

|   |   |                                       |  |
|---|---|---------------------------------------|--|
| <b>Fiscal Year:</b>                               | FY 2018   | <b>Task Last Updated:</b>             | FY 05/23/2019  |
| <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<br>(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  |                                       |  |
| <b>PI Email:</b>                                  | <a href="mailto:sburke@ist.ucf.edu">sburke@ist.ucf.edu</a>  | <b>Fax:</b>                           | FY   |
| <b>PI Organization Type:</b>                      | UNIVERSITY  | <b>Phone:</b>                         | 407-882-1326   |
| <b>Organization Name:</b>                         | University of Central Florida   |                                       |  |
| <b>PI Address 1:</b>                              | Institute for Simulation and Training   |                                       |  |
| <b>PI Address 2:</b>                              | 3100 Technology Pkwy  |                                       |  |
| <b>PI Web Page:</b>                               |   |                                       |  |
| <b>City:</b>                                      | Orlando   | <b>State:</b>                         | FL   |
| <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>                      | 08/21/2020   |
| <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>                | 3   | <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>                           | Williams, Thomas  | <b>Contact Phone:</b>                 | 281-483-8773   |
| <b>Contact Email:</b>                             | <a href="mailto:thomas.j.will1@nasa.gov">thomas.j.will1@nasa.gov</a>  |                                       |  |
| <b>Flight Program:</b>                            |   |                                       |  |
| <b>Flight Assignment:</b>                         |   |                                       |  |
| <b>Key Personnel Changes/Previous PI:</b>         | June 2018 report: No key personnel changes. July 2017 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>During the timeframe covered within this report, 2017-2018, the primary focus has been on the analysis of archival sources from within the space-industry that may contain insight into how cultural diversity within the crew may impact the team interaction during spaceflight. In doing so, we are particularly interested in how mission phase may impact the types of challenges seen as well as the mitigation strategies that may prove useful. In doing so, we have examined the life sciences data archive as well as analyzed a series of archived operational assessments/interviews focusing on team interaction during exploration missions to extract themes related to cultural diversity and team interaction. The products resulting from the examination of the Life Sciences Data Archive include an annotated bibliography as well as insight into where gaps in knowledge may lie in terms of the impact of cultural diversity on team interaction in the context of exploration missions. This insight was utilized to draft interview protocols for use in later years of the project as well as help to guide decisions regarding the complement of measures and focus of data collection within an analog environment (i.e., SIRIUS (Scientific International Research In a Unique terrestrial Station) 4-month mission).</p> <p>In conjunction with this effort, analysis of archived interviews with NASA subject matter experts provided information and corresponding gaps in knowledge regarding the impact of culture on crew interaction, mitigation strategies/countermeasures, and information on how the above may differ based on mission phase/stage/temporality. Some of the insights gained from this work include: differences in leadership styles, cultural factors that cause negative affect, and how mission phase/stage may impact the cognitive scripts crew members have concerning member interaction and how this impacts what crew members are willing to 'accept.' Findings also emerged that provide information on key trigger points where cultural differences may cause degradation in the quality of coordinated action among long duration spaceflight crews. For example, segmented workflow between cultures was mentioned as tending to amplify cultural differences. Additionally, insight is being gained into those more informal mechanisms that can be used to build cohesion within culturally diverse crews, such as the sharing of meals together and other socialization opportunities (both informal, formal), many of which can be done prior to flight. The importance of humor and inclusive leadership was also mentioned as important, but the appropriate use of humor can be a stumbling block.</p> <p>This information as well as gaps in knowledge concerning the impact of cultural diversity on team interaction across the crew and mission lifespan is being used to not only guide future data collection efforts within the SIRIUS 4-month mission, but is serving to refine the development of a semi-structured interview protocol for subject matter experts. During the current reporting period, an initial draft of the interview protocol was developed.</p> <p>Additionally, during this reporting period, the project received the final approval to be part of the complement of studies included in the SIRIUS 4-month mission (a joint mission between IBMP (Russian Institute for Biomedical Problems) and NASA). Therefore, the project team began to engage in some of the preparatory work necessary for inclusion as part of the complement of studies the SIRIUS 2018-2019 mission. For this 4-month study, primary research questions include: (1) What is the impact of cultural diversity on team dynamics (team process, emergent states) and team outcomes across the team's lifespan? and (2) Where are the places that cultural diversity causes challenges for team</p> |
| <p><b>Task Progress:</b></p>                       |  |

|   |  |
|---|--|
|   | <p>dynamics and where can it be a synergistic force?</p> <p>With respect to the SIRIUS mission, the project team has attended planning and update meetings as well as begun to complete the necessary protocols and delineate the constructs that will be focused upon for our part of the mission, as well as the timing of specific measures. It is expected that in examining the primary research questions above information on individual differences (i.e., cultural values, cultural intelligence, personality, social intelligence), team processes and states (i.e., teamwork, shared mental models, faultlines, and positive/negative affect), and outcomes (i.e., team effectiveness) will be collected. Additionally, crews will engage in journaling activities that will provide a more qualitative in depth understanding of their experiences while in the analog with respect to team interaction and culture.</p> |
| <b>Bibliography Type:</b>                 | Description: (Last Updated: 09/04/2023)  |
| <b>Articles in Peer-reviewed Journals</b> | Lacerenza CN, Marlow SL, Tannenbaum SI, Salas E. "Team development interventions: Evidence-based approaches for improving teamwork." Am Psychol. 2018 May-Jun;73(4):517-31. <a href="http://dx.doi.org/10.1037/amp0000295">http://dx.doi.org/10.1037/amp0000295</a> ; PubMed <a href="https://pubmed.ncbi.nlm.nih.gov/29792465/">PMID: 29792465</a> , May-2018   |
| <b>Articles in Peer-reviewed Journals</b> | Salas E, Reyes DL, McDaniel SH. "The science of teamwork: Progress, reflections, and the road ahead." Am Psychol. 2018 May-Jun;73(4):593-600. <a href="http://dx.doi.org/10.1037/amp0000334">http://dx.doi.org/10.1037/amp0000334</a> ; PubMed <a href="https://pubmed.ncbi.nlm.nih.gov/29792470/">PMID: 29792470</a> , May-2018   |
| <b>Articles in Peer-reviewed Journals</b> | Shuffler ML, Diazgranados D, Maynard MT, Salas E. "Developing, sustaining, and maximizing team effectiveness: An integrative, dynamic perspective of team development interventions." Acad Manag Ann. 2018 Jun;12(2):688-724. <a href="https://doi.org/10.5465/annals.2016.0045">https://doi.org/10.5465/annals.2016.0045</a> ; PubMed <a href="https://pubmed.ncbi.nlm.nih.gov/30931078/">PMID: 30931078</a> ; PubMed Central <a href="https://pubmed.ncbi.nlm.nih.gov/PMC6438631/">PMCID: PMC6438631</a> , Jun-2018  |
| <b>Dissertations and Theses</b>           | King M. "The effects of cultural diversity on team performance and team satisfaction: A meta-analysis." Master's Thesis, Ludwig-Maximillan Universität, Munich, March 2018. , Mar-2018   |