

Fiscal Year:	FY 2014	Task Last Updated:	FY 03/31/2014
PI Name:	Salas, Eduardo Ph.D.		
Project Title:	Optimizing Crew Performance in Long Duration Space Exploration: Best Practices for Team Training and Cohesion Measurement		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Behavior and performance		
Joint Agency Name:	TechPort:	No	
Human Research Program Elements:	(1) BHP: Behavioral Health & Performance (archival in 2017)		
Human Research Program Risks:	(1) Team: Risk of Performance and Behavioral Health Decrements Due to Inadequate Cooperation, Coordination, Communication, and Psychosocial Adaptation within a Team		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	77005	Congressional District:	7
Comments:	NOTE: Previous affiliation was University of Central Florida, until mid-2015		
Project Type:	GROUND	Solicitation / Funding Source:	2008 Crew Health NNJ08ZSA002N
Start Date:	08/15/2009	End Date:	12/31/2013
No. of Post Docs:	0	No. of PhD Degrees:	1
No. of PhD Candidates:	3	No. of Master' Degrees:	0
No. of Master's Candidates:		No. of Bachelor's Degrees:	4
No. of Bachelor's Candidates:		Monitoring Center:	NASA JSC
Contact Monitor:	Leveton, Lauren	Contact Phone:	
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Flight Program:			
Flight Assignment:	NOTE: End date is now 12/31/2013 per NSSC information (Ed., 7/29/13) NOTE: End date is now 8/14/2013 per NSSC information (Ed., 6/15/2012) NOTE: period of performance changed to 8/15/2009-8/14/2012 (from 5/22/09-5/21/12) per JSC (3/10)		
Key Personnel Changes/Previous PI:	N/A		
COI Name (Institution):	Fiore, Stephen (University of Central Florida) Smith-Jentsch, Kimberly (University of Central Florida)		
Grant/Contract No.:	NNX09AK48G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	<p>This project addresses questions regarding methods and technologies for training crews to maintain crew cohesion and optimal performance during exploration missions (BHP Team GAP5; IRP Gap - BHP 2.3.1) and metrics for monitoring crew cohesion (BHP Team GAP2; IRP Gap - BHP 2.2.1). Specific aims of this project are threefold: (1) identify evidence-based guidelines/best practices for training to maximize team cohesion, and team performance; (2) design, develop, and validate evidence-based instructional strategies to mitigate performance failures from cohesion decrements among spaceflight crews and coordinating ground crews; and (3) design, develop, and validate an evidence-based index measuring and diagnosing cohesion over the course of a mission. These specific project aims meet NASA goals and objectives (BHP Team Gap 2 and Team Gap5) by capturing cohesion levels shown to be integral to long duration spaceflight mission success as well as developing countermeasures designed to mitigate the negative impact of cohesion issues. Organized as a multi-year project, primary tasks for the first year included the development of recommendations for training crews to optimize cohesion and team performance, mitigate negative impacts of long-duration missions, and measuring crew cohesion over time. Second and third years of the project focus on applying recommendations derived from year one research by developing, implementing, and evaluating instructional strategies to maximize crew cohesion and mitigate negative psychosocial impacts of long-duration missions. Overarching project goals are to: (1) mitigate performance failures due to a lack of cohesion between spaceflight crews and coordinating ground crews, (2) diagnose cohesion decrements during exploration missions, and (3) provide just-in-time training to improve any noted cohesion decrements during spaceflight.</p>
Rationale for HRP Directed Research:	<p>Working together on long-duration space exploration missions in conjunction with ground control requires the ability to communicate, coordinate, and cooperate for extended durations under complex, dynamic conditions such as extreme isolation and confinement (NASA, 2009). Factors related to team cohesion (e.g., interpersonal conflict, impaired communication) were noted as contributors in both the Challenger and Columbia shuttle accidents. Determining the best strategies for equipping crew members with the cognitive, behavioral, and attitudinal tools necessary to cope under such intense conditions while maintaining optimal performance, and developing a means to unobtrusively monitor crew adaptation over time are critical to the success of such missions. The multipronged research approach will yield (1) an understanding of the factors that contribute to a lack of cohesion and (2) the identification of stressors relevant to spaceflight crews, which will aid in pinpointing training strategies and methodologies to equip team members with the competencies necessary for coping with isolated, confined environments for long durations. Additionally, the focus on self-correction and regulation will enable teams to maintain levels of cohesion and team performance as well as to mitigate the negative impact of cohesion decrements over the course of long duration spaceflight.</p>
