulate a little fire in the lab area in which I would burn my left hand and lower arm and would suffer from a minor smoke poisoning. The simulated accident had occurred, while I was working on life samples, as the Bunsen burner developed a side-flame because of a leak, igniting a nearby plate filled with alcohol and other stuff. I activated the test of the fire alarm and was positively surprised how quickly and professional my two comrades reacted. Christoph extinguished the simulated fire, while Markus started the first aid treatment. He lead me to the water tap and had me hold my burnt arm for 10 minutes underneath the cold water flow. Accurately observed by our flight surgeons - through the MDRS' webcams - Markus and Christoph performed flawlessly, including even a treatment of simulated shock, by infusion and other paramedic measures.

After this little excursion into stress-burdened on-the-spot hands-on applied paramedic treatment, the afternoon was relatively quiet. Markus and Christoh concentrated on their scientific data and reports, while I repaired the Aerobot's structure, which had gotten damaged by a hard landing yesterday due to a unpleasant gust.

Finally the EVA team arrived again at the MDRS and after we had un-donned the suits it was time for some afternoon lunch at about 16:00. That may sound odd, but by now we have got used to live our everyday life at the MDRS in a bit more flexible way. While the wake up time is pretty strict, the rest of the day - although aligned at a carefully prepared flight plan - slides a bit back and forth, mostly defined by the needs of our exploration and scientific infrastructure. With that respect there is not too much of difference to the daily life on a sailing ship, where one is also required to quickly adapt to the needs of the ship, be it a routine activity like hoisting sails, cleaning the deck or immanent necessities, like surviving in a storm or navigating in dangerous waters in general.

They say that the first Mars astronauts will embark on a mission very much similar to the ones of the famous explorers here on Earth, like Columbus, Magellan, Cook and Louis and Clark, charting unknown waters and territories. Of course the equipment has changed over the centuries, but I strongly believe that behind all these gadgets and tools it is still the human that is the deciding element. A deciding element that has to be prepared for its tasks, prepared in an as analogous environment as possible, like at the MDRS and other high-fidelity simulators…

Signing off for today

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Executive Officer's Report
Alexander Soucek Reporting

In Austria, I spend summer weekends from time to time in the mountains. Coming from an Alpine country, this is natural, you might say, but it is not necessary. In fact you are often longing for things you don't have, and aiming at changes and different views, if you can. Hence, being surrounded by mountains which stretch into my home city of Salzburg, a mountain tour had never been of any peculiarity to me - until I moved to Italy, where I've been living some miles off the coast in a Mediterranean environment for two years now. I love it. And suddenly I started to appreciate hiking.

Will this become the Executive Officer's biography? No, it wont, no worries. I'm trying to convey to you the fascination of geology. Some would say that's a mission impossible. There's nothing more dead than rocks, and nothing more boring. But in fact, rocks DO speak. Just, and thanks God, not very loud. They do tell their story. Geology is a key scientific subject exploring Mars; the most fascinating pictures of Mars, the stunning images you'll find in any glossary space book: rocks. Geological formations. Rims. Canyons. Mountains. Volcanoes. Sand. Deserts. Craters.

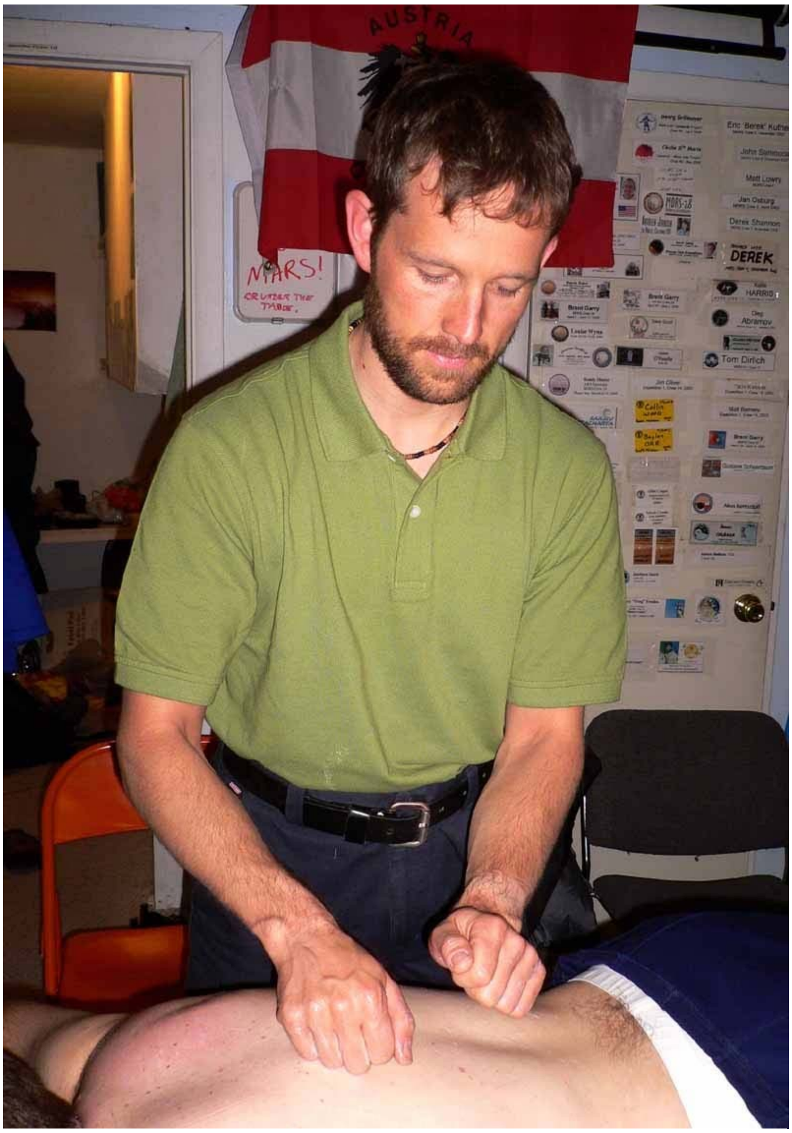
It's (almost) all about rocks, their origin, their formation, their present state and all what can be deducted from it, like the influence of water on the Planet's surface, the history of the Planet itself, its interior. No matter whether rovers or human missions land on Mars: None of them finds books or photographs of Martian history. First and most of all, they find rocks.

That's why the AustroMars mission puts a lot of emphasis on geology, cooperating with the University of Vienna. Many scouting missions have been conducted during the last days, and the sample plastic bags pile up, carefully sorted and described by our Mission Scientist for Planetary Sciences, Christoph Kandler. After having accompanied him (and learning from him) during a six hour EVA recently, I was leading another "GeoMars" EVA today, looking for interesting sites, taking waypoints and recording our activities. Of course all of us have taken a geology course during the extensive preparation and training for our high fidelity simulation; but everyone of us has different backgrounds, skills and interests. Hence we've assigned different posts to the crew members, but that's not to be understood as exclusive. Christoph has told me about the possibility of naming formations and features in the landscape; no matter how many MDRS crews have scouted the land before, you always find something new. And so, indeed, we discovered two spectacular features which had not been marked by a waypoint and a name before. They are from now on officially called "Paul's sand-pit" (Paul is Christoph's 18 months old son) and "Mélanie's Column", to pay tribute to my girlfriend who has endured almost two years of sharing me with this AustroMars mission.

