IDEA: PRINCIPLES IN PRACTICE WITH THE TREX ANALOG ROVER TEAM. R. V. Patterson[1], M. L. Meier[2], A. Hendrix[3], S. Buxner[3], J.A. Grier[3], [1]University of Houston (rvpatter@cougarnet.uh.edu), [2]University of Idaho, [3]Planetary Science Institute.

Introduction: The NASA SSERVI Toolbox for Research and Exploration (TREX) project, headquartered at the Planetary Science Institute (PSI), investigated a terrestrial analog site in Yellowcat, Utah, to aid in the development of human and robotic exploration of the Moon. A notable facet of TREX was the conscious effort taken by its leadership to incorporate Inclusion, Diversity, Equity, and Accessibility (IDEA) practices into team operations.

IDEA in Planetary Science. The planetary science workforce has long been dominated by white, cisgender, male, and heterosexual community members ([1] and refs therein). Yet, research has demonstrated that diverse groups are better able to solve complex issues and outperform homogenous groups composed of high performing individuals [2-5]. Lack of diversity is not only 'bad' science, it demonstrates a lack of human empathy towards fellow colleagues and investigators.

A recent survey of astronomical and planetary scientists asked if they had experienced a hostile work environment, and found underrepresented populations reported the most harassment (e.g., inappropriate comments, assault, etc.), directly contributing to them pursuing fewer scholarly opportunities [6, 7].

The planetary science community is working towards incorporating IDEA principles into the fabric of mission planning. For example, NASA's PRISM proposal calls now incorporate a section for PIs to craft a plan for enacting IDEA principles within their team assembly and mission planning [8].

Here, we report demographics of the TREX 2022 participating science team collected from a self-reported survey, share feedback from the field science team, and offer recommendations for other fieldwork science teams.

TREX Demographics: The TREX fieldwork team is comprised of researchers spanning a variety of scientific expertise, career stage, ethnicity, gender identity, and sexual orientation. An anonymous, free-response survey was administered for data collection. The team consists of three subteams: field scientists, robotics, and science backroom.

Field Scientists. The field team consists of 11 personnel from PSI and other external institutions (Fig. 1). The group features multiple science career stages, including graduate students up to senior research scientists. Over 50% of the field team self-identify as women, many serving in leadership roles in the field team.

Figure 1. TREX field scientists subteam on-site in Yellowcat, Utah, in October 2022.

Rover Robotics Team. PSI collaborates with Carnegie Mellon University (CMU) to provide the robotics asset used in field operations. The rover robotics team includes one senior scientist (a man) and four engineering graduate students (2 women and 2 men) to operate the rover mechanics, electronics, and software.

Backroom Science Team. The backroom consists of 10 researchers with varied scientific expertise, including spectrometry, physics, and geology. The team was segmented based on specialty (e.g., ~2 scientists per instrument with overlap for some instruments). The team is led by a senior scientist from PSI, while the instrument leads and other members are a mix of graduate students, postdoctoral researchers, and senior scientists. Contrasting with historical demographics on mission science teams [1], women comprised 75% of the science backroom. Within this subset of eight women, two identify as members of the LGBT+ community, one is an international student, three are graduate students, two are postdoctoral researchers, and three are senior scientists.

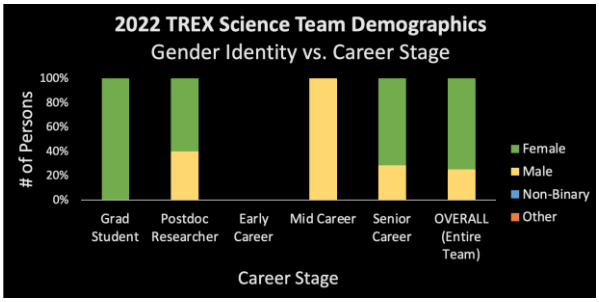

Figure 2. 2022 TREX science team members displayed by self-reported gender and career stage. No members of the science team self-reported as early career stage, or non-binary or other gender identity.

