13* 1.87	EX 2020		EX 07/02/2021
Fiscal year:	FY 2020	Task Last Updated:	FY 07/03/2021
PI Name:	Binsted, Kim Ph.D.		
Project Title:	Using Analog Missions to Develop Effe	ective Team Composition Strateg	ties for Long Duration Space Exploration
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline Element/Subdiscipline:	HUMAN RESEARCHBehavior and p	performance	
Joint Agency Name:		TechPort:	No
Human Research Program Elements:	(1) HFBP:Human Factors & Behavioral	Performance (IRP Rev H)	
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:	96822-2217	Congressional District:	1
Comments:			
Project Type:	Ground	Solicitation / Funding Source:	2014-15 HERO NNJ14ZSA001N-Crew Health (FLAGSHIP & NSBRI)
Start Date:	07/01/2015	End Date:	07/01/2020
No. of Post Docs:		No. of PhD Degrees:	1
No. of PhD Candidates:	2	No. of Master' Degrees:	
No. of Master's Candidates:		No. of Bachelor's Degrees:	
No. of Bachelor's Candidates:		Monitoring Center:	NASA JSC
Contact Monitor:	Whitmire, Alexandra	Contact Phone:	
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Flight Program:			
	NOTE: Extended to 7/01/2020 per NSSC information (Ed., 1/29/2020) NOTE: Extended to 12/31/2019 per NSSC information (Ed., 7/23/19)		
	NOTE: Extended to 7/31/2019 per J. Garrett/JSC (Ed., 12/21/18)		
Flight Assignment:	NOTE: Extended to 12/31/2018 per NSSC information (Ed., 8/24/17)		
	NOTE: Element change to Human Facto (Ed., 1/17/17)	ors & Behavioral Performance; p	previously Behavioral Health & Performance
Key Personnel Changes/Previous PI:			

COI Name (Institution):	 Bedwell, Wendy Ph.D. (University of South Florida, Tampa) Bishop, Sheryl Ph.D. (University of Texas, Galveston) Hunter, Jean Ph.D. (Cornell University) Kozlowski, Steve Ph.D. (Michigan State University) Miller, Christopher Ph.D. (Smart Information Flow Technologies, LLC) Roma, Peter Ph.D. (Institutes for Behavior Resources, Inc) Wu, Peggy B.S. (Smart Information Flow Technologies, LLC) Schmer-Galunder, Sonja M.S. (Smart Information Flow Technologies, Inc.) 		
Grant/Contract No.:	NNX15AN05G		
Performance Goal No.:			
Performance Goal Text:			
Task Description:	Astronaut crews for long-duration multi-national missions will endure many physical challenges and psychological stressors, some largely predictable in type and timing and others unpredictable. Crews are likely to be diverse with respect to educational background, skill set, ethnicity, gender, leadership/followership styles, etc., yet they must form a cohesive team, and continue to function together at a high level of objective performance and remain responsive to mission support over the duration of the mission. Crew cohesion will be more fragile at times of high stress and fatigue, yet those are the times when performance must be unimpaired if the crew is to succeed. Adding to the challenge, the pool from which crews must be selected may be significantly constrained by other factors, such as past radiation exposure. For these reasons, it is essential that we understand how best to compose and support crews for long-duration space missions, and that we develop a set of validated tools to this end. In order to enable and advance long duration human space exploration, we are investigating individual and crew		
	characteristics that may affect crew function and performance, by measuring both characteristics and performance on a range of simulated missions in analog environments. Based on the correlations found, we will develop a predictive model of the relationship between crew composition and performance. We will validate and enhance this model via data collected on two 8-month Hawai'i Space Exploration Analog and Simulation (HI-SEAS) missions, and use the results to provide NASA with a set of tools to optimize its crew composition strategies.		
	Ed. note December 2018: Project has been rescoped and the specific aims of the re-scoped study are:		
	* Aim 1: Collect, develop, and verify a set of individual, dyad, and crew characteristics that are expected (based on past investigations) to be relevant to crew composition.		
