

<b>Fiscal Year:</b>	FY 2022	<b>Task Last Updated:</b>	FY 07/18/2022
<b>PI Name:</b>	Burke, Shawn Ph.D.		
<b>Project Title:</b>	Facilitating the Synergistic Side of Cultural Diversity in LDSE: Identification of Challenges and Development of Cultural Training		
<b>Division Name:</b>	Human Research		
<b>Program/Discipline:</b>			
<b>Program/Discipline--Element/Subdiscipline:</b>	HUMAN RESEARCH--Behavior and performance		
<b>Joint Agency Name:</b>		<b>TechPort:</b>	No
<b>Human Research Program Elements:</b>	(1) <b>HFBP</b> :Human Factors & Behavioral Performance (IRP Rev H)		
<b>Human Research Program Risks:</b>	(1) <b>HSIA</b> :Risk of Adverse Outcomes Due to Inadequate Human Systems Integration Architecture (2) <b>Team</b> :Risk of Performance and Behavioral Health Decrements Due to Inadequate Cooperation, Coordination, Communication, and Psychosocial Adaptation within a Team		
<b>Space Biology Element:</b>	None		
<b>Space Biology Cross-Element Discipline:</b>	None		
<b>Space Biology Special Category:</b>	None		
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<b>Zip Code:</b>	32826-3281	<b>Congressional District:</b>	7
<b>Comments:</b>			
<b>Project Type:</b>	GROUND	<b>Solicitation / Funding Source:</b>	2014-15 HERO NNJ14ZSA001N-MIXEDTOPICS. Appendix E: Behavioral Health & Human Health Countermeasures Topics
<b>Start Date:</b>	08/22/2016	<b>End Date:</b>	08/21/2023
<b>No. of Post Docs:</b>	0	<b>No. of PhD Degrees:</b>	0
<b>No. of PhD Candidates:</b>	2	<b>No. of Master' Degrees:</b>	1
<b>No. of Master's Candidates:</b>	2	<b>No. of Bachelor's Degrees:</b>	0
<b>No. of Bachelor's Candidates:</b>	0	<b>Monitoring Center:</b>	NASA JSC
<b>Contact Monitor:</b>	Whitmire, Alexandra	<b>Contact Phone:</b>	
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<b>Flight Program:</b>			
<b>Flight Assignment:</b>	NOTE: End date changed to 8/21/2023 per NSSC information (Ed., 7/22/22) NOTE: End date changed to 8/21/2022 per NSSC information (Ed., 8/24/21) NOTE: End date changed to 8/21/2021 per NSSC information (Ed., 7/27/20)		
<b>Key Personnel Changes/Previous PI:</b>	July 2022 report: No key personnel changes		
<b>COI Name (Institution):</b>	Salas, Eduardo Ph.D. ( Rice University )		
<b>Grant/Contract No.:</b>	NNX16AP96G		
<b>Performance Goal No.:</b>			
<b>Performance Goal Text:</b>			

<p><b>Task Description:</b></p>	<p>Culture has been a factor for space exploration since the mid 1970s when the U.S. first partnered with Russia. Work has indicated that culturally-based differences in values, beliefs, and preferences for cognition and action can have an impact on interdependent action (Stahl et al., 2010). Cultural diversity can pose challenges for a number of transition, action, and interpersonal processes and emergent states in teams. However, almost all of this work has been conducted outside the context of spaceflight. The little work that has been conducted within spaceflight has begun to suggest that the impact of culture on teams may be different in long-duration space exploration (LDSE--see Suedfeld et al., 2013). This drives the question as to whether cultural diversity within spaceflight crews has the same impact on team performance as that reported within the wider literature on cross-cultural teams and what can be done to create synergy. We leverage prior work on cultural diversity and teams in mission critical environments and archival data on team interaction in ICE (isolated, confined environments) and pair this with experimentation in ground analog studies to better understand the critical challenges created by cultural diversity in LDSE and use this information to create and test cultural training tools that can be used pre- and in-flight. Specifically, we take a multi-pronged approach to answer the following questions: (1) what are the critical issues surround culture and team performance in LDSE, (2) from a compositional standpoint is there an 'ideal' team profile in terms of cultural orientations to facilitate team performance and adaptability in LDSE, (3) what types of cultural training can be developed for use pre-flight and in-flight, and (4) what tools can be developed to facilitate practitioners in maximizing the potential synergy in culturally diverse teams operating in LDSE (e.g., pillars, guidelines, practices, tips).</p> <p>Stahl, G.K., Makela, K., Zander, L., &amp; Maznevski, M.L. (2010a ). A look at the bright side of multicultural team diversity. <i>Scandinavian Journal of Management</i>, 26 (4), 439 - 447.</p> <p>Stahl, G. K., Maznevski, M. L., Voigt, A., &amp; Jonsen, K. (2010b). Unraveling the effects of cultural diversity in teams: A meta - analysis of research on multicultural work groups. <i>Journal of International Business Studies</i> , 41 (4), 690 - 709.</p> <p>Suedfeld, P., Wilk, K. E., &amp; Cassel, L. (2013). Flying with strangers: postmission reflections of multinational space crews (pp. 185-209). Springer, Berlin Heidelberg.</p>
