

Fiscal Year:	FY 2012	Task Last Updated:	FY 06/15/2012
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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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:	0
No. of PhD Candidates:	2	No. of Master' Degrees:	0
No. of Master's Candidates:	3	No. of Bachelor's Degrees:	
No. of Bachelor's Candidates:		Monitoring Center:	NASA JSC
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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:	NA		
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:	
Research Impact/Earth Benefits:	<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>
Task Progress:	<p>Year 3 (Y3) efforts have focused on: (1) the development and planning of field and lab-based studies in order to provide empirical support from which our guidelines and intervention techniques will be grounded, (2) continued analysis of archival analogue data collected from US Submarine teams and US air traffic controller teams, (3) the development of a cohesion measurement toolkit to monitor cohesion levels over time, and (4) convening the first of two workshops dedicated to bringing together a diverse community of experts around the topic of team training in complex environments.</p> <p>Efforts within Thrust 1 (Cohesion) were dedicated to continued literature analysis. Findings from this analysis supported the development of an initial cohesion toolkit that includes an attitudinal measure, a behavioral measure, and a sociometric measure. In addition, Y3 efforts resulted in the successful identification and development of an experimental methodology appropriate for studies dedicated to exploring issues related to long duration spaceflight (LDSF) crew functioning and performance. Data from laboratory studies will be analyzed in order to assess the reliability and validity of the cohesion toolkit. Efforts related to Thrust 2 (Stress) involved: (1) constructing a theoretical conceptualization of team-level stress, (2) identifying guidelines for the measurement of team-level stress, (3) examining the implications of boredom and monotony for future long-duration missions, and (4) analyzing the indicators of team stress from an archival Air Traffic Controller data set. In addition, a manuscript submitted during Y2 was revised and submitted for review for publication in a peer-reviewed outlet relevant to NASA. Thrust 3 (Self-Regulation) efforts were dedicated to designing and implementing a study aimed at empirically validating a strategy for debriefing teams. The strategy under investigation is Team Dimension Training (TDT). Briefly, TDT is a strategy for guiding teams in a structured process of self-correction to facilitate team members in developing shared and accurate knowledge about the components of effective teamwork and accelerate their mastery of targeted teamwork skills. Furthermore, Project Pegasus has received a one year no-cost extension to continue this effort in order to scientifically determine the degree to which estimates of TDT's validity obtained in prior research will generalize to the NASA population.</p> <p>Thus, Y3 progress included several core tasks: analysis of data sets collected from analogous samples and reviews of existing literature (Task 3), the development of a preliminary cohesion toolkit (Task 4), preparation for experimental studies and collection of data from these studies (Task 5), conducting the first project workshop (Task 8), and coordinating with our NASA sponsors to initiate the validation study of the TDT debriefing technique (Task 9).</p> <p>Besides the publications listed in the Bibliography below, we have an Unpublished White Paper: Bedwell, W.L., Grossman, R., Potocnik, M.J., Dietz, A.S., & Salas, E. "Workshop Executive Summary: Best Practices for Enhancing Team Performance." November 2011.</p>
Bibliography Type:	Description: (Last Updated: 09/04/2023)