Half a year ago I started my first minerals and precious stone's collection. I guess the popularity of collecting minerals ranges just above collecting stamps. But that's tolerable. This collection is just a minor pass time activity of mine, and whenever I don't have 1000 other programs (like AustroMars or another of the many COOL things in life), I work a bit on it. What has been a good solution to fill the last remaining free minute of a usual week of mine proves to be a good add-on knowledge for the mission, and during today's EVA through the dry river beds of Mars I very much enjoyed the scientific field work.

I wonder how it will be to step out of this Habitat after the end of the simulation. With quite a beard, that's for sure, as the crew decided not to shave during the mission (a tradition from sailing ships of the good old times back on Earth). No, what I mean is something different: The first step into "fresh air" without a helmet and a life support backpack, without an entire EVA suit and a strict ten minutes depressurization sequence. It's a small step for an analogue astronaut... but... I have no idea. The thought of something fresh to eat, something healthy and homemade, something grown in the garden (garden? What's that?!); perhaps an apple. Just a thought, but coming back persistently during the last days.

But then again: I wouldn't mind skipping apples for another week on Mars.



MSL Markus Spiss performing massage on an EVA crewmember as taught in a physiotherapy crash-course during analogue astronaut training,

Engineering Report Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Wendy Hobbs Meter: 3366.6 hrs (+14.5 hrs since yesterday)
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: full
Oil Pressure: 35 PSI
Water Drained: yes

Xantrex Inverter/Dynasty Batteries: Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
21:35 - 26,7 - 12 - 15 - on - float
06:05 - 26,1 - 16 - 12 - on - bulk
17:30 - 26,7 - 08 - 14 - on - bulk

Fuel Status (as of 19:04):

Diesel: Approximate Reading - 3/4

Propane Tank: Approximate Reading - 49% (490 gallons = 1854.8 L)

Gasoline:
Consumed Today: 5 gallons = 18.9 L
Quantity Remaining: 27 gallons = 102.2 L

Oil:
GenSet Quantity: 7.5 quarts
ATV Quantity: 9 quarts
V'ger Quantity: 8 quarts

Water Status:

Outside Potable Water Tank Level: 300 gallons = 1135.6 L
Trailer Potable Water Tank Level: 94 cm from the base
Potable Water Meter Reading: 9706.7 gallons = 36743.7 L (+9396 gallons since yesterday)
Out to Toilet Meter Reading: 2473.4 gallons = 9362.8 L (+18.8 gallons since yesterday)
In to GreenHab Meter Reading: 14969.9 gallons = 56667.1 L (no change since yesterday)
Flushes: 4
Showers: 2
Sponge Baths: 2
Notes/Comments: So it seems that the wonderful 12 VDC pump doesn't like the greywater. It didn't work today.

GreenHab:

Crops Watered: yes
Crop Condition: Nothing new to report.

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 5 gallons = 18.9 L
Tire Status: good
Odometer: 168584 miles (+113 miles since yesterday)

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 2 gallons = 7.6 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 3: Used - yes
Oil Checked: yes
Fuel Consumed: 2 gallons = 7.6 L
Tire Status: good

HVAC: Nothing new to report.

Mars Surface Suits: Used Suit No. 1, 5 & 6. PLSS No. 1, 2, 3. Helmets No. 2, 3, 4 on EVA 21

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Notes/Comments: The ATVs were running well today and no problems with the tires!

„Hugging Mars": only a little time left in simulation mode and still so much to discover.

Health & Safety Report
Gernot Groemer Reporting

The last days activities took their toll: two of our crewmembers have catched a minor cold including headache, congested nose and general weakness. Therefore Mission Control made a flexible change in the flightplan and shifted todays plans to do a pedestrian EVA near Skyline Rim and had us go for a GeoMars excursion. The cold itself is probably also due to high workload, slight lack of sleep and too much EVA activity, all leading to a reduced immune response in an environment where six humans share a small living space and there are a lot of places - like in the space station- where microbes can prosper.

Besides this, we experienced another medical "planned" anomaly, which involved a fire in the lab: our CDR had a problem with the Bunsenburner whilst handling chemicals. In the simulation, there was an explosive flame leading to a fire alarm and to 1-2nd degree burns on the left arm. The fire was extinguished the MSP Christoph Kandler, the wound was rinsed for 10min with water, covered in sterile dressings, laid down on the ground, covered with a blanket and oxygen applied whilst the vital parameters were taken and medical control was informed.

This operation was lead by Markus Spiss, our Mission Specialist Life Sciences, because - thanks to the MCC - yours truly intrepid report-writer had been sent out on EVA. The idea was to test the reaction of the crew to medical emergencies when the HSO is absent. The good news was, however, that our MSL is also a certified mountaineering EMT: this underlines the old wisdom, that even in small groups, a redundant setting of the team member specialisations are important for vital parts of the mission: this is not only relevant fot the medical, but mostly also for the engineering components, be it man or machine. When the life support fails, there will never be any science. Otherwise, in "real" station life, except for the two minor colds, the team is up and running on 100% and we are fairly optimistic, that somehow we will manage to scoop together sufficient food until the end of the mission and kill some of the 18 kg of rice stocks from the emergency rations in the stations food storage.

HSO Personal Report:

Two days, ten hours left on Mars. Somehow, we are realizing that this mission will be nearing its end. This was a very prominent feeling when we returned from todays EVA number 21, so we are now above 100 manhours of total EVA-time. One thought I had repeatedly was, when we drove back on pathways I am aware we will probably never see those sweet spots again before returning to Earth, aka Austria. But, on the other hand, maybe it is a little bit to early to think about the return.

It is hard to summarize so many impressions and emotions after such an intense period here at the station, we have taken hundreds of pictures already, not to count the many photos from our On-Site Support team, especially our project photographer Andreas Koehler who has been hiding hours after hours near waypoints where our EVA-teams were supposed to show up at specificied times: he is the one who has been hiding under camouflage nets, covered in dust in such a way that it is virtually impossible to detect him even when standing next to him. Andreas might be compared to a cameramen of the discovery channel, waiting for his "photographic prey", as the "shy astronauts come to the oasis to drink in the early morning" or so. He has accompanied the entire project since the end of last year starting in September in the first planning workshops in Salzburg, all the way through the crew selection and traninig process and creation of the experiments.

We are very lucky to have been sponsored by so many companies with equipment and hardware, in his case we had Nikon lending us a 9500 USD teleobjective which can pinpoint a needle in a ridiculous long distance shot. So far he has created several thousand photos of the project, which means anyone close to him can hear a nearly constant clicking every thirty seconds, when the camera takes another shot. But, on the other hand, his photos are a real work of art, especially when he lets his computer do some finetuning. So, the project documentation is very well taken care of from the pictorial side - and I am already thinking about some spots in my office back at my university, where I will put some of his artwork with the signatures of my crewmates.

Signing off for today...

Yours Truly
Gernot Groemer, HSO

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: Very good.
Brief Narrative of Today's Results: This morning Mission Control injected a medical anomaly - at 09:30, our Health and Saftey Officer "fell off a ladder" and got a deep, strongly bleeding wound on his left lower arm, which had to be treated immediately. As also the second medical expert of the team, our Mission Scientist for Life Sciences, was not available (GreenHab duty), two "greenhorns", CDR and XO, had to help, and XO performed a two-hour surgery stitching the wound in a sterile environment, demonstrating that such proceedings can be undertaken in the confined environment like the MDRS hab. The afternoon featured another long-range EVA (CDR, MSL, MSP), combining engineering tasks and geological sample collection, and leading to Skyline Rim on foot. From there, direct Vox contact could be established with the Hab without Repeater Hill's help.
EVA: 1.
Plans for Tomorrow: See flight plan day 14 of MCC.

