

Fiscal Year:	FY 2023	Task Last Updated:	FY 08/17/2023
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Project Title:	Facilitating the Synergistic Side of Cultural Differences in LDSE: Identification of Challenges and Development of Cultural Training		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Behavior and performance		
Joint Agency Name:		TechPort:	No
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Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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No. of PhD Candidates:	2	No. of Master' Degrees:	1
No. of Master's Candidates:	1	No. of Bachelor's Degrees:	0
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Flight Program:			
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Key Personnel Changes/Previous PI:	July 2023 report: No key personnel changes		
COI Name (Institution):	Salas, Eduardo Ph.D. (Rice University)		
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Performance Goal Text:**Task Description:**

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. Cultural differences 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). This drives the question as to whether cultural differences 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 differences 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 differences 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).

Rationale for HRP Directed Research:**Research Impact/Earth Benefits:**

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 differences 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 differences into a synergistic force. The existent literature on cross-cultural training does little to focus on cultural differences 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.

During this reporting period, the primary activities have focused upon the following thrusts: (1) data integration and analysis with respect to the full SIRIUS 8-month mission. (2) preparatory work on the cultural training, and (3) analog adjustment (moving from SIRIUS to Human Exploration Research Analog/HERA). Herein, we primarily report on some of the efforts with respect to the SIRIUS 8-month mission. A subset of preliminary analyses have been conducted for the full 8-month mission, including quantitative and qualitative. With regard to the quantitative data, we examined the relationship between cultural values and the following constructs: team action processes, team identity, faultlines, and effectiveness. Using non-linear dynamics, we also examined the degree of regularity/stability in team member cognition and affect over the course of the mission and the degree to which dyads within the crew exhibited alignment in their social behaviors. Note that the data presented below 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 both quantitative and qualitative data suggest that in terms of cultural differences the SIRIUS 8-month crew was on the low to moderate end of the spectrum for those cultural values that were assessed.

Despite the low to moderate cultural differences within the crew, quantitative results begin to suggest how cultural values may impact crew member perceptions of teamwork processes, team identity, team faultiness, and team effectiveness. With regard to team dynamics, several trends were evidenced suggesting that cultural values may impact perceptions of the aforementioned processes, emergent states, and outcomes. These trends were variable over time. However, on average members whose cultural values included collectivism, high context communication, and members who were high in uncertainty avoidance trended towards identifying with the team to a greater extent. Cultural values of masculinity and indirect communication tended to have less of an impact on the degree to which crew members identified with the team. While long-term orientation and power distance tended to trend towards negative relationships with team identity.

Task Progress:

There was a great degree of variability with respect to how the various cultural values related to team action processes. For example, uncertainty avoidance trended towards a strong to moderate positive relationship with action processes, especially early in the mission. Therefore, crew members who are less comfortable with uncertainty tend to perceive a greater degree of team action processes. Indirectness, on the other hand, while having a positive relationship with action processes early in the mission, quickly began to trend towards a small negative relationship with action processes. This relationship remains negative and becomes moderate to strong in strength from around Week 24 to the end of the mission.

There was also an overall trend for crew members who value high levels of power distance and have a long-term orientation to perceive there to be more faultlines within the crew. Overall, the relationship between the remaining cultural values and perceptions regarding faultline trends is strongly negative, this is especially true for collectivism. The relationship among the following cultural values – indirectness, masculinity, and uncertainty avoidance – and perceptions of faultlines tend to mirror one another.

Finally, there is variability across time with respect to the strength and direction of the relationship between specific cultural values and team effectiveness; however, the overall picture presented is one in which uncertainty avoidance and long-term orientation see moderate to strong positive relationships with team effectiveness, especially up through the

	<p>first four months of the mission. The remaining cultural values (collectivism, power distance, indirectness, context) tend to show similar trajectories with respect to their relationship with team effectiveness. Specifically, while there are some small positive spikes in the relationship among these values and team effectiveness, overall, the relationship is near zero or slightly negative.</p> <p>We will continue to work on analyzing the full set of data from the SIRIUS '21 mission (quantitative, qualitative). Once analyzed, we will then see where the areas of convergence and difference lie across the '19 and '21 missions.</p>
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