Abstracts for Journals and Proceedings	<p>Keeton KE, Tani D, Goodwin G, Smith-Jentsch K. (W.L. Bedwell & A.S. Dietz (Co-Chairs) "Extreme teams: Is a paradigm shift required?" 55th Annual Meeting of the Human Factors and Ergonomics Society, Las Vegas, NV, September 19-23, 2011.</p> <p>Proceedings of the 55th Annual Meeting of the Human Factors and Ergonomics Society, Las Vegas, NV, September 19-23, 2011. (pp. 2109-2122). , Sep-2011</p>
Abstracts for Journals and Proceedings	<p>Dietz AS, Sierra MJ, Smith-Jentsch K, Salas E. "Guiding principles for team stress measurement." Paper accepted for presentation at the 56th Annual Meeting of the Human Factors and Ergonomics Society, Boston, MA, October 22-26, 2012.</p> <p>56th Annual Meeting of the Human Factors and Ergonomics Society, Boston, MA, October 22-26, 2012. In press as of June 2012. , Jun-2012</p>

Abstracts for Journals and Proceedings	Oglesby J, Salas E. "The issue of monotony and low workload in spaceflight: Considerations for the mission to Mars." Poster accepted for presentation at the 56th Annual Meeting of the Human Factors and Ergonomics Society, Boston, MA, October 22-26, 2012. 56th Annual Meeting of the Human Factors and Ergonomics Society, Boston, MA, October 22-26, 2012. In press as of June 2012. , Jun-2012
Abstracts for Journals and Proceedings	Grossman R, Bedwell WL, Burke CS, Thayer A, Dietz AS, Salas E. "Modeling Cohesion in Long-Duration Spaceflight." Poster presented at the 2012 NASA Human Research Program Investigators' Workshop, Houston, TX, February 14-16, 2012. 2012 NASA Human Research Program Investigators' Workshop, Houston, TX, February 14-16, 2012. , Feb-2012
Abstracts for Journals and Proceedings	Salas E, Smith-Jentsch K, Fiore SM, Bedwell WL, Sierra MJ, Dietz A, Oglesby J, Grossman R. "Optimizing Crew Performance in Long Duration Space Exploration: Best Practices for Team Training and Cohesion Measurement." Poster presented at the 2012 NASA Human Research Program Investigators' Workshop, Houston, TX, February 14-16, 2012. 2012 NASA Human Research Program Investigators' Workshop, Houston, TX, February 14-16, 2012. , Feb-2012
Abstracts for Journals and Proceedings	Bedwell WL, Smith-Jentsch KA, Sierra MJ, Salas E. "Team Dimensional Training validation: A field study with flight controllers." Poster presented at the 2012 NASA Human Research Program Investigators' Workshop, Houston, TX, February 14-16, 2012. 2012 NASA Human Research Program Investigators' Workshop, Houston, TX, February 14-16, 2012. , Feb-2012
Abstracts for Journals and Proceedings	Grossman R, Bedwell WL, Dietz AS, Benishek L, Oglesby JM, Spencer J, Salas E. "Best Practices for Team Training." Poster presented at the 2012 NASA Human Research Program Investigators' Workshop, Houston, TX, February 14-16, 2012. 2012 NASA Human Research Program Investigators' Workshop, Houston, TX, February 14-16, 2012. , Feb-2012
Abstracts for Journals and Proceedings	Grossman R, Bedwell W, Benishek L, Oglesby J, Salas E. "The many faces of cohesion: Toward a unified conceptualization." In Grossman, R. & Thayer, A. (co-chairs), & Bedwell, W. (discussant). Team constructs: Before we can understand them, we must define them. Symposium conducted at the 33rd Annual Industrial-Organizational Psychology and Organizational Behavior (IOOB) Conference, Orlando, FL, March 9-11, 2012. 33rd Annual Industrial-Organizational Psychology and Organizational Behavior (IOOB) Conference, Orlando, FL, March 9-11, 2012. , Mar-2012
Abstracts for Journals and Proceedings	Sierra MJ, Smith-Jentsch KA. "The nature of team stress in air traffic control teams." Presented at the 33rd Annual Industrial-Organizational Psychology and Organizational Behavior (IOOB) Conference, Orlando, FL, March 9-11, 2012. 33rd Annual Industrial-Organizational Psychology and Organizational Behavior (IOOB) Conference, Orlando, FL, March 9-11, 2012. , Mar-2012
Abstracts for Journals and Proceedings	Bedwell WL, Kozlowski SWJ. (Co-Chairs). "The science of teams: Learning from the extremes." Symposium conducted at the 27th Annual Conference for the Society of Industrial and Organizational Psychology, San Diego, CA, April 26-28, 2012. 27th Annual Conference for the Society of Industrial and Organizational Psychology, San Diego, CA, April 26-28, 2012. , Apr-2012
