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The Mars Desert Research Station: Real Science, Real Education.

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Abstract

Terrestrial Martian analogs are a vital resource for training mission scientists, engineers, and planners for the rigors of surface operations on Mars. The Mars Desert Research Station in Hanksville, Utah is the most accessible, cost-effective analogue station available. Each year the station is host to research projects from multiple disciplines including biology, geology, meteorology, engineering, and psychology.

1. Introduction

The Mars Desert Research Station (MDRS) was established in 2002 as an affordable alternative to the analogs in the Arctic and Antarctic.. Its founding principles of "Safety, Sim, Science" continue to drive the station to this day.

Figure 1: Picture of the MDRS.

Crews of students and researchers from universities and research institutions across the world apply competitively for the 10 annual crew rotations. Each crew consists of 6 "astronauts" who spend two weeks living and working in Mars simulation.

The 2009-2010 field season involved seventy five participants from twelve different countries. One 2010 participant, Diego Urbina, went on from MDRS to participate in the five hundred and twenty day Russian Space Agency Martian simulation, Mars500.

2. Hanksville as Geologic Analogue

The Hanksville, Utah area is an amazing geologic analog for many of the geologic features found on Mars. The Cretaceous and Jurassic era shales and sandstones, especially the stark red Morrison formation, form a landscape amazingly familiar to those seen in the MER rovers and HiRISE imagery.

Some of these features include: mountains, canyons, gullies, lag surfaces, clay plains, inverted river channels, "blueberry" concretions, colluvial fans, talus piles, flood plains, nodular anhydride beds, gypsum fields, and down/upflow pipes. [1][2][3]

Figure 2: Martian 'blueberries' near MDRS.

A diverse mineralogy provides for field testing of spectrometers and other instruments for use by either human or robotic operators.

3. Signs of Life

One of the key questions driving Martian exploration is if life ever existed on the planet. The unique geology of the MDRS area provides many opportunitiy to test detection methods for past and present Martian Life.

3.1 Extremophiles

If life currently exists on Mars, it is likely extremophile in nature. These hearty microorganisms can exist inside and below sedimentary rocks which provide reasonable protection from sterilizing UV rays. The Hanksville area has large outcroppings of porous sandstone and transparent chirt where endoliths and hypoliths respectively can be found in large numbers.

3.2 Paleosites

The area surrounding MDRS contains many fossilized remains. The Hanksville-Burbee Dinosaur Quarry is one of the richest finds in North America. Fossilized sauropods, shellfish, sharks, and petrified wood can be readily found throughout the area, some within sight of the habitat. These fossils provide challenging identification targets for robotic and telerobotic exploration.

3.3 Cryptogamic soils

One of the most important desert features are Cryptogamic soils. These biological soil crusts are formed by colonies of cyanobacteria. The crusts are important to desert ecology, and while not likely on Mars due to the intense UV, provide an interesting test subject for biologicial detection instruments.

5. Research

This year saw an unprecedented number of professional research projects at the MDRS.

Figure 3: In-Sim deployment of the Terra X-Ray Diffraction Analyzer [4].

These include: Field trials of the Mars Underground Mole, CRUX Ground Penetrating Radar, and Terra X-Ray Diffraction Analyzer [4]; Field analysis of organic matter and minerals in the MDRS area [5]; two telerobotic exploration field trials [6][7]; field trial of a wind and solar power system for the analog station [7]; a Mars analog food study conducted by K. Binstead, seismologic and electromagnetic soundings of the area [8]; and many more.

6. Summary and Conclusions

The MDRS station continues to serve as the world's most cost effective Martian analog station. Students and researchers interested in participating in the program should contact Artemis Westenberg at: marsgoddess@gmail.com.

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