Soldier a stranger in a strange land

By CPT Jason Held

Editor's note: CPT Held is a Colorado National Guard Soldier assigned to the 193rd Space Support Battalion. He has deployed numerous times during recent combat operations in support of Space missions. A computer engineer as a civilian, Held worked hardware-software integration on the Wide Field Camera 3 portion of the Hubble Space Telescope, as well as biomedical engineering projects. He was a lead instructor at the Interservice Space Fundamentals Course teaching satellite design theory, propulsion theory and orbital dynamics. As a member of the Mars Society, an organization composed largely of scientists devoted to the goal of reaching Mars, Held recently participated in an experiment, funded partly by NASA, in which those involved lived and worked in a simulated Mars environment.

MARS DESERT RESEARCH STATION, Utah — With President Bush's announcement of a human Mars program, accented by the stunning successes of Opportunity and Spirit landings, Mars is in the hearts and on the minds of many Americans today.

Mars sparks the imagination, moves the mind and creates images of humanity normally seen in science fiction and dreams, rather than the reality it may become. There is a lot of engineering we need to do before we go, as well as sound politics and sound science. Many questions exist — how would one live on Mars? How would you eat? How would you live and work?

It is with those questions in mind that I took a vacation from my holiday vacation and drove an old, beat-up pickup truck into the heart of the Utah desert for an exploration of my own.

I'm a member of the Mars Society; a group of Space advocates and engineers from all over the world lead by former Martin Marietta Mars Lead engineer Robert Zubrin. Dr. Zubrin invented a human Mars mission plan, which was radically different and logistically much more sound than the NASA plan published for then-President George Bush (senior) in the 1980s and early 1990s.

The original plan, requiring over a thousand tons in orbital construction, years of advanced scientific engineering work, and tons of supplies was an ambitious idea. But priced at $500 billion, the plan sent Congress into sticker shock faster than you can say "Low Earth Orbit Forever."

Dr. Zubrin's plan, called "Mars Direct," required less than $50 billion. How? Create the resources we need to live on Mars "In-situ." All of the usable resources, from fuel to precious oxygen, can be produced on the surface before explorers even arrive, reducing the multi-ton "Battlestar Galactica" to a much more modest and manageable version. It is this plan, or a version of it, that the current President Bush and NASA intend to send to Congress for ratification.

So let's go back to Utah. The Mars Society has two research stations refining the tactics, techniques and procedures astronauts will need to live and work on Mars. These stations are crewed by volunteers and scientists from all over the world. One station, located in Devon Island in Canada and on the Arctic Circle, is a perfect location to test Space weather phenomenon. The desert station in Utah has a perfect sky for an observatory. They are funded by a wide variety of organizations, from PayPal dot-com guru Elon Musk to the Discovery Channel, to the Plumbers and Pipefitter's Union, to NASA (whose "Crew Exploration Vehicle" bears a striking resemblance). At these stations, crews conduct research that helps develop both the technology and operations of living on Mars, but often has Earth applications as well.

LTC John Blick, a Defense Advanced Research Projects Agency engineer, used the station to test robots, which were eventually used (and destroyed) during the Sept. 11, 2001 rescue at the World Trade Center. It was not the first time that the Mars Society conducted joint research with the U.S. Army, and I can tell you, it will not be the last.

My job with them was to combine both scientific skills with military management experience to create a training plan to assist new crews integrate with the habitat. It's a complex structure, two stories high, with its own internal wiring, plumbing and Ethernet, as well as satellite and weather telemetry. There is a greenhouse (connected to partially recycled water wastes) and a professionally constructed observatory. As such, many crews enter this environment for the first time, and have to re-learn from scratch all of the lessons I was going to learn first-hand over the next two weeks.

Driving up to the place, I could see right away why they chose this location. The Utah desert, just 10-minutes west of Hanksville, Utah, is one of the most desolate places on Earth. Nothing grows there — the ground hued a deep red from the volcanic structured soil. The habitat itself you almost miss driving by, as it's nestled between two of the 20-foot high berms dotting this foreign landscape.

Entering the habitat, the bottom floor consists of two air-

CPT Held, left, and Daimon Sheets troubleshoot a GMRS remote radio used to communicate with a retrans site 10km to their west. Unfortunately, the weather had its way with the radio and it was too rusted to be of use. *Photo by Jonas Jonsson*

locks, a laboratory for biology and geology experiments, and a shower and toilet facility. The toilet, by the way, was of an Incinolet variety, a steel contraption designed to burn waste at a healthy 4000 volts. (Keep this in mind; we will speak of it again.) Upstairs is where the crew lives and works, with six closet-sized staterooms (for a six-person crew), as well as a modest kitchen/living area.

Crews stay at the desert station for two weeks in field condition, which means that whenever you leave the habitat, you simulate working on Mars. Meaning, you leave, you wear an analog Space suit. At first glance, that's not as bad as it sounds. It was certainly easier living than I've had on other, more military deployments. With the kitchen and a shower every two days (to conserve water), it was certainly not a difficult deal by Army standards. This, I thought at the time, was going to be easy. Needless to say, I was in for some surprises.