Abstracts for Journals and Proceedings	Sierra MJ, Smith-Jentsch KA, Dietz A.S. "Understanding team stress: Lessons learned from air traffic control teams." In W. L. Bedwell & S. W. Kozlowski (Co-Chairs), The science of teams: Learning from the extremes. Symposium conducted at the 27th Annual Conference for the Society of Industrial and Organizational Psychology, San Diego, CA, April 26-28, 2012. 27th Annual Conference for the Society of Industrial and Organizational Psychology, San Diego, CA, April 26-28, 2012. , Apr-2012
Abstracts for Journals and Proceedings	Smith-Jentsch KA, Bedwell WL, Sierra MJ, Jones RP, Oglesby JM, Fiore SM, Salas E. "Entrainment at the extremes: Understanding adaptation needs of astronaut crews." In W. L. Bedwell & S. W. Kozlowski (Co-Chairs), The science of teams: Learning from the extremes. Symposium conducted at the 27th Annual Conference for the Society of Industrial and Organizational Psychology, San Diego, CA, April 26-28, 2012. 27th Annual Conference for the Society of Industrial and Organizational Psychology, San Diego, CA, April 26-28, 2012. , Apr-2012
Abstracts for Journals and Proceedings	Bedwell WL, Smith-Jentsch KA, Sierra MJ, Salas E. "Beyond low-earth orbit: Team training needs analysis applications & advances." In K. Kraiger (Chair), By land, sea, and air: Advancements and applications of training needs assessment. Symposium conducted at the 27th Annual Conference for the Society of Industrial and Organizational Psychology, San Diego, CA, April 26-28, 2012. 27th Annual Conference for the Society of Industrial and Organizational Psychology, San Diego, CA, April 26-28, 2012. , Apr-2012
Abstracts for Journals and Proceedings	Smith-Jentsch KA, Rinke LM, Sierra MJ, Dalal SG. "Is shared cognition always beneficial?: Why team member personality matters." In D. DiazGranados & K. A. Smith-Jentsch (Co-Chairs), How and when does team composition affect performance? Symposium conducted at the 27th Annual Conference for the Society of Industrial and Organizational Psychology, San Diego, CA, April 26-28, 2012. 27th Annual Conference for the Society of Industrial and Organizational Psychology, San Diego, CA, April 26-28, 2012. , Apr-2012
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Abstracts for Journals and Proceedings	Sierra MJ, Smith-Jentsch KA. "A Multilevel Analysis of What's Missing from Team Training Transfer Theory and Research." Poster presented at the 7th Annual Interdisciplinary Network for Group Research Conference, Chicago, IL, July 12--14, 2012. 7th Annual Interdisciplinary Network for Group Research Conference, Chicago, IL, July 12--14, 2012. , Jul-2012
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Articles in Peer-reviewed Journals	Shuffler ML, DiazGranados D, Salas E. "There's a science for that: Team development interventions in organizations." Current Directions in Psychological Science, 2011 Dec;20(6):365-72. http://dx.doi.org/10.1177/0963721411422054 , Dec-2011
Articles in Peer-reviewed Journals	Salas E, Tannenbaum SI, Kraiger K, Smith-Jentsch KA. "The science of training in organizations: What matters in practice." Psychological Science in the Public Interest, 2012 Jun;13(2): 74-101. http://dx.doi.org/10.1177/1529100612436661 , Jun-2012
Articles in Peer-reviewed Journals	Dietz AS, Driskell JE, Sierra MJ, Weaver SJ, Salas E. "Stress and Teams: A Framework for Understanding, Optimizing, and Diagnosing Teamwork under Stress." Human Factors. Under review as of June 2012 , Jun-2012
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Articles in Peer-reviewed Journals	Sierra MJ, Smith-Jentsch KA, Young BL. "Determinants of individual motivation and learning during team training: A multilevel perspective." Journal of Applied Psychology. Under review as of June 2012. , Jun-2012
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