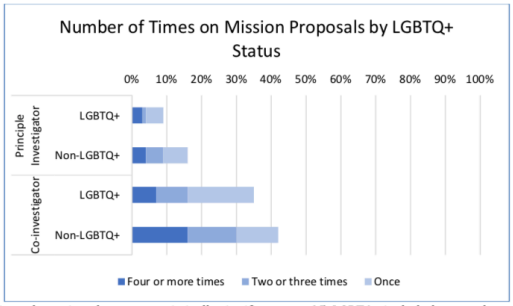
DIVERSITY AND INCLUSION IN SPACECRAFT SCIENCE TEAMS: WHAT DO WE KNOW AND WHAT CAN WE DO ABOUT IT? J. A. Rathbun[1], E. G. Rivera-Valentín[2], J. Bayron[3,4], L. C. Quick[5], [1]Planetary Science Institute (Rathbun@psi.edu), [2]John Hopkins University Applied Physics Lab, [3]American Museum of Natural History, [4]CUNY Hunter College, [5]NASA Goddard Space Flight Center.

Introduction: Not only does the planetary science community lack diversity [1-3], the subset of the community that participates on spacecraft science team is even less diverse than the community as a whole [1, 4].

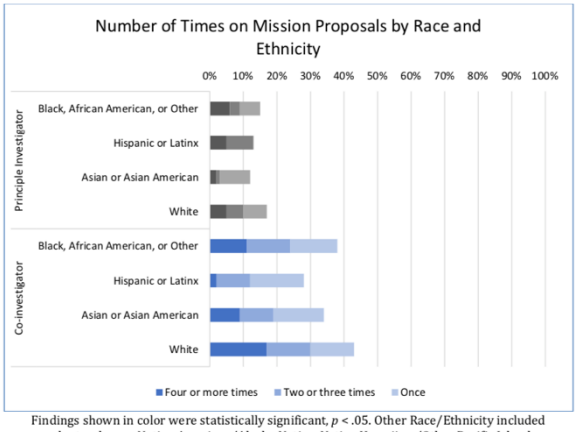
Results of 2020 Workforce Survey: Previous studies of the diversity of members of spacecraft science teams made incorrect assumptions about the nature of the data before collecting the data. Those analyses assumed a binary gender and ignored the existence of planetary scientists who are neither men nor women [4-6]. We present here results where demographic data was collected without assumptions; each individual surveyed supplied their own answers to demographic questions.

The April 2020 survey of Planetary Scientists, which was conducted by the Statistical Research Center of the American Institute of Physics (AIP) and funded by the American Astronomical Society (AAS)'s Division of Planetary Science (DPS) asked participants their gender with 4 possible responses: Woman, Man, Another identify (please specify if you wish), and Prefer not to answer. 32% of respondents chose Woman, 67% chose Man and 1% chose Another gender identity [1]. The survey also asked demographic questions on race, ethnicity, LGBTQ+ identity, and disability. For a full list of questions, see https://dps.aas.org/sites/dps.aas.org/files/reports/2020/survey2020_questionnaire.pdf.

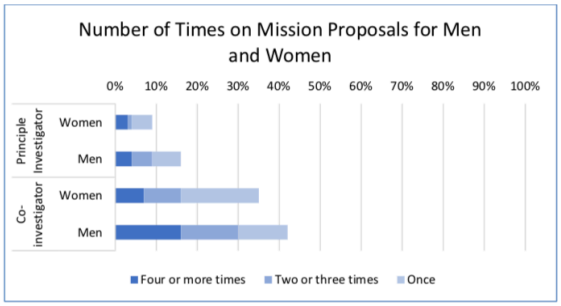
In addition to demographic questions, the 2020 Workforce survey asked how many times respondents had been involved in Mission proposals as a Principal Investigator (PI) and, separately, as a Co-Investigator (CoI) [1]. Answers to questions about mission involvement were correlated with answers to demographic questions and the results show that members of historically underrepresented groups (non-white scientists, women, members of the LGBTQ+ community, and disabled scientists) were less likely to be involved in spacecraft mission proposals than were members of historically overrepresented groups [1]. The figures below show the correlated responses for four different axes of underrepresentation [1]. Note that while the figure on gender shows only Women and Men (due to the small percentage of folks answering "Another gender"), non-binary respondents are included in the LGBTQ+ community figure.



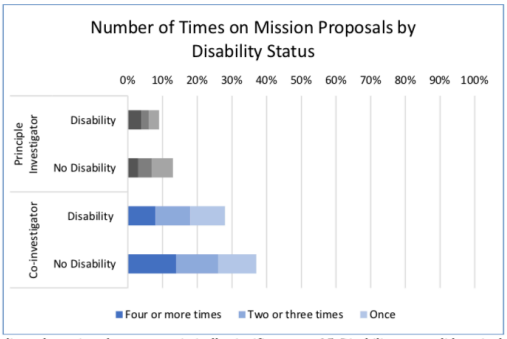
Findings shown in color were statistically significant, $p < .05$. LGBTQ+ included respondents who identify as gay, lesbian, bisexual, transgender, another sexual orientation, or another gender identity.



Findings shown in color were statistically significant, $p < .05$. Other Race/Ethnicity included respondents who are Native American/Alaska Native, Native Hawaiian /Other Pacific Islander, or wrote in another Race/Ethnicity. These groups were too small to report separately and were combined for analysis.