The first surprise happened upon arrival. The electric power runs on a 20K-watt generator, which powers all of the systems, from cooking to the laboratory, to the observatory, to yes, our notorious Incinolet, which caused all the lights to flicker when used. The generator, however, was gone. It was back in Grand Junction, Colo., for repairs, and all we had was a 7K-watt generator. I now had to develop a training plan, which included low power use. With myself as the crew's engineer, the team leader (an accomplished environmental engineer from Canada) and the assistant engineer (an aerospace grad student from Sweden) managed to rewire systems to allow us to communicate with Mission Control headquarters in San Diego, Calif., light the upstairs floor and keep some appliances running. We certainly could not use the Incinolet, and had to resort to burning wastes the "old fashioned way" — Mogas, which certainly brought back memories of those more military deployments.

But this was only for a few days before the large generator returned, so we made the best of it. Systems, naturally, were quirky for the rest of the two weeks, and I had my share of repair and upgrading tasks. There was much to do for this training plan, and most of it I was determined to experience for myself. As such, I decided to go on Extra-Vehicular Activity (EVA) to both validate the navigation portion of the training and assist the crew geologist take soil samples from areas about 8-kilometers north. So we both donned our Space suits…. not as simple as it sounds. Although the habitat's Spacesuits are not pressurized (they are analogs, after all), they still have their complexities, with communications system and water, as well as electric powered air intakes, and a specific procedure to don them. It took us almost 45-minutes to put them on, test the fittings and make radio checks, before we could even enter the airlock.

Part of the simulation of living on Mars meant we must wait five minutes to "depressurize" prior to leaving for the surface. The tradition with the crew was to tell very bad jokes during this time but that did not last past the first few departures. Five minutes of "grosser than gross" jokes, after all, can be a very long time.

We departed the habitat, mounted our ATVs and left for the Great Unknown.

Navigation in simulated Mars conditions, would, I knew, have its challenges, although as an Army trained person,

my confidence was high. Yet with no magnetic field around Mars proper, using a compass is forbidden, as it would be useless on an actual Mars mission. We had a GPS, mainly for safety and for accuracy of the science (which requires accurate locations for geologic experiments), but once again, the first crews on Mars will probably not have an autonomous navigation system as precise as GPS, so I opted to use the challenge of terrain association to get to our destination and back.

As is true with the rest of this journey, the trip provided more challenges than you can at first imagine. To begin with, understand the nature of the suit itself. Wearing thick gloves and a suit severely limits your motion and vastly reduces your tactile sensations. Simple tasks, such as taking the surveyed map from the bag, required a surgeon's diligence. The helmet has a large bubble providing a solid 180-degree field of view. We hit the road, with ATVs screaming down dirt trails, arriving at our destination in short time. Destination — a bluff overlooking a canyon with an incredible desert view.

Opposite page, top, view of the habitat from on top of one of the overlooking berms. Observatory is to the far left on the hill, with the Greenhab just to the right of the habitat; opposite page, center, CPT Held on an EVA, pre-storm. The faceplate is not fogged but the wind and gloves made handling the map difficult; above, the crew having Christmas dinner on the upper floor of the habitat. Crew, from left to right are, CPT Held (Chief Engineer/XO), Daimon Sheets (Biologist), Allan Morrison (Canadian, Team leader), Jonas Jonsson (Sweden, Engineer), Jonathan Drew (Biomedical Engineer), and Chalbeth Reynolds (Geologist); *Photos by Jonas Jonsson*

Taking our soil samples (as well as a few pictures) was awkward because of the bulkiness of the suits, but not impossible with two people working as a team. We wanted to linger and enjoy the scenery, but could not spend much more time—there was a storm front moving in and desert winds were picking up. Storms can prove dangerous on either planet.

And that's when the navigation became difficult. It was not easy to begin with — the maps dated from 1980 and many of the features, volcanic in nature, were not on the map. New features were hand-drawn in pencil and locations were suspect. Reading the map was becoming difficult, as the helmet started to fog from the inside, a layer of dust and mud formed on the outside, and visibility was drastically reduced.

The storm was coming closer and the map flapped in my thick gloves in 30-knot winds. The terrain, rolling berms of sand and clay, was looking the same in every direction. Looking two kilometers back, the canyon we just came from was under a flash deluge. I didn't want to think of trying to navigate in that. If things became real world dangerous, I thought, we could always remove our helmets…. we aren't here for anachronisms, after all, and there are no deluges on Mars proper. Nevertheless, we decided instead to press on, in simulation, racing ahead of the storm to get home.

We made it home in time, in simulation, and with quite a few lessons learned. The navigation, we were pleased to learn later, was only 100-meters off from GPS spottings, so the soil samples taken were sound. One of the hand-drawn map corrections was placed a whole three-kilometers too far south, and will have to be corrected. Allan Morrison, our Canadian team leader, cooked for us a fine meal of, to my surprise, Army issue Meals Ready to Eat, which we wolfed down greedily. This was not the only surprise of the day, as it turned out, the new generator had arrived, and the once silent Incinolet was alive again, but for some mystical reason would not shut off. As the crew's engineer, I drew the task of fixing it.

What can I say? Some jobs are dirtier than others. All for the advance of science, my friends. All for the advance of science. The Incinolet, too, has made it in to the Mars Desert Research Station's training plan.

As I write this, I note the cover of Time Magazine — the red face of Mars with an astronaut, an American astronaut, on its surface. Will we do it? Who knows, but I was happy to be a cog along the way.