Research Impact/Earth Benefits:	<p>The following is a submission of the overall final report of the research project. This research project (Project PEGASUS) is dedicated to providing valid, evidence based training recommendations for optimizing and maintaining crew cohesion and team performance during long duration spaceflight (LDSF) missions. The specific objectives associated with Project PEGASUS include: (1) Identify evidence-based guidelines and best practices for training to maximize team cohesion and team performance; (2) Design, develop, and validate theoretically driven, evidence based instructional strategies to mitigate performance failures from cohesion decrements among spaceflight crews and coordinating ground crews; and (3) design, develop, and validate an evidence based toolkit for measuring and diagnosing cohesion over the course of LDSF missions.</p> <p>This report includes the tasks that have been conducted for the project, as well as updates following the previous Y4 annual report completed. The first phases of the project involved investigating the characteristics of the LDSF environment, by reviewing the literature of team performance in isolated, confined, and extreme (ICE) environments. Our literature review was organized by investigating three constructs—categorized as thrusts—that are considered important for effective team performance in ICE environments: (1) cohesion, (2) stress, and (3) self-regulation.</p> <p>The literature review helped in the development of inquiries for the structured interviews with subject matter experts. These subject matter experts were astronauts with NASA who had previous experience with LDSF mission in the International Space Station (ISS). These interviews involved astronauts to provide insight into their experiences of these missions, including stress that they experience during taskwork and in the work environment, preparing crewmembers for spaceflight missions, and working with fellow teammates before and during the mission. Additionally, we also gained insight about what conditions of training interventions they deemed useful for preparing the team for their spaceflight mission. Based on our literature review and talking with the subject matter experts, we concluded that Team Dimensional Training (TDT), a structured debriefing strategy that is associated with team self-correction, can help personnel in the spaceflight context for learning and maintaining optimal collective performance.</p> <p>The main update associated with this final report involves the conduction and conclusion of our field study, which investigated TDT in a Mission Control setting. This involves data collection, analysis, and interpretation of results. Findings indicate that participants rate the TDT debriefing strategy to allow for more open and participative debriefing, and also rated the TDT strategy with higher levels of learning value than the baseline debriefing condition. Additionally, findings indicate that the TDT strategy has resulted in quicker certification times for trainees in comparison to the baseline condition.</p> <p>Overall, our efforts in this four year research project involved gaining insight into the characteristics and challenges associated with long duration spaceflight. Our efforts also included the validation of training countermeasures (i.e., TDT) aiming to benefit personnel in the spaceflight work environment to prepare for future missions.</p>
Task Progress:	
Bibliography Type:	Description: (Last Updated: 09/04/2023)
Abstracts for Journals and Proceedings	<p>Dietz A, Grossman R, Oglesby J, Coultas C, Lazzara E, Benishek L, Salas E. "Developing team training and cohesion measurement best practices for long duration spaceflight." 2014 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-13, 2014.</p> <p>2014 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-13, 2014. http://www.hou.usra.edu/meetings/hrp2014/pdf/3057.pdf, Feb-2014</p>

Abstracts for Journals and Proceedings	Thayer A, Smith-Jentsch KA. "The Influence of Team Composition on Team Flexible Coordination." Accepted for presentation at 29th Annual Conference of the Society for Industrial and Organizational Psychology, Honolulu, Hawaii, May 15-17, 2014. 29th Annual Conference of the Society for Industrial and Organizational Psychology, Honolulu, Hawaii, May 15-17, 2014. , May-2014
Articles in Peer-reviewed Journals	Salas E, Grossman R, Hughes AM, Coultas CW. "Measuring team cohesion: observations from the science." Hum Factors. 2015 May;57(3):365-74. http://dx.doi.org/10.1177/0018720815578267 ; PubMed PMID: 25875429 , May-2015
Articles in Peer-reviewed Journals	Salas E, Tannenbaum SI, Kozlowski SWJ, Miller CA, Mathieu JE, Vessey WB. "Teams in space exploration: A new frontier for the science of team effectiveness." Curr Dir Psychol Sci. 2015 Jun;24(3):200-7. http://dx.doi.org/10.1177/0963721414566448 , Jun-2015
Articles in Peer-reviewed Journals	Driskell JE, Salas E, Driskell T. "Foundations of teamwork and collaboration. " Am Psychol. 2018 May-Jun;73(4):334-48. https://doi.org/10.1037/amp0000241 ; PMID: 29792452 , May-2018
Articles in Peer-reviewed Journals	Fiore SM, Wiltshire TJ, Oglesby JM, O'Keefe WS, Salas E. "Complex collaborative problem-solving processes in Mission Control." Aviation, Space, and Environmental Medicine. 2014 Apr;85(4):456-61. http://dx.doi.org/10.3357/ASEM.3819.2014 , Apr-2014
Books/Book Chapters	Driskell T, Driskell JE, Salas E. "Lexicon as a predictor of team dynamics." in "Team dynamics over time." Ed. E. Salas, W.B. Vessey, L.B. Landon. Bingley, UK: Emerald Publishing, 2017. p. 231-257. https://doi.org/10.1108/S1534-085620160000018010 , Aug-2017
NASA Technical Documents	Smith-Jentsch KA, Sierra MJ, Weaver SJ, Bedwell WL, Dietz AS, Carter-Berenson D, Oglesby J, Fiore SM, Salas E. "Training 'the right stuff': An assessment of team training needs for long-duration spaceflight crews." Houston, TX: NASA Johnson Space Center, 62 p. 2015 Sep. NASA/TM-2015-218589. , Sep-2015