

Simulating Mars on Earth: Measuring Crew Function and Performance at a Mars Analog

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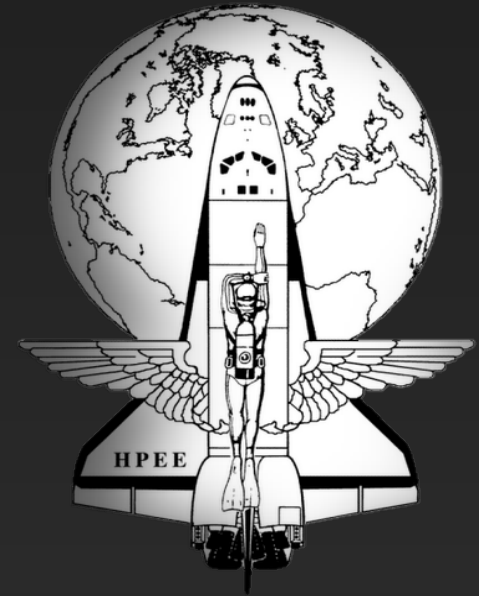


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ERAU Student Chapter of the Society for Human Performance in Extreme Environments



Our goal is to understand how humans survive and succeed in settings that have extraordinary physical, psychological, and interpersonal demands that require significant human adaptation for survival and performance.

Our chapter is focused on conducting research in this area, connecting with men and women who live and work in extreme environments, and providing “extreme” experiences to our members.

Ignite's Learning Outcomes

1. Define a research problem
2. Design a study
3. Apply ethical principles in study design
4. Conduct the study
5. Analyze data and develop sound conclusions from the results
6. Communicate results

Background

- Psychological challenges of long duration space flight
 - > Prolonged isolation
 - > Variable levels of workload
 - > High levels of stress
 - > **Crew interactions**
 - Currently no way to routinely measure the function and performance of space crews



Overall Study Purpose

- Research experience for undergraduate students
- Conduct studies in an accurate Mars analog
- Answer questions necessary for successful future long duration space flight missions



Chosen Analog



Method

- 7 participants
 - > 3 male, 4 female
- 2-weeks at space analog
 - > Mars Desert Research Station
- Each student conducted their own study

Effects of Gaming on Stress and Anxiety

- **Research problems:**
 - > Do multiplayer games improve mood more than single player games
 - > Do electronic games provide more benefits than non-electronic games.
- **Method:**
 - > Profile of Mood States (POMS)
- **Results:**
 - > Overall mood increased
 - > Tension decreased on Game days
 - > Small sample size
- **Conclusion:**
 - > Games seem to be effective coping method, further research needed.



Effects of Exercise on Mood

- **Research problem:**

- › Can exercise reduce stress and improve mood in an isolated and confined environment?

- **Method:**

- › Varied low- and high-intensity workouts over 2 weeks, participants completed mood survey (POMS)

- **Results:**

- › Mood not significantly affected by exercise intensity
- › Similarities between most crewmembers
- › According to personal interviews, crewmembers enjoyed the high intensity workouts

- **Conclusion:**

- › Additional research with larger sample needed



Effects of Music on Stress

- **Research problems:**
 - > Does music affect stress while in an isolated and confined environment
 - > Do different music genres produce different effects?
- **Method:**
 - > POMS, Perceived Stress Survey (PSS), Heart Rate, and Blood Pressure
- **Results:**
 - > Slight variability in HR and BP over time, no clear patterns
- **Conclusion:**
 - > Additional research with introduction of other genres and larger sample



Effect of Horticulture Activity on Stress

- **Research Problem:**
 - > Does horticulture activity affect stress levels in an isolated and confined environment?
- **Method:**
 - > Experimental group received 1hr of active horticultural activity session over 2 weeks and completed POMS, HR, BP
- **Results: V**
 - > Variability in HR and BP, but no clear patterns
- **Conclusion:**
 - > Additional research is needed to increase the sample size



Sleep Patterns & Fatigue in an Isolated & Confined Environment

Research problem:

- > Do sleep patterns change between normal environment to an isolated and confined environment?

Method:

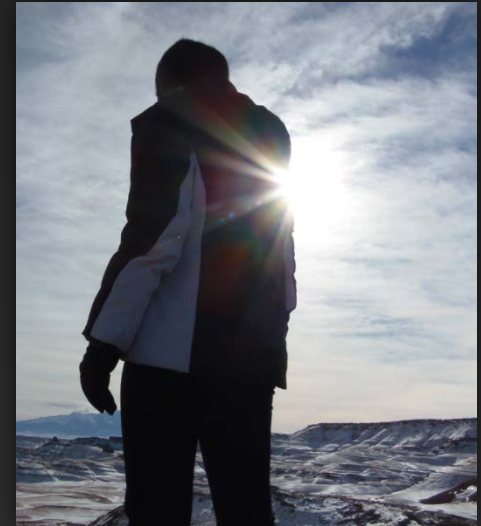
- > Three stages of data collection: before, during, and after MDRS
 - Actigraphs, sleep journals, Pittsburg Sleep Quality Index (PSQI), activity logs, POMS

Results:

- > Moderate differences between crewmembers
- > Different levels of fatigue were present among crewmembers
- > Extreme changes in sleep performance when environments were altered

Conclusion:

- > Further research will be conducted with additional samples



Effects of Habitat Design

- **Research problem:**
 - > Does the design of a habitat affect mood and perception of the environment?
- **Method:**
 - > Questionnaire, interviews, observations at beginning, middle, and end of mission
- **Results:**
 - > Environmental factors were significant
 - > Negative observations about color
 - > POMS data variable, small sample size
- **Conclusion:**
 - > Additional research, including analysis of crew quarters, is needed



Dynamic Monitoring of Crew Function and Performance at a Mars Analog

- ① **Research problem:** Currently no way to monitor crew function in real-time during spaceflight
- ① **Method:** Administered questionnaires in evenings
 - > Group Environment Scale (GES)
 - Team cohesion
 - > Work Environment Scale (WES)
 - Team productivity
 - > Profile of Mood States (POMS) & Positive and Negative Affect Scale (PANAS)
 - Mood
 - > Perceived Stress Scale (PSS)
 - Stress
- ① **Results:** The POMS and PSS showed fluctuations well. The GES and WES also showed fluctuations but they are currently too long.
- ① **Conclusion:**
 - > POMS and PSS will be added to P-STAT
 - > Some items from the GES and WES will be added
 - > The P-STAT will undergo further testing during the next MDRS field season.



Future Research Plans

- Further data collection at MDRS winter 2013/2014
- Further data collection at other space analogs
- Present at HFAP and HFES conferences
- Increase involvement by creating more opportunities for further research

The background of the slide is a dark, starry night sky. In the lower portion, there is a dark, silhouetted landscape with rolling hills. A small, white, cylindrical structure, possibly a habitat or a piece of equipment, is visible on the right side of the landscape. The overall scene is dimly lit, with the stars providing the primary light source.

Thank you for your time!

And a big thanks to Ignite for funding this research!