Findings shown in color were statistically significant, $p < .05$.



Findings shown in color were statistically significant, $p < .05$. Disability status did not include respondents over 60 years old, who also indicated they were deaf, hard of hearing, or had serious difficulty standing, walking, and climbing stairs.

Conclusion: Being part of a spacecraft science team is a goal for many planetary scientists. With it comes brand new data, more stable funding, and a sense of awe and exploration. It can lead to a cascade of opportunities from conference and public presentations, to membership in subsequent mission teams, and prestige in the community [4]. As a result, participation in spacecraft teams can be used a measure of success within the field. From the survey results, we see that members of historically excluded groups, even after they have overcome barriers to participating in the field, are still experiencing barriers to success within the field itself.

Why?: The diminishing percentage of members of underrepresented groups as a career progresses has been referred to as a "leaky pipeline". However, this fails to adequately capture the experiences of the members of these underrepresented groups as it implies a passive process. In order to capture the active processes (bias, discrimination, harassment, and other exclusionary behaviors) that contribute to low retention in the workforce, the term "Hostile Obstacle Course" is more useful [7,8]. It is these processes that need to be addressed in order to retain valued members of our community.

Moving Forward: In order to broaden participation in planetary science, particularly mission science teams, we need to address conditions that create hostile workplace climates. What can mission teams and other groups do to address these conditions? First, each group/team needs to evaluate their own members to determine what specific barriers exist in their own interactions. One tool to accomplish this would be an anonymous survey designed to understand how team members feel about working within the group. Working with professionals who know how to create and analyze such surveys (often called "climate surveys" when applied to University students, for example) would ensure that the survey meets its goals and does not make assumptions that counter the meaningfulness of the results. Such professionals in EDIA (Equity, Diversity, Inclusion, and Accessibility) and workplace culture can make suggestions for policy changes that would eliminate hostile workplace conditions.

Policy changes that are often suggested include instituting professional EDIA training for the team and/or for team leadership, instituting and following a code of conduct [9], including more interactive group activities in group meetings, etc.

Training and information on EDIA is available for all members of the planetary science community. The first place to look would be in your University or Institution's EDIA or human resources offices. By-

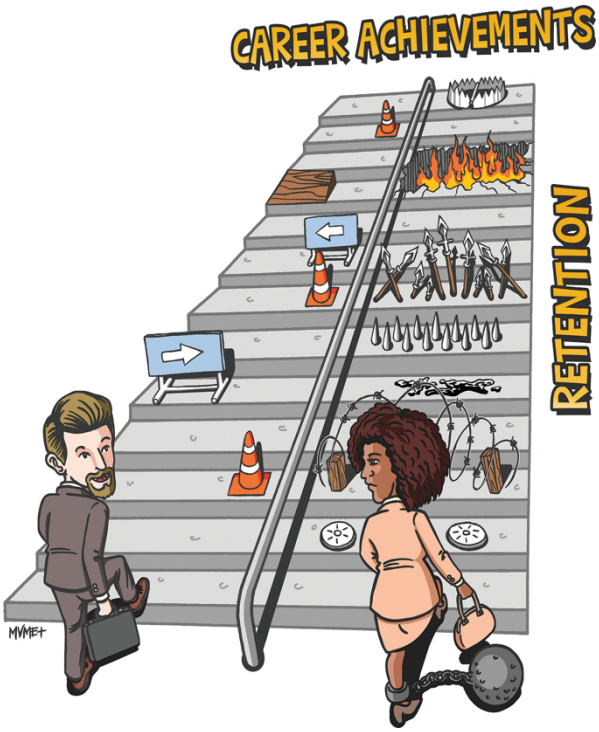


Figure from [7] illustrating the Hostile Obstacle Course

stander Intervention is often offered as part of other meetings [10]. A newer offering is a Workshop on EDIA for Leaders in Planetary Science led by Julie Rathbun (first author of this abstract) and JA Grier (https://edialps.psi.edu/). This 3-day workshop gives participants the tools they need to enact positive change in their personal and professional spheres. The first workshop was help in November 2022 and another workshop will take place in the late spring 2023 with exact dates to be announced soon.

References: [1] Porter, A. et al. (2020) AIP report https://dps.aas.org/sites/dps.aas.org/files/reports/2020/Results_from_the_2020_Survey_of_the_Planetary_Science_Workforce.pdf [2] Rathbun J. A. et al. (2021) *LPS LII,* #2094. [3] Rivera-Valentín E. G., et al. (2021) *LPS LII,* #2163. [4] Rathbun, J.A., 2017, *Nat. Ast.,* **1,** id 0148. [5] Rathbun, J. A. et al., 2015, *DPS47*, 312.01. [6] Rathbun, J. A. et al., 2016, *DPS48*, 332.01. [7] Berhe, A. A. et al., 2021, *Nature Geosci,* doi: 10.1038/s41561-021-00868-0. [8] Marín-Spiotta, E. et al. 2020, *Adv. Geosci.*, 53, 117-127. [9] Diniega, S. et al (2021) *BAAS*, 53, e-id. 448. [10] Milazzo, M.P., et al. (2018) *LPSC49*, id. 2214.