	* Aim 2: Identify correlations, if any, between those characteristics and crew function/performance, using data from a series of simulated missions of various lengths at analog sites.		
	* Aim 3: Build a predictive model based on these correlations.		
	* Aim 4: Validate that model over two eight-month simulated missions at the HI-SEAS analog. Ed. note: The second of these was disrupted in the second week of isolation, and was unable to be completed. For this reason, this grant was rescoped to include data from NNX13AM78G.		
	* Aim 5: Develop a set of tools (e.g., rubric, implemented model, best practices) NASA can use to optimize crew composition.		
Rationale for HRP Directed Research			
Research Impact/Earth Benefits:	The objective of this investigation is to provide data and recommendations to inform crew composition for long-duration space missions, and to enable the implementation of countermeasures for problems related to crew behavioral health and performance. This research addresses the following gaps, identified in the Human Research Roadmap :		
	- Team Gap 101: We need to understand the key threats, indicators, and evolution of the team throughout its life cycle for shifting autonomy and interface with automation in increasingly earth independent, long duration exploration missions.		
	- Team Gap 102: We need to identify a set of quantifiable and validated measures, based on 5-12 key indicators of mission-relevant and identified spaceflight acceptable thresholds (or ranges) of team function, to effectively monitor and measure team health and performance of integrated NASA and commercial/private crews, during shifting autonomy in increasingly Earth independent, long duration exploration missions.		
	- Team Gap 103: We need to identify psychological and psychosocial factors, measures, and combinations thereof for use in selecting individuals and composing highly effective crews most likely to maintain team function during shifting autonomy in increasingly earth independent, long duration exploration missions.		
	This research also addresses behavioral health and performance issues in similar situations on Earth (e.g., small groups isolated during a pandemic).		

Task Progress:	Our goal in designing HI-SEAS (Hawaii Space Exploration Analog and Simulation) mission conditions is to mimic the surface-exploration phase of a long-duration space mission as closely as practical. Of course, there are many aspects of HI-SEAS that are low fidelity: we do not attempt to simulate microgravity or a thin atmosphere, for example. Our focus is on those aspects of a mission that are most relevant to our research questions. In particular: Isolation: HI-SEAS trewmembers do not have any in-person interactions outside the crew for the duration of the mission. Exchange of items (e.g., samples, food) is done via a resupply container, which is out of sight of the habitat. The only exception is for essential medical care that cannot be provided remotely. Communication: The time it takes for planets. For this reason, all communications between HI-SEAS crewmembers and non-crewmembers are delayed by wenty minutes. In order to avoid confounding our duration-related sub-studies, we do not vary this latency over the course of the mission. This latency prevents the crew from having any real-time interactions with anyone else, or from using interactive websites. The only exception is for necessary functions (e.g., banking) that would typically be handled by a family member or assistant during a real mission.	
Bibliography Type:	Description: (Last Updated: 05/20/2025)	
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Articles in Peer-reviewed Journals	Dunn Rosenberg J, Jannasch A, Binsted K, Landry S. "Biobehavioral and psychosocial stress changes during three 8-12 month spaceflight analog missions with Mars-like conditions of isolation and confinement." Front Physiol. 2022 Dec 7;13:898841. <u>https://doi.org/10.3389/fphys.2022.898841</u> ; <u>PMID: 36569765</u> ; <u>PMCID: PMC9768546</u> , Dec-2022	
Articles in Peer-reviewed Journals	Lyons KD, Slaughenhaupt RM, Mupparaju SH, Lim JS, Anderson AA, Stankovic AS, Cowan DR, Fellows AM, Binsted KA, Buckey JC. "Autonomous psychological support for isolation and confinement." Aerosp Med Hum Perform. 2020 Nov;91(11):876-85. <u>https://doi.org/10.3357/AMHP.5705.2020</u> ; <u>PMID: 33334408</u> , Nov-2020	
Articles in Peer-reviewed Journals	Wilson EL, DiGregorio AJ, Villanueva G, Grunberg CE, Souders