Report Transmission Schedule:
1. Commander's Check-in: 18:30
2. Commander's Report: 21:00
3. XO Report: 20:00
4. HSO Report: 20:00
5. Engineering Report: 19:30
6. EVA Report: 21:00
7. Photographs: 21:00

Miscellaneous: nothing.
Support Requested: none.

Alexander Soucek
Commander, MDRS Crew 48
"AustroMars," on behalf of CDR

FE Hutsteiner looking over the shoulders of MSL Spiss when he is labelling skin samples.

Commander's Journal
Norbert Frischauf Reporting

AustroMars Mission Sol 13: "13 is a lucky number!"

They say that 13 is an unlucky number, but this Sol number 13 was one of my luckiest days in the MDRS. All was triggered by a special event in the afternoon, which switched my mind to Martian modus entirely and made me feel like a real astronaut on Mars. As I write these lines I am still fully absorbed by this feeling – a feeling that came as a huge surprise as there was no indication that the day could develop into something great like this.

Contrary the morning was rather stressful. First of all the primary satellite connection, which had recovered yesterday, degraded again to a point where we had to switch over to our backup satellite connection. Having that one solved, Gernot Grömer, our Health and Saftey Officer, "fell off a ladder" – in a simulated anomaly ordered by our Mission Control Center in Salzburg - and got a deep, strongly bleeding wound on his left lower arm, which had to be treated immediately. Since the second medical expert of the AustroMars team, Markus Spiss, the Mission Scientist for Life Sciences, was not available at the time of the accident because of his GreenHab duties, it was up to two "greenhorns", Alexander Soucek, the First Officer, and myself (Norbert Frischauf) to perform the first help. Gernot played his part so realistically, that I first did not realise that Christoph Kandler, the Mission Scientist for Planetary Sciences, was standing at the accident area with a video camera filming every move of Alexander and myself. After we had applied the first aid, Alexander performed a two-hour surgery stitching the wound in a sterile environment, demonstrating that such proceedings can be undertaken in the confined environment like the MDRS Hab. He had of course not an easy job, as both the flight surgeon and Gernot eyed him closely, but at the end Alex proved that the pre-flight training had paid off.

In the meantime, both Christian Hutsteiner, the Flight Engineer and Markus had found an interim solution for the immanent problem with the 12V greywater sump pump (in reality a bilge pump), whose pumping power is not sufficient to overcome the level difference between the greywater tank and the tanks in the Greenhab. The interim solution is that a bucket and a hand pump is installed at ground level, pumping the grey water from the tank into the bucket and from there the 12V bilge pump can do the rest.

The afternoon finally featured the event which had me land entirely on the red planet, with both my mind and my heart. Markus, Christoph and I were sent on a long-duration GeoMars and Track and Trace EVA, northbound of Lovell Highway, to collect three geological samples from the soil and from a vertical wall, including also a core drill approximately 2 km away from the MDRS in a dried river bed. Afterwards we were sent to a spot on top of Skyline Rim, where Markus and Christoph had just found a way to reach the top two days ago in a spectacular scouting mission, in alignment with “Operation Edelweiss”, which shall lead to a simulated spectrographic measurement of a spot at the Factory Butte “Volcano”, where a Martian orbiting spacecraft has found traces of Methane and Water vapour. But as the altitude is too high for the Aerobot and the distance is too big for the AustroMars Rover it is up to the astronauts to conduct the scientific measurements.

Using the scouted route, we quickly reached the requested sampling coordinates and took a geological sample there. To enable later crews to also find the way we have taken and such to ease the further exploration of Skyline Rim and Factory Bench, we created two waypoints. One at the base of the route called “Thoar Tirala”, the other one at the top of the route called “Thajer Joch”. The names were assigned by Markus and refer to land sites nearby his home in Tyrol. Up on top of Skyline Rim we could nicely see the Factory Butte (Volcano) in the distance – an impressive sight! Exploring a bit further, we moved southwards, hoping that from the edge of Skyline Rim we would be able to see Repeater Hill, if not by naked eye then maybe by using a teleobjective and an analysis of the photo afterwards. On the way to the edge we found an impressive cape that we consequently added in as new waypoint, naming it “Kap AustroMars”. And then we stood at the edge – the view was absolutely astonishing. More than 100 m higher than the Lower Blue Hills plain to our feet, we could easily see Phobos Peak and other land sites we had visited during the course of the AustroMars mission. It was at this precious moment that I suddenly really felt like an astronaut on Mars, when I remembered the graphic of the astronaut standing at the edge of Vallis Marineris with the rising sun in the back, and then suddenly the image switched and in the very next moment I was THIS astronaut. It was not only this feeling, but also the fact that I realised we had accomplished this goal in an impressing group effort. Over three days we had brainstormed, planned, and conceived a strategy together with our MCC to reach Skyline Rim on a direct route and not via Coal Mine Wash. And there we stood, Markus, Christoph and I, in a silent moment reflecting on all the ups and downs that we had encountered within Operation Edelweiss. In trying to capture this moment, but also to show this spectacular view to the other crew members we made a 360° panorama shot. As this place was so special for me we added it in as a new waypoint and I named it “Andreas' Buena Vista”, so that my four year old son would not have to stand behind his sister Carina, who had got “her” quarry (waypoint “Carina's Quarry”) some days ago already.

When we did he photo shots, my crew mates and I communicated by radio and were quite surprised when suddenly the Hab responded. Obviously Skyline Rim is so high that the radio waves can relatively easy reach the MDRS, although there is no direct line of sight because of Repeater Hill. Of course this was great news, as it meant that for future excursions we could rely on radio communications and thus the WLAN is not required anymore - at least not for EVAs at the edge of the Rim.

As said before, this was the luckiest day for me within the AustroMars mission. A lot of factors came together to make this happen: the fact that we have made it up there although there were a lot of obstacles to overcome, the team spirit that came to fruition to achieve this goal and finally the great view, which let me think that I was standing at the edge of Vallis Marineris as a future Martian astronaut. The afternoon was so great that the morning stress and all the troubles were easily forgotten. And from now on I will not call “13” an unlucky number anymore – well maybe I won't be so strict on that point here on Earth but definitely on Mars...

Signing off for today

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

Executive Officer's Report
Alexander Soucek Reporting

My flight plan for Thursday, 20th April 2006, showed one of the rare spare time slots our Mission Control Center grants us from time to time. Well, good, I thought, let's write some reports during these hours. Or start to clean the Hab - slowly we have to think of our return flight to Earth. It's approaching faster than we actually want. But then, our Health and Safety Officer fell off a ladder.

That turned my flight plan upside down. First, I heard the cries out of the EVA preparation room. Our Commander N. Frischauf, working on the Hab's WLAN connection, was the first to arrive at the accident victim; I followed shortly after him. In the first seconds of agitation and stress we didn't even see the cameraman behind our poor HSO: Very calmly, even leisurely, Christoph Kandler stood in the corner next to the airlock and filmed every single movement of the "Greenhorn First Aid Emergency Troop". At this point, I shall clarify that the entire AustroMars crew underwent extensive emergency aid training together with the Medical University of Graz and the Tyrolean Red Cross. But theory and practice (even simulated practice) are two things separated by a distance approximately similar to the one between Earth and Mars - at Conjunction, mind you!