The gender identity portion of the survey was presented as a free-response question and no team members self-identified as non-binary.

IDEA Principles in TREX:

Inclusion. TREX has carried out field operations in the past, so senior teammates were well-acquainted with one another prior to the mission. Several new teammates joined the 2022 field season and were thus new to the group. New members were sought out by senior members and invited to dinner to "break the ice". The new members were also consciously incorporated into conversations and debrief meetings. This fostered a community between teammates and allowed feedback and scientific discussions to flow more freely earlier on in the mission.

Diversity. TREX members span several axes of diversity (e.g., gender, sexual orientation, career stage, ethnicity, and scientific specialty). It is the opinion of the authors that the diverse team population directly contributed to a successful and innovative work environment. Research shows a lack of diversity in scientific fieldwork investigations may lead to a negative experience and drive minoritized identities away from continued studies [9].

Equity. Debriefs were conducted at strategic points throughout the 14-day mission. The seats were arranged in a circle so that no one person was elevated relative to the team. Each member was given the opportunity to speak at length, regardless of their seniority within the team. When a junior member was intentionally left out of important email communications, senior members were able to confront the sender and solve the issue immediately.

Accessibility. A teammate was experiencing some mental health issues at roughly the halfway point of the mission. They described feeling burned out and homesick. The team member needed special accommodations, so the TREX leadership instated a hybrid working scenario in which the affected team member was able to participate in the mission from their hotel room during flexible and reduced hours.

Feedback from Field Work: After the field season was complete, feedback was solicited anonymously from all team members through an online form. Feedback included comments about logistics, leadership, and interpersonal interactions. Actionable feedback included suggestions to improve communication and training both before and during field work. More support of new team members was noted as a need in the future as well as making all expectations and norms part of shared governance that all team members contributed to and agreed to. Lastly, it was suggested that team members complete implicit bias training to improve communication and overall interactions given potential stressful interactions.

Recommendations to Future Rover and Science Teams:

1) When forming mission teams, intentionally choose a diverse teammate population with respect to gender identity, career stage, ethnicity, etc. For the sake of the future of space exploration and innovation, the importance of crafting a diverse and inclusive team cannot be overstated.
2) When drafting the mission proposal, include open positions for grad students and postdocs that can be filled later. Advertise these open positions during conferences and interview the interested parties.
3) Craft and review the team Code of Conduct in person prior to the commencement of mission activities. Be sure to discuss what will and will not be tolerated. It is vitally important all team members are present and engaged during this process.
4) Consciously encourage non-lead team members to take on responsibility such as leading morning meetings and presenting results during debriefings. This will allow more voices to be heard and allow non-lead members to feel more comfortable sharing concerns or issues with the leads.
5) If a team member is experiencing challenges with the workload or team setting, communicate with them to find a suitable solution. This will shield them from judgement and the team remains productive. Investigate training and interventions that will empower the team to change the nature of goals and the definition of success such that those with challenges and disabilities remain full contributors.
6) Hold group events such as team dinners and recreational activities during days off. This fosters a good morale between teammates, which will transfer into the mission operations.

Acknowledgments: This study is supported by the National Aeronautics and Space Administration (NASA) through the Solar System Exploration Research Virtual Institute 2016 (SSERVI16) Cooperative Agreement NNH16ZDA001N (TREX).

References: [1] Rathbun J. A. et al. (2022) *LPS LIII*, Abstract 2161. [2] Antonio A. L. et al. (2016) *Psychological Science*, 15, 507-510. [3] Page S. (2007) *The Difference*, Princeton U. Press. [4] Sommers S. R. (2007) *Legal and Criminal Psych.*, 12, 171-187. [5] Phillips K. W. (2014) *Scientific American 311*, 4, 42-47. [6] Klancy K.B.H. et al. (2017) *JGR*, 112, 1610-1623. [7] Richey C. R. et al. (2019) *BAAS*, 51(4). [8] NASA PRISM Solicitation (2022) F.10-19 to F.10-21. [9] McKay J. et al. (2020) AGU, Abstract #ED016-09.