<p><b>Rationale for HRP Directed Research:</b></p>	<p>Within this project, we seek to answer the following questions: (1) what are the critical issues surrounding culture and team performance in long duration spaceflight, (2) is there a team cultural profile that facilitates team performance and adaptation in long duration spaceflight, and (3) what tools can be developed to facilitate synergy/mitigate decrements in teamwork and team performance within culturally diverse teams operating in the context of spaceflight. The proposed project will impact numerous areas. First, this research will address current theoretical gaps surrounding the critical challenge of cultural diversity in long duration spaceflight (both on the ground and in orbit). This information is then used to build a series of complementary, modular training tools to facilitate the crew's ability to turn cultural diversity into a synergistic force. The existent literature on cross-cultural training does little to focus on cultural diversity in crews operating in isolated, confined environments. Additionally, the focus of most cross-cultural training programs is to prepare expatriates to go abroad; therefore, teaching cross-cultural competence with regard to teamwork skills is rarely seen. In building our training we seek to validate the effectiveness of such programs within analog environments using sound scientific methods and training evaluation techniques. Finally, as an important part of training development is the assessment of the skills gained during training we will also deliver a set of assessment tools that can be used to diagnose cross-cultural competence levels with regard to team interaction.</p>
<p><b>Research Impact/Earth Benefits:</b></p>	<p>Efforts within the current reporting period have primarily focused on the SIRIUS-21 mission – specifically, survey implementation, data management, and coordination efforts. Additionally, a subset of preliminary analyses have been conducted for the initial 4 months of the 8-month mission. Note that the data presented herein is preliminary and action on any results should be viewed with caution due to the low sample size (1 crew, 6 individuals). Due to the small sample size, the results reported below focus more on effect sizes than actual significance levels; therefore, they are referred to as 'trends'. Comparison to SIRIUS-19 results and forthcoming missions will serve to provide greater confidence in initial results and allow us to move towards team level analyses. Results also need to be viewed in light of the fact that results from the quantitative data suggest that, in terms of cultural diversity, the SIRIUS 8-month crew was on the low to moderate end of the spectrum for those cultural values that were assessed. [Ed. Note: Missions through the Scientific International Research In a Unique terrestrial Station, or SIRIUS, represent an international, multicultural series of studies researching the effects of isolation and confinement on human psychology, physiology, and team dynamics to help prepare for long-duration space exploration.]</p> <p>Some of the differences noted by the crew were differences in language fluency, leadership style, gender norms, and religious practices. These differences were noted, at times, to result in tension within the crew. Additionally, there is evidence for subgroup formation at various levels within the crew. The drivers of such subgroup formation are currently being investigated more thoroughly through examination of journal and interview data. There is also some evidence that tensions amongst the crew may have been amplified by relations between the crew and the (Mission Control Center) MCC at various times within the mission.</p> <p>Despite the low to moderate cultural diversity within the crew, quantitative results begin to suggest how cultural values may impact crewmember perceptions of trust and cohesion amongst the crew. With regard to team dynamics, several trends were evidenced, suggesting that cultural values may impact perceptions of emergent states (e.g., trust, cohesion). While these trends were variable over time, on average, crewmembers who possessed any of the following were found to report lower perceptions of cohesion: higher levels of power distance, higher comfort with uncertainty. Moreover, masculinity, collectivism, and long-term orientation produced trends suggesting a moderate positive relationship with cohesion.