Thus, our very first reaction was hectic. Very soon, however, we started to remember all steps we had learned. The wound was deep and long and smelled of ketchup. The Commander and I applied a sterile wound dressing and a pressure bandage, and then I had the romantic idea of having finished a successful first aid action and could return to flight plan duties.

I guess first aid is called FIRST aid because there's always a second aid. And not even 30 seconds had passed when our very (!) conscious accident victim politely reminded me of the next step: stitching the wound during a complete sterile surgery. My morning was gone. Several moments later I found myself on the Hab's first floor with a sterile surgical coat, sterile gloves, sterile mouth and head cover and a complete set of surgical instruments. Performing my surgery at the breakfast table was maybe a challenge for imagination, but during the work itself I had to concentrate enough to forget about my environment. When I pulled off my gloves at noon, I was tired and satisfied. I looked at a maybe not completely symetrically stiched wound, but it was made with love and passion, on Mars, more than you can ever ask from a professional surgeon.

To demonstrate the feasability and practicability of medical procedures like small surgeries is of great importance for AustroMars. And, after all, for "the real thing", a long-duration space mission to Mars. Nobody can predict what will happen during one year in space, and if wounds are not treated correctly, using the equipment at hand and dealing with circumstances like zero-G (during the flight), psychological and physiological stress, confinement and isolation, and many others, the crew might face more than severe problems. AustroMars performed a great deal of medical experiments during the last two weeks. Thanks to our excellent cooperation with many medical institutions and experts all over Austria, who willingly prepared the crew during many training sessions, the quality of the results is very satisfying.

When I watch the sun setting behind the mountains of Mars, I'm getting a bit sentimental. I have no idea how I will be able to go to the toilet without taking urine samples and mixing them with HCl, how I should walk outside without a PLSS, how I will be capable of sleeping more than six hours again, how I should find my way without precision GPS, how I should live without a flight plan (my God, imagine that: You get up in the morning and there's no Flight Plan!), how I will deal with the banalities of terrestrian life, how I will feel without my blue, worn-off flight suit.

I know exactly, however, that I will be very happy to have my apple, some "Parmigiano" chees and a glass of good Italian wine, finally. With the same sun setting behind a different landscape, on Earth.

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Wendy Hobbs Meter: 3377.1 hrs (+10.5 hrs since yesterday)
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: full
Oil Pressure: 40 PSI
Water Drained: no

Notes/Comments: Not like the last days, where Wendy started smoothly and instantly, she was giving me a hard time starting her today. Before the first attempt Wendy's batteries had 26.1 V. Same before the second. After charging Wendy's batteries (one after another) with a car to 26.6 V and using some Starting Fluid, she started after the 3rd attempt. Everytime the first thing to see was white smoke coming out of the exhaust pipe. At the 3rd attempt she started after few seconds without any problems.

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
17:30 - 26.7 - 08 - 14 - on - bulk
06:30 - 20.9 - 15 - 12 - off
14:20 - 23.9 - 09 - 17 - off
17:10 - 21.7 - 09 - 21 - off
18:35 - 26.2 - 09 - 22 - on -bulk

Fuel Status (as of 19:14):

Diesel: Approximate Reading - 3/4

Propane Tank: Approximate Reading - 47% (470 gallons = 1779.1 L)

Gasoline:
Consumed Today: 4 gallons = 15.1 L
Quantity Remaining: 22 gallons = 83.3 L

Oil:
GenSet Quantity: 7.5 quarts
ATV Quantity: 9 quarts
V'ger Quantity: 8 quarts

Water Status:

Outside Potable Water Tank Level: 250 gallons = 946.4 L
Trailer Potable Water Tank Level: 94 cm from the base
Potable Water Meter Reading: 9746.6 gallons = 36894.8 L (+40 gallons since yesterday)
Out to Toilet Meter Reading: 2499.7 gallons = 9462.4 L (+26 gallons since yesterday)
In to GreenHab Meter Reading: 15011.8 gallons = 56825.7 L (+41.1 gallons since yesterday)
Flushes: 7
Showers: 2
Sponge Baths: 2
Notes/Comments: Took the greywater sump pump out of the tank, it was a little bit clogged, cleaned it and outside the tank it works very well. Seems that it is too weak to pump the greywater always from the bottom of the tank into the TF1 Reservoir. Now we have a bucket next to the opening of the greywater tank, the pump is in this bucket and the greywater is pumped up by hand from the tank. So this wonderful system works!

GreenHab:

Crops Watered: yes
Crop Condition: Nothing new to report.

One of the last pittouresque photo opportunities during the simulation.

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 2 gallons = 7.6 L
Tire Status: good
Odometer: 168609 miles [+25 miles since yesterday]

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 3: Used - yes
Oil Checked: yes
Fuel Consumed: 2 gallons = 7.6 L
Tire Status: good

HVAC: Nothing new to report.

Mars Surface Suits: Used Suit No. 1, 4, 5. PLSS No. 1, 2, 3. Helmets No. 2, 3, 4 on EVA 22

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Notes/Comments: The only solution for the neverending greywater sump pump story is to buy a new "decent" sump pump not a bilge pump which is used as a sump pump. In my opinion thats the only way to make make this story an end.

Health & Safety Report
Gernot Groemer Reporting

"This morning, I was on the wrong side of the needle": that's what paramedics say, when they become patients themselves and that's exactly what happend to your truly Health and Safety Officer this morning. In another "anomaly" directed by the Mission Control Center, I "had to" stumble on a ladder and fall down on an open drawer in the EVA prep room cutting my left forearm down to a depth of 1 cm.

The tricky thing about the situation was, that I had to wait until Markus Spiss, our other EMT was out in the Greenhab so that no certified medical personnal was available when I "tumbled at the ladder", and fell down with a loud scream. Our Commander Norbert Frischauf who was busy with doing electronics stuff and our First Officer Alexander Frischauf working on the command deck rushed into the prep room and started providing the first aid. Two months ago, we had received a wonderful training at the University Hospital Graz's emergency room and our XO was eager to try out the equipment.

I was transported to the upper deck, where the cleanest place in the hab can be found and the XO was dressed in a sterile way by his assistant, our MSP Christoph Kandler, who was also doing the camcorder filming for the medical documentation. I got eight stitches into an artificial skin which was glued above my realk forearm and has been radiation sterilized back on Earth, aka Austria. The resaon for working with sterilised equipment on artficial skin is to show, if we are able to sustain a clean enough environment in the station to prevent the astronaut from acquiring a nasty infection which, in the worst case scenario may spread across the body and infest itself in more serious troubles.

There were many lessons learned which will make their way into the medical reports in the weeks to come. - Looking forward toa complete compilation of all these medical anomalies. An interested outsider must think we are fairly clumsy and lubberly, but, dear reader be assured, that these anomalies have been carefully conspired by our dear Mission Control Center.

Otherwise, the crew is in good health, the two crewmembers who had the cold yesterday have recovered sufficiently enough to be sent out to another EVA, which has mostly been conducted on ATV's.

Groemer, HSO

HSO Personal Report

I love those Emails, which start: "Personal Info only", because that means, that one is being directed to be the source of an anomaly. That is usually the moment, when the respective crewmember bows over the laptop monitor and anxiously looks around him if no one else had been reading that particular message. The usual next step is a big question mark on the teammembers face which externalizes the big questionmark of "hmm... how am I going to implement that particular request from Earth?". In this case it meant secretly abducting some tomato sauce and strawberry jam to mix a at least marginally realistic artificial blood replacement, hide the aluminium ladder in the preproom whilst still satisfying the official flight plan directives (otherwise crewmates might ask questions like "aren't you supposed to do something else"?); cleverly, Mission Controlled had assigned a task -calibrating medical sensors- which required my presence in that particular location. Next step: getting a trustworthy accomplice, in my case Christoph, whom I had to explain the Video camcorder first without raising suspicion.

CDR Frischauf and XO Soucek treat a severely bleeding HSO Groemer.

On a sidenote it should be mentioned, that all of us are expecting mission anomalies any moment any time during the day or night, of any kind: may it be a solar storm, a medical victim or even things Mission Control definitely cannot be blamed for. That means that our collegues on Earth get bei held responsible for, like a broken sink pump or a bad satellite dish orientation (well, maybe they talked our ghosts of Mars into doing it :)). So, after about 15 minutes of careful planning, I let the ladder fall down, scream and wait for the faces of the CDR and XO who pop up in the door of the prep room and are being filmed whilst they provide a well-trained first aid. - Good to realize, that even when the HSO and the MSL are down, there are still people who can and are willing to provide qualified medical response for life threatening emergencies.

I would love to see more people like them on the street capabale of providing the same kind of qualified help, then I see in real life when working at the ambulance service.

Signing off from Mars for today.
Groemer

E V A R e p o r t
G e r n o t G r ö m e r & N o r b e r t F r i s c h a u f R e p o r t i n g

EVA Number: 22
EVA Name: Long-Duration GeoMars and W-Lan setup Engineering

Objectives: Go to the coordinates NAD27 UTM 14254022m, N 517945m E and collect three geological samples from the soil and from a vertical wall, including also a core drill. Afterwards proceed to coordinates NAD27 UTM 14252416m N, 514714m E on top of Skyline Rim. If time permits establish the WLAN repeater at Repeater Hill in alignment with Operation Edelweiss.

EVA Commander: N. Frischauf
EVA Navigator: C. Kandler
EVA Crew: M. Spiss
Hab Comm: G. Groemer

Planned Route: MDRS - NAD27 UTM 14254022m, N 517945m E - NAD27 UTM 14252416m N, 514714m E - Repeater Hill - MDRS

Timeline:
Don Suits: 14:15
Enter Airlock: 14:55
Egress: 15:05
Ingress: 18:45
Enter Hab: 18:55

New Waypoints Established by EVA Crew: 4, NAD27 UTM 14251529m N, 515207m E, 1517m MSL - Kap AustroMars; NAD27 UTM 14251480m N, 515230m E, 1521m MSL - Andreas' Buena Vista; NAD27 UTM 14252416m N, 514714m E, 1486m MSL - Thajer Joch; NAD27 UTM 14252358m N, 514802m E, 1448m MSL - Thoar Tirala

Sample Number: 23-1 / 23-2 / 23-3 // 23-4
GPS-Coordinates: NAD27 UTM 14254022m, N 517945m E // 14252416m N, 514714m E, 1486m MSL - Thajer Joch
Time: 15:30 // 16:40
Photos: 2 / 2 / 2 / 2

XO Soucek applies several surgical stitches on the laceration of the HSO's arm. Clinical training was only a few weeks old at that time.

Narrative: Today was the day we wanted to get up on Skyline Rim, using the route that the MSP (C. Kandler) and MSL (M. Spiss) had scouted out on April 17th. This GeoMars EVA led us first to NAD27 UTM 14254022m, N 517945m E, where we were ordered to collect three geological samples from the soil and from a vertical wall, including also a core drill. Afterwards we proceeded along Brahe Road to the foot of Skyline Rim as were ordered to take a geological sample at coordinates NAD27 UTM 14252416m N, 514714m E on top of Skyline Rim, in alignment with - Operation Edelweiss. This point was later on called - Thajer Joch by our MSL and from here we made a southbound excursion of the Skyline Rim Plateau, reaching finally NAD27 UTM 14251529m N, 515207m E, 1517m MSL - Kap AustroMars and afterwards NAD27 UTM 14251480m N, 515230m E, 1521m MSL - Andreas' Buena Vista. Here we were able to establish radio communication with the MDRS, even though the Repeater Hill radio device is non-operational. Communications were not perfect but in pilot's terms (reading 1- 5) at scale 3-4. After a 360° Panorama shot and a careful look at Factory Butte, we headed back to the MDRS, establishing another waypoint at the beginning of the route on top of Skyline Rim (NAD27 UTM 14252358m N, 514802m E, 1448m MSL - Thoar Tirala), so that later crews can also find the way for further exploration of Skyline Rim and Factory Bench. As we were able to establish radio communication, the WLAN setup at Repeater Hill was skipped/postponed.

April 21st 2006

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: Exhausted but well.

Brief Narrative of Today's Results: The last full day of AustroMars brought another two GeoMars EVAs in direction of Skyline Rim. Meanwhile, the remaining crew members started writing the final reports, uploaded images and prepared the hab for tonights extensive cleaning and packing session. Depending on the weather, there might be one final EVA for five people in the frame of AustroMars' astronomy project, TeleMars.

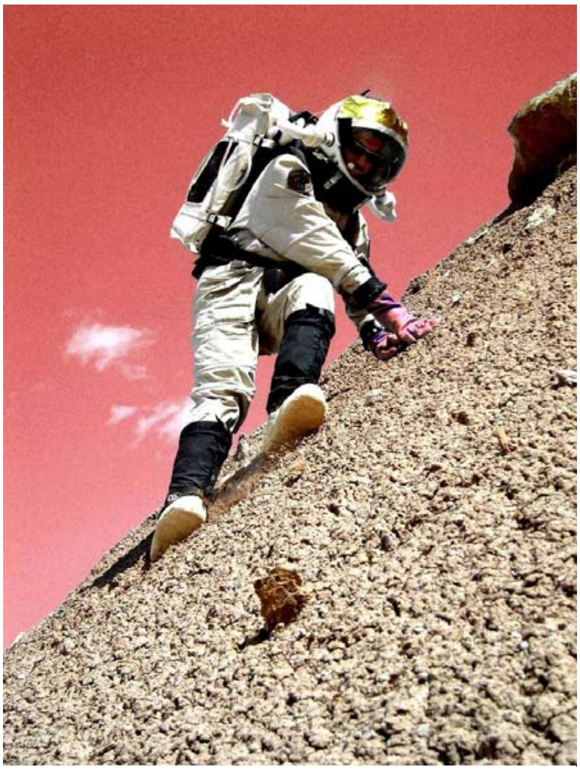
EVA: 2.

Plans for Tomorrow: End of the AustroMars Simulation in 9 hours.
Report Transmission Schedule:

1. Commander's Check-in: 19:30b 2. Commander's Report: 21:00
3. XO Report: 21:00
4. HSO Report: 20:30
5. Engineering Report: handed in
6. EVA Report: 21:00
7. Photographs:21:00

Miscellaneous: nothing.
Support Requested: none.
Nothing more to follow. AustroMars at MDRS was an experience to remember. We thank everyone who helped making it possible.

Alexander Soucek
Commander, MDRS Crew 48 "AustroMars," on behalf of CDR



XO Soucek masters rough terrain whilst on a geological survey EVA (background reddened artificially).

Commander's Journal
Norbert Frischauf Reporting

AustroMars Mission Sol 14: "Operation Edelweiss acomplished!"

The last day of the AustroMars Mission saw a final that was absolutely in alignment with this remarkable mission. Beside of the usual communication issues with our primary satellite connection, which is constantly interrupted for very long periods and then starts to work surprisingly again, our Mission Control Center in Salzburg had organised the flight plan in such a way that two teams would explore Skyline Rim in alignment with Operation Edelweiss.

After a very nice breakfast, which featured an opinion exchange of what everyone will eat as first as soon as we have landed on Earth again, the first EVA team – officially called “EVA Team 23”, as it was our 23rd EVA – started to prepare itself for the airlock procedure. The team was comprised of Christian Hutsteiner, our Flight Engineer, acting as EVA Commander, Christoph Kandler, the Mission Scientist for Planetary Sciences and Markus Spiss, the Mission Scientist for Life Sciences. While Christian wore the normal MDRS space suit, Christoph and Markus were dressed in the spacy silvery sterilised gown, which is a typical feature of the Tack and Trace experiment.

This experiment is set up to quantify backward and forward contamination, an absolute novelty in the Mars analogue science scene. Measuring the backward contamination or the transport of material from outside the Airlock into the Habitat, is done by having an astronaut wearing a sterile cover over its space suits on which specific plates are mounted to collect samples outside of the Habitat and as such to obtain data how much outside material is transported back into the Airlock and/or the Habitat. Contrary, the forward contamination experiment is done with a normal looking space suit, on which fluorescent micro spherules of different colour are applied to the left and the right arm. In addition specific places of the space suit are covered with special collectors, which are to accumulate some of these micro spherules to check for cross and forward contamination, which is happening while doing normal activities on the Martian surface.

Even though the sterile silvery space suits feature a very bad thermal balance, leading to an enormous heat build-up inside, Christoph and Markus walked up on Skyline Rim with Christian (but then on the other hand these two fellows come from Tyrol and climbing on mountains is part of their daily life anyhow). There they scouted out the terrain in direction to Factory Butte, before they went down again and followed the base of the Skyline Rim in southerly direction. All in all this EVA was very productive, as six samples were collected on top and at the base of the Rim.

After a lunch which gathered the whole flight crew at the table, it was up to the second EVA team to move on, form where EVA team 23 had stopped. In the mission scenario of Operation Edelweiss, the AustroMars astronauts are sent to Skyline Rim to conduct a simulated spectrographic measurement of a spot at the Factory Butte, which resembles a simulated volcano. The reason for the excursion is that a Martian orbiting spacecraft has found traces of Methane and Water vapour. But as the altitude is too high for the Aerobot and the distance is too big for the AustroMars Rover it is up to the astronauts to conduct the scientific measurements.

The second EVA team – EVA team 24 – was comprised of Alexander Soucek, the First Officer, Gernot Grömer, our Health and Saftey Officer – wearing Track and Traces patches for forward contamination quantification - and myself (Norbert Frischauf), acting as EVA Commander. Christian was the HabCom, who we would try to connect via radio once we are on the edge of Skyline Rim.

Using the scouted route, we quickly reached yesterday’s waypoints “Kap AustroMars” and “Andreas’ Buena Vista” on the Rim. From there on we moved on to the highest point of Skyline Rim at coordinates NAD27 UTM 14250980m N, 515293m E at an elevation of 1547.1 m. We conducted our simulated spectrographic measurement of the volcano from there – the results are currently analysed by our scientists. To remember the great effort that was required to get there we created a waypoint at the spot where we conducted the measurements and called it “Edelweiss Peak”.

Such as yesterday, we were today also able to establish direct radio communication with the MDRS from the edge of Skyline Rim. But as the quality of the signal was today only bearable and sometimes communication could not be continued at all, any crew that intends to follow our footsteps, continuing the exploration of Skyline Rim, should make sure the radio repeater at Repeater Hill is fixed and operational again. Leaving Skyline Rim, Gernot, Alex and I wanted to go to a specific point at the Tank Wash to obtain some geological samples. Unfortunately we had to abort this EVA on the way to the geological site because of radio communication problems.

Now we are all in the MDRS again, packing stuff and preparing for our flight home to mother Earth. This last evening is of course something special and we intend to celebrate it in a way that none of us will ever forget it. By tomorrow we will be free to open the door of the MDRS again and immediately thereafter we will meet our On-Site-Support team, Johannes Nendwich, René Vidalli and Johannes Gross, as well as Andreas Köhler, our photographer. I am pretty sure that there will be a lot of joking and hugging and I am particularly looking forward to all the little stories, which accompanied certain anomalies that we encountered during our mission.

Still we are not at home, but have 20 hours of flight in front of us, before we can embrace our girlfriends, wives and children. In my case I am absolutely sure that these 20 hours will feel similar to 5 months of trip time. But that should not surprise or concern me too much at this stage, as these 5 months are exactly the duration foreseen for a return flight from Mars to Earth…

Signing off for today

Norbert Frischauf
Commander, MDRS Crew 48 "AustroMars"

MSP Kandler posing in front of a magnificent Skyline Rim plateau.

Executive Officer's Report
Alexander Soucek Reporting

In a time slot not foreseen by our flightplan, I prepared a little good bye present for my crewmates. It was today between two and four o clock in the morning; as Executive Officer, I had signed off since a while already, as Alexander Soucek I was still on duty. Not very intelligent, our Flight Surgeon and our Mission Control center would have said most probably. Too tired tomorrow! Not enough sleep! But night's my nature. And my most productive time window, given that I have my mind free, my body under a blanket, my laptop on my knees and music in my ears. And so I turned some of the most stunning images of the last two weeks into old fashioned-looking, yet enhanced black-and-white images.

When the colour fades away - like our most immanent experiences and memories will fade with time - the essential becomes visible. And that's the nucleus that will stay with us, that we part and pass on. The idea of creating AustroMars two years ago, when Gernot, Norbert and I had still more but less grey hair; the many weekends of brainstorming and the constantly re-appearing question: Can we make it? Shall we do it? And then: We did it. The more than 120 people doing it with us. The fascination spreading like a fever epidemic across Austria. The Austrian public landing for the first time on Mars.

New friends. New experiences. New projects. Walking on the thin border line of enthusiasm and frustration, for so many months.

All those memories can be seen in the black-and-white photos of tired, bearded men in dirty blue flight-suits decorated with paint and HCl acid holes. We have learned a lot during the last weeks, and I am not only talking about science and engineering. Spitting in little plastic tubes is important to monitor the Cortison level indicating stress development, but it is not what you take home in your heart, and what you communicate to children at school. It is not what makes it special to have been here, even if it is the purpose of our mission.

MDRS is a unique place, maybe one of the very few places to live a piece of tomorrow. Nevertheless I want to be honest and remark that this station didn't make it always easy for us. I wonder what would have happened to our "high-fidelity" mission if we had not engineers and technicians in our crew, who repaired pumps, helped with electricity problems, power generator cut-downs, broken greywater systems and an internet constantly breaking down. My first impression arriving at "the Hab", late at night in complete darkness, with the hab's portholes illuminated, was simply: breathtaking. Beating of the heart. My first impression standing inside: student hostel atmosphere. A space (actually, sorry, planetary surface) station with wooden stairs, cornflakes packages, seven folding chairs in six colours, isolation foam everywhere and posters on a light blue wall. Hm. But it became our home on a hostile planet. I guess that future Mars stations will actually look a bit like student! Hostels, because to live in a confined, sterile and technical place for years would drive everyone crazy who has a heart under his or her worked-out astronaut body. On Mars, you will try your best to be reminded of everyday life on Earth. Just here, on Earth, it does not help escaping everyday life during the few days you have. Maybe it wouldn't take too much: painting the yellow isolation foam white, fixing loose parts of the wall, putting six similar and comfortable chairs around a nice table. It was interesting to hear that the crew had one thought in common: The part reminding you most of a station on another planet, the part helping you to escape from this world, is the outer hatch of the main airlock. Even if you cannot lock it and therefore strong winds fling it open occasionally (killing the crew...), it is simply - cool.

But on the other hand, this is not an adventure holiday hotel or Disneyland. It is just enough to serve its purpose - and it serves it well. It's unique in itself. And science can be done regardless of cornflakes packages and yellow isolation foam. We have performed seventeen (17!) experiments from a large range of disciplines in close cooperation with our PIs back in Europe; we will come home with much, much data. I think, we - the team of MDRS and Mars Society, the Mission Control Center in Salzburg, all supporters, scientists, administrators, and last but not least the crew, can be proud of what has been achieved by AustroMars. The outreach effort has reached dimensions never imagined before, and together with strong science and engineering cases, this will be the basis to plan new steps, whenever, wherever...

Tomorrow I will finally have my apple (if I find one in Hanksville). The day after tomorrow, I will have my Italian wine and my fresh bred and cheese enjoying the lights of Rome by night from my roof terrace. Then, I will look up to the starry night sky and see this faint reddish light near the western horizon.

I will miss Mars.

Two crewmembers dragging a rope attached to the bi-ped mountaineering equiment to lever up an injured crewmate.

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Casper: not used

Wendy Hobbs Meter: 3389.7 hrs [+12.6 hrs since yesterday)
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: 7/8
Oil Pressure: 40 PSI
Water Drained: no

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
06:40 - 21,5 - 09 - 15 -off
14:30 - 24,2 - 10 - 19 -off
18:15 - 21,9 - 10 - 22 -off
19:00 - 26,7 - 10 - 23 - on - bulk

Fuel Status (as of 19:06):

Diesel: Approximate Reading - 3/4

Propane Tank: Approximate Reading - 46% (460 gallons = 1741.3 L)

Gasoline:
Consumed Today: 3 gallons = 11.4 L
Quantity Remaining: 20 gallons = 75.7 L

Oil:
GenSet Quantity: 7.5 quarts
ATV Quantity: 9 quarts
V'ger Quantity: 8 quarts

Water Status:

Outside Potable Water Tank Level: 350 gallons = 1324.9 L
Trailer Potable Water Tank Level: 80 cm from the base
Potable Water Meter Reading: 9800.7 gallons = 37099.6 L (+54 gallons since yesterday)
Out to Toilet Meter Reading: 2525.7 gallons = 9560.8 L (+26 gallons since yesterday)
In to GreenHab Meter Reading: 15035.8 gallons = 56916.5 L (+24 gallons since yesterday)
Flushes: 5
Showers: 2
Sponge Baths: 2
Notes/Comments: No change in the status of the greywater sump pump.

GreenHab:

Crops Watered: yes
Crop Condition: Nothing new to report.

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 4 gallons = 15.1 L
Tire Status: good
Odometer: 168695 miles [+86 miles since yesterday.]

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 3: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

HVAC: Nothing new to report.

Mars Surface Suits: Used Suit No. 1, 4, 5 & 6. PLSS No. 1, 2, 3, 5 & 6. Helmets No. 1, 2, 3, 4 on EVA 23 & 24
Computers/Networking Infrastructure: Nothing new.
Appliances: Nothing new.
Data Logger: Nothing new.
Upgrade Work: Nothing new.
Notes/Comments: Nothing new on the Hab systems!

Health & Safety Report
Gernot Groemer Reporting

It is our meanest enemy. It crawles into any joint mechanism and cripples it, it floats down invisibly into human airways, causing infections, it can charge itself electrically and thus sabotage our communication equipment. It is a major design driver in creating a safe mission scenario. It is so small it is hard to detect unless it has been accumulated in dangerous amounts. Dust. You mention it, we fear it. Seriously: dust on Earth is a plague, but no hazard - on Mars, it is both: the Martian soil is highly oxidative and in some places even cancerogene due to hexavalent chrome contents. With that in mind, dust mitigation is a major issue here in our mission: therefore we were the first one to bring along a simulated glove box to handle our soil samples. The EVA-crews were required to brush off their suits and boots before entering the Habitat, in worst cases, after very dirty EVA's even clean the entire suit with a strong vacuum cleaner which can filter the dust. One of the problems all Apollo surface crewmembers mentioned was the dust. I think it was Al Shepard who said that pretty much any technical challenge of a planetary surface mission can be overcome, except for dust.

Speaking of soil, some stress was caused by a core sample we had taken on EVA-21 which had a yellowish coloring in the sunlight. Mentioning this to Mission Support (which is a kind of secondary Mission Control Center to Salzburg and a contingency infrastructure in case we loose contact with our primary team) caused a lot of stir, as there was concern that this sample might be comprised of uranium, which is indeed found in Utah; fortunately, this development came to an end as pictures and detailed descriptions were sent to both Mission Control Salzburg, Mission Support Denver and our Geology Operations Console. Well, although this was a rather exotic incidence at this station (didn't I say previously, that on this station, anything is possible?), but it stirred an interesting debate during lunch time of how a crew on the Red Planet would react to such a developement.

Speculation, speculations, spectulations of what might one day be... and we are laying the brickstones making the road to that planet in a not too-distant future... Signing of from Mars for the last evening - I can already hear the turbopumps filling the tanks for the main combustion chamber of our Earth return vehicle... as of now we are experiencing our last sunset on Mars.

Your's Gernot Groemer, HSO

EVA-23 Report:
Crew 48 Reporting
EVA Name: GeoMars
Objectives: Acquire some geological samples at the following koordinates: point A: 515150 E, 4250560 N and south along Skyline Rim; Point B: around 514712 E, 4252416 N. Test Track and Trace suits: MSL and MSP with TT1= backward contamination

EVA Commander: C. Hutsteiner
EVA Navigator: C. Kandler
EVA Crew: M. Spiss, C. Hutsteiner, C. Kandler
Hab Comm: A. Soucek

Planned Route: MDRS - point B - point A - MDRS

Timeline:
Don Suits: 08:30
Enter Airlock: 9:15
Egress: 9:25
Ingress: 11:58
Enter Hab: 12:08

New Waypoints Established by EVA Crew:
Paul's Sandpit: 14254224m N, 514810m E, 1465m MSL (UTM S12 NAD 1927 Conus)

Sample Number: 23-1 / 23-2 / 23-3 / 23-4 / 23-5 / 23-6 / 23-7
GPS-Coordinates: 14252317m N, 514937m E / 14252369m N, 514733m E / 14252398m N, 514706m E / 14251831m N, 515101m E / 14250560m N, 515150m E / 14250616m N, 515210m E / 14250633m N, 515224m E
Time: 10:05 / 10:35 / 10:45 / 11:05 / 11:15 / 11:25 / 11:30
Photos: 2 / 2 / 2 / 2 / 2 / 2 / 2 /

Narrative: This EVA intended to serve two experiments: GeoMars and Track and Trace. While the first one meant that the EVA was to obtain specific samples on pre-defined waypoints, in this case the first point lead us up to the Skyline Rim which was a nice climb to get awaken, the later one implied that two EVA crew members were equipped with special EVA suits. C. Kandler and M. Spiss wore the sterilised silver-plated cover above the analogue space suit. On it were 8 biological sample collectors, they were added on only in the airlock, to collect samples throughout the whole GeoMars EVA to quantify backward contamination. Track and Trace was therefore from this perspective a major success, as was GeoMars itself, since we were able to obtain 7 samples.

EVA-24 Report

Gernot Groemer Reporting

EVA Number: 24 **EVA Name:** Scouting mission to Skyline Rim **Objectives:** go to Skyline Rim and take GPS Measurements.

EVA Commander: N. Frischauf
EVA Navigator: A. Soucek
EVA Crew: G. Groemer
Hab Comm: C. Hutsteiner

Planned Route: MDRS - Skyline Rim - MDRS

Timeline:
Don Suits: 14:10
Enter Airlock: 14:40
Egress: 14:50
Ingress: 19:30

Enter Hab: 19:40

New Waypoints Established by EVA Crew: 1 (Edelweiss Peak)

Sample Number & GPS-Coordinates and if new waypoint, labeled as:
Edelweiss Peak (N 14250980, E 515292,50, height: 1547,10 m

Narrative: This EVA lead us to Skyline Rim which has once again impressed us by a great scenic view. Being Austrians, we went for the highest point possible and named it Edelweiss Peak - one of the secondary objectives was to establish a radio voice communication from there - which worked just fine. Interestingly we found a forgotten solar panel set-up right there without any electrical device attached to it, so our guess was that previously another EVA-Tam from the MDRS was there, it can be easily reached via pressurized rover via the official streets (which we decided not to use in order to stay in the high-fidelity simulation). Our next objective was to proceed to WPT 25 and take a geological detour towards Tank Wash. Unfortunately two of our three radios showed malfunctions and mission rules say that loss of communication means also end of EVA, so we had to abort the EVA and return to the station.

Commander's Check-In
Alexander Soucek Reporting

Crew Physical Status: Exhausted but well.

Brief Narrative of Today's Results: The AustroMars mission officially ended today at 0900. After getting up at 0545, the crew opened the outer hatch of the main airlock for the first time without EVA suits at 0600 (end-of-sim) and went towards Phobos Peak on foot, in order to climb it and watch the sunrise together. Up there, the crew also met their colleagues from the On Site Support and the team's photographer, who were all but invisible during the last weeks of the high fidelity simulation (our "ghosts of Mars"). This get-together, the sunrise and, finally, some proper breakfast on top of the mountain brought everything to a wonderful (and sentimental) conclusion. From 0900 onwards, the crew cleaned the hab, packed all belongings and experiments and prepared for hand-over and departure.

EVA: none

Plans for Tomorrow: Leaving the Hab, leaving Utah, returning to real life.

Report Transmission Schedule:

1. Commander's Check-in: 17:00
2. Engineering Report: 20:00

Miscellaneous: nothing.

Support Requested: none.

Nothing more to follow. AustroMars at MDRS was an experience to remember. We thank everyone who helped to make it possible.

Alexander Soucek
Commander, MDRS Crew 48 "AustroMars," on behalf of CDR

Engineering Report
Christian Hutsteiner & Joschi Gross Reporting

Generator/Electricity:

Casper: not used

Wendy Hobbs Meter: 3397.0 hrs (+7.3 hrs since yesterday)
Voltage: 120 VAC
Frequency: 60 Hz
Oil Level: 7/8
Oil Pressure: 35 PSI
Water Drained: no
Notes/Comments: Again Wendy gave us a hard time to start her. In the morning we used two cars to jumpstart, after she turned off without any recognizable reason. After Don shut her down to demonstrate C49 how to start, he wasn't able to start her at first. We tried to start her as well - without success - although the voltage was as high as 26.4. Don started her anyway later in the afternoon. She is still leaking diesel like hell (about 1 qt every 3 hours). The refuelling relay is not working - you have to refuel manually. The battery gauge indicator is not working correct - you have to use a multimeter to check the battery gauge.

Xantrex Inverter/Dynasty Batteries:
Time - Voltage (Temp Comp) - Load - Temp - Generator Running?
06:30 - 26,1 - 09 - 17 - on - bulk
14:30 - 24,2 - 08 - 19 - off
16:30 - 27,4 - 06 - 26 - on - bulk

Fuel Status (as of 17:01):

Diesel: Approximate Reading - 3/4

Propane Tank: Approximate Reading - 45% (450 gallons = 1703.4 L)

Gasoline: Quantity Remaining - 17 gallons = 64.4 L (-3 gallons since yesterday)

Oil:
GenSet Quantity: 7.5 quarts (no change since yesterday)
ATV Quantity: 9 quarts (no change since yesterday)
V'ger Quantity: 8 quarts (no change since yesterday)

Water Status:

Outside Potable Water Tank Level: 320 gallons = 1211.3 L
Trailer Potable Water Tank Level: 80 cm from the base
Potable Water Meter Reading: 9840.6 gallons = 37250.6 L (+40 gallons since yesterday)
Out to Toilet Meter Reading: 2538.1 gallons = 9607.7 L (+13 gallons since yesterday)
In to GreenHab Meter Reading: 15043.6 gallons = 56946.0 L (+8 gallons since yesterday)
Flushes: 6
Showers: 0
Sponge Baths: 0
Notes/Comments: Still no change in the status of the greywater sump pump!! You have to scoop manually (!) the greywater from the greywater tank up to the interim greywater bucket next to the opening of the greywater tank. Then the RuleMate1100 is able to pump from the bucket into TF1.

GreenHab:

Crops Watered: yes
Crop Condition: They are alive and kicking.

Transportation:

V'ger: Used - yes
Oil Checked: yes
Fuel Consumed: 3 gallons = 11.4 L
Tire Status: 3/4 good
Odometer: 168756 miles (+61 miles since yesterday)

Kawasaki ATV 1: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 2: Used - yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Kawasaki ATV 3: Used: yes
Oil Checked: yes
Fuel Consumed: 1 gallon = 3.8 L
Tire Status: good

Notes/Comments: The V'ger will be brought back to SLC tonight for the next crew. The rear right tire lost a little bit of air during the night. We used tire gel to fix it.

HVAC: Nothing new to report.

Mars Surface Suits: Nothing new.

Computers/Networking Infrastructure: Nothing new.

Appliances: Nothing new.

Data Logger: Nothing new.

Upgrade Work: Nothing new.

Notes/Comments: This is our last ERpt. The last three weeks have been very interesting in terms of using our general knowledge to fix things and to keep the station running. Also it showed that written procedures don't fit anytime to the given situations. So long, we want to thank the wholeengineering team for the appropriate and long lasting support! And we wish the incoming crew 49 a successful mission. Good luck with Wendy, the greywater pump, the roof, ... Joschi & Hutti