SUMMARY REPORT - CREW 108

Crew 108 (3 Dec. - 18 Dec. 2011)

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Short Presentation

As first Crew of the MDRS season 2011-2012, we were all thrilled when John Barainca and Shannon Rupert gave us the keys to the Hab: our sweet home on Mars for the following two weeks.

Coming from a variety of countries and educational backgrounds presented a challenge to making our crew a cohesive team. Thanks to our common good temper, we were up to the challenge.

Food Experimentation

The crew participated in a food study developed by Jean Hunter of Cornell University to determine the role of food and cooking in future long-duration missions.

This required crew members to rotate between two days of eating pre-prepared freeze dried foods (without improving them with additional ingredients), and two days of cooking creatively with dehydrated and other shelf-stable ingredients. We weighed ourselves every morning and answered an online survey about our appetite and mood every evening.

Aside from attempts to grow sprouts and make yogurt (neither with tremendous success), the food study went well, providing many opportunities for meaningful and humorous discussions. The process proved less demanding than initially expected, although we did miss steaks, fresh fruits and vegetables, and good cheese.

Engineers' Work (A. Dale & M. Lotto)

The Hab was extremely well prepared for us by the Mars Society Team, but several miscellaneous tasks still required attention.

Started by the support team, the pressurized tunnel, which connects the Engineering Hatch to the GreenHab, was not quite finished. So, the engineers finished construction on the pressurized tunnel in addition to their standard maintenance checks around the Hab.

They then tackled multiple repairs, many of which involved the EVA equipment. Several EVA suits' fans were not nominally operating due to failures in supporting electronics, so the engineers corrected various wiring problems. In addition, the power supply for EVA suit 2 continually caused difficulties during EVAs because it was not fully secured in its pack. To ensure cooling capabilities for EVA suit 2, the battery was firmly secured to the pack and has not caused problems since the repair.

In addition to repairs and maintenance, the engineers headed up the first efforts in standardizing hand signals for basic communication on ATVs. These hand signals are to be primarily used when the EVA team's radios are malfunctioning or impractical.

Astrobiological Findings (U. Lingappa)

Rock varnish is a thin, dark, natural coating that forms on exposed surfaces of rocks in many arid environments on Earth. It is home to several different genera of bacteria, and there are quite a few hypotheses that these microbes are responsible for its formation. There is also good photographic evidence of rock varnish on Mars. If the varnish on Mars is the same as the varnish on Earth, and the

varnish on earth is in fact the product of microbial processes, the implications for microbial life on Mars similar to that on Earth are very exciting.

Our biologist spent the last two years studying the diversity and physiology of rock varnish micro flora from the Mojave and Atacama deserts focusing on UV resistance in actinomycetes. At the MDRS, she built off this work by attempting to cultivate organisms from rock varnish within the limitations of aseptic sampling in simulation on EVA, and returning to work in a minimal microbiology lab. She successfully isolated what looked like micro colonial fungi but not the bacteria she was looking for, due to limited availability of ingredients for growth media and difficulty maintaining incubation temperature.

Studying the microbiology of Mars analog environments on Earth (like desert rock varnish) will help us to better understand where and how to look for life on Mars. Developing reliable aseptic microbiological techniques for Martian simulations is crucial to biology work on a real Mars mission.

Geological Findings (M. LeClair)

Having no previous experience working with sedimentary rock Mission Geologist Michael LeClair initially directed efforts towards structured field geology excursions and collecting samples of hematite concretions, while becoming familiar with geomorphology and paleoenvironment literature for the area available at the Hab. One notable discovery - possibly undocumented previously - are the borehole features located at Burpee Dinosaur Quarry. Kissing Camel Range to the south of the Hab was identified as an inverted channel.

Concretion examples exhibiting a brown outer surface, a light to white colored interior and lacking internal zoning as described by Battler, Clarke and Coniglio were located in abundance at 5 different sites throughout the Dakota Sandstone strata and sandstone units in the Summerville Formation. Sample inspection was limited to 20x magnification through a visual wavelength microscope. The rock saw in the Hab Lab does not effectively cut thin sections, however concretions could still be halved and examined.

Much thought was given to human-machine collaboration during Exploration Geology EVAs and the many avenues for automation during sample collection, documentation and in situ interpretations.

BuddyBot Rover (Ch. Poupon)

While Opportunity was finding a gypsum vein, obviously created by liquid water, BuddyBot discovered its analog ground around the Hab. In its first version, our rover had both logistic and scientific platforms and carried a remote camera, a recording camera, and two LED lamps. To improve BuddyBot's mobility over loose soil we made it lighter and moved all the gear to a single platform for the second version.

Working on BuddyBot and answering questions from Mission Support to help future robotics programs at the MDRS has led us to imagine new ideas for improving the performance of remote control rovers. We discussed the use of a helium balloon to hold up an antenna and increase the range of the remote control, and the use of 3x3 driven triple-wheels and under-pressurized tires to traverse rugged ground.

"Domestic" rovers like BuddyBot could be part of future manned missions to Mars.

A rover could help Marsonauts on their EVAs by exploring hazardous places such as narrow canyons or caves, and its high antenna could enhance communications between EVA crew and Hab.

Light Measurements (Ch. Poupon)

A small installation was put on the MDRS roof from the inside cupola, to collect hourly data on the level of natural illumination. This will contribute to the development of a prototype autonomous lighting system (ALS) for confined environments like submarines, polar bases and space ships.

The data collected at MDRS was the first step of research that will be submitted to ESA answering an "Announcement of Opportunity For Medical, Physiological and Psychological Research Using

Concordia Antarctic Station as Human Exploration Analogue," this coming January. Further in the future, it will also be submitted to the submarine department of the French Navy.

This research program is developed by Charlotte Poupon (Industrial Designer, Reservist on duty in the French Navy, MDRS crew 108) and Amaury Solignac (Ph.D., Psychologist, French Southern and Antarctic Lands, MDRS crew 14). It might be submitted to the Mars Society as a possible permanent study during future campaigns, at either MDRS (to collect data) or at FMARS (to test the ALS device once prototyped).

Alicia Framis Film

Alicia Framis filmed a 35 minute art piece about Mars exploration. Three days into our simulation, her film crew arrived in Hanksville from Amsterdam.

We spent three EVAs over the course of two days being filmed - with objects designed by artists including empty books and compasses pointing to earth.

Before the departure of both of the film crew and Alicia, our Station Leader made sure that all participating crew members and more importantly the Mars Society would be credited for this film. Without the Mars Society none of this would have been possible.