</p> <p><b>Task Progress:</b></p> <p>With regard to the relationship between cultural diversity and trust, similar trends were seen. Specifically, results suggest a trend towards uncertainty avoidance and collectivism having a moderate to strong relationship with perceptions of trust. While there was some variability in both of the relationships, in general, individuals higher in uncertainty avoidance and collectivism perceived more trust within the team. The relationship between indirectness and team trust was variable over time. Overall, there was a moderate positive relationship with team trust; however, there were downward trends at two time points in the first four months. Similarly, power distance trended towards a moderate negative relationship with team trust, while at times during the middle of the fourth month trending towards a weak positive relationship.</p>

	<p>The final emergent state that we examined were crew member mental models regarding teamwork. Analyses were conducted using the Pathfinder program (Schvaneveldt, Durso, &amp; Dearholt, 1989). In looking at crewmember mental models, we were primarily interested in the degree to which teamwork mental models varied by culture. In investigating this question, our analyses examined the degree to which crewmembers' mental models changed over time (individual-level focus) and the degree to which there was variation amongst the crew's mental model at a single point in time (team-level focus). Initial results indicate: (1) variability in single crewmember mental models over time in terms of the density and interconnections, and (2) differences between the mental models of crewmembers at a single point in time (density, interconnections, agreement). We are further unpacking these differences to examine the degree to which the differences align along national lines, cultural values, and subgroupings. Preliminary analyses have also been conducted to examine the relationship between cultural values, social intelligence, and cultural intelligence.</p> <p>Moving forward, we will continue to analyze the remaining information contained within the 8-month mission and look forward to the opportunities that will be afforded when we compare the 4- and 8-month missions, such that with both data sets we can begin to talk about cultural diversity in more detail. We will also continue to utilize and integrate the information gained to this point into the products we are building. With respect to the SIRIUS mission, the project team has attended planning and update meetings. Finally, additional data collection/analysis opportunities will serve to refine our initial findings and facilitate the integration of this information into the products we are building.</p>
<b>Bibliography Type:</b>	Description: (Last Updated: 09/04/2023)
<b>Articles in Peer-reviewed Journals</b>	Traylor AM, Tannenbaum SI, Thomas EJ, Salas E. "Helping healthcare teams save lives during COVID-19: Insights and countermeasures from team science." Am Psychol. 2021 Jan;76(1):1-13. <a href="https://doi.org/10.1037/amp0000750">https://doi.org/10.1037/amp0000750</a> ; PMID: <a href="https://pubmed.ncbi.nlm.nih.gov/33119329/">33119329</a> ; <a href="https://pubmed.ncbi.nlm.nih.gov/PMC8543842/">PMC8543842</a> , Jan-2021
<b>Articles in Peer-reviewed Journals</b>	Santos M, Luna M, Reyes DL, Traylor A, Lacerenza CN, Salas E. "How to be an inclusive leader for gender-diverse teams." Organ Dyn. 2022 Jun 2;100914. Online ahead of print. <a href="https://doi.org/10.1016/j.orgdyn.2022.100914">https://doi.org/10.1016/j.orgdyn.2022.100914</a> , Jun-2022
<b>Articles in Peer-reviewed Journals</b>	Kilcullen M, Bisbey TM, Rosen M, Salas E. "Does team orientation matter? A state-of-the-science review, meta-analysis, and multilevel framework." J Organ Behav. 2022 Mar 22. Review. <a href="https://doi.org/10.1002/job.2622">https://doi.org/10.1002/job.2622</a> , Mar-2022
<b>Books/Book Chapters</b>	Croitoru N, Bisbey TM, Salas E. "Team training for long-duration space exploration: A look ahead at the coming challenges." in "Psychology and Human Performance in Space Programs: Extreme Application. " Ed. L.B. Landon, K.J. Slack, E. Salas. <a href="https://doi.org/10.1201/9780429440854">https://doi.org/10.1201/9780429440854</a> Boca Raton, FL: CRC Press, 2020. p. 81-99., Jan-2020