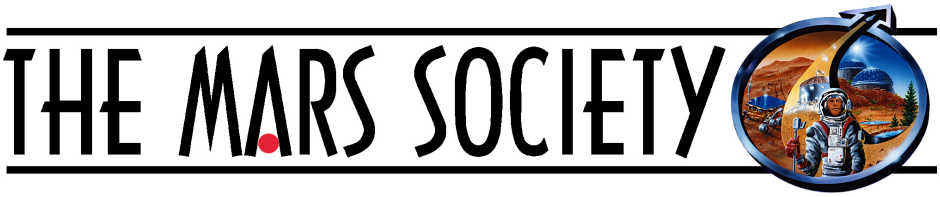

MDRS Risks

Risks associated with the Mars analog habitat during the 2-week analog missions are chiefly the risks of outdoor work in the high desert, psychosocial stress of living in an isolated microsociety under somewhat uncomfortable living conditions, and delays in delivery of medical treatment in case of illness or accident.

1) Subjects may find living and working in the analog habitat, and going on EVAs, to be physically demanding, especially if they take no regular exercise. (Probability moderate, 0.1 - 0.2, harm potential low)

2) The MDRS analog habitat is smaller and more crowded than typical dwellings. There is a risk of emotional distress due to the confined space and/or lack of solitude. (probability < 0.05, harm potential minimal to low, reversible)

3) The MDRS habitat is smaller, more noisy, and less comfortable than participants' typical dwellings. Air conditioning is limited. Water for personal hygiene use is extremely limited and personal care products are limited to those compatible with the water treatment system. Subjects may find these limitations burdensome. (probability ~ 0.5, harm potential low, reversible)

4) There is a risk of injury from wild animal, snake, spider or scorpion bites/stings at MDRS, which is located in rural Utah. Stings of nonvenomous scorpions are similar in effect to wasp stings. Bites from venomous spiders and snakes, bark scorpion stings, or wild animal attack, will require medical evacuation. We are aware of no incidents of snake or venomous spider bites, and of one non-venomous spider bite, during MDRS's 100+ mission rotations over 10 years (a total of 7000-8000 person-days). Scorpions and snakes have been observed near the MDRS. A mouse is seen inside the habitat 3-8 time per year and a scorpion every 2-3 years. Feral dogs have been observed near MDRS during the 2009 and 2010 seasons; none were observed during the 2011 season. Cougar tracks and cougar kills have been observed in the vicinity of MDRS during the 2009 -2011 seasons but no interactions between cougars and crewmembers have ever occurred. Probability of wildlife-related injury very low, < .001, harm potential minimal to severe.

5) As part of their analog simulation experience participants will wear EVA suits (analog spacesuits) when outside the habitat. Since the EVA suit constricts and limits a person's ability to safely conduct activities outside the habitat such as walking over rough terrain, riding vehicles such as ATV’s or rovers, climbing and sample collection, participants undertake a greater risk of bodily injury or death than if they conducted such

activities “out of sim” wearing normal clothing and protective equipment. In ten years (around 7000 person-days) of operation at MDRS there has been one ATV crash severe enough to require medical attention. Probability of an event < 0.01, harm potential low to catastrophic.

6) A participant who falls ill or suffers an injury at the analog site risks delays in obtaining medical assistance or evacuation; such delays may complicate the participant's medical condition. The nearest medical clinic is about 45 minutes away; the nearest hospital, about 60 minutes. Probability of an event very low, impact minor to catastrophic.

7) There is a risk that participants will feel homesick and miss their loved ones during the analog mission. In addition, they may tire of the food, the living quarters, the electronic presence of mission support personnel, and the mission rules. Since communication with the outside world during MDRS missions is restricted to email except in case of emergency, participants may miss their normal use of internet, telephone and broadcast services. These environmental stressors may cause emotional distress. Probability of an event < 0.01, harm potential minimal to moderate.

8) Since MDRS uses a webcam (3 minute still picture interval) as part of the Mars Society outreach program, and to assist in safety monitoring by mission support volunteers, and since each participant's bio, photo, and the crew's daily reports will be posted on the web, participation as a study subject will not be entirely confidential. Probability certain, harm potential negligible.

9) The small crew size of MDRS missions and the public nature of crew membership pose a risk to subjects' privacy regarding their personal study results being deducible from data on MDRS studies published in scientific journals or presented at technical meetings. The investigators will make every effort to prevent this outcome but cannot guarantee it. Probability of event < 0.001, harm potential low.

10) Working in an EVA suit constricts and limits the user's ability to safely conduct outdoor activities, including but not limited to hiding, riding ATVs, climbing, taking samples, and other EVA activities. Such restricted abilities in the Utah desert environment may be dangerous and can lead to serious injury or even death. Probability of event < 0.01, harm potential minimal to catastrophic

11) Driving ATVs in the Utah desert is dangerous per se and can lead to bodily injury, death, or property damage. Probability of event <0.01 if speed limits are observed and safety helmets are worn; higher otherwise; harm potential minimal to catastrophic.

12) Individuals working in the Utah desert run a risk of dehydration, heat stroke, exhaustion, exposure, sunburn, falls, abrasions, foot blisters, and other risks of wilderness outdoor activities.

Mitigation of risks associated with the habitat.

1) The risk of fatigue will be minimized by advising participants of the need for physical fitness. A buddy system (no one alone in the Hab or on EVA) is used for all trips outside the habitat.

2) Each participant has his or her own private sleeping space, a "stateroom", average size 11' x 4' x 8' ceiling. Work schedules normally allow time for individual and social activities in the evenings.

3) The mission length is only two weeks. Participants are advised in advance about the water limitations and encouraged to practice water-limited hygiene in advance of their missions.

4) The risk of injury from animal encounters will be addressed as follows: danger from outdoor wildlife will be minimized by a buddy system (no one goes outdoors alone). Indoor rodents will be trapped. Participants will wear slippers when moving about the habitat at night (scorpions are nocturnal)

5) Risks due to reduced mobility and visibility in EVA suits/helmets will be addressed by training early in the two-week mission. Face mask defog spray will be provided to prevent helmet fogging during cold weather. A buddy system is used at all times. ATV training is provided. Each crew is required to do a training EVA before work related or recreational EVAs begin. EVA teams out of line-of-sight from the hab report back to the Habitat at least hourly by portable radio.

6) The health risks due to long distance from emergency care are currently addressed at MDRS by a telemedical support system. The MDRS medical program director is on call 24/7 via a text-messaging pager and can summon a physician or ambulance local to MDRS if necessary. The telemedical request system will be tested at the start of each two-week mission. If the habitat's satellite internet service fails, out-of-sim modes of communication remain open: crewmembers can use an emergency cell phone, or ham radio equipment if they are licensed, to call for help. The Wayne County, UT ambulance service also serves the MDRS with a 30-45 minute delay between call and arrival.

7) If necessary, supportive intervention will be provided to participants by email or out-of-sim text/voice chat with the physician on call or other qualified professional. In case a participant wishes to leave the study early, arrangements can be made in Hanksville to drive them to the Grand Junction airport (2.5 hours away) or the Green River, UT bus station (1 hr away, daily Greyhound service to Grand Junction & Salt Lake City).

8) Nothing will be done to mitigate this risk; subjects must accept in advance that they

will appear on webcam images and that they will be subscribed to the mission support mailing list for the habitat before their mission and during the duration of the two-week study.

9) Investigators will make every effort to prevent deductive identification of individual crewmembers from results published or presented.

10-11-12) Subjects must observe established safety and hydration guidelines and must know and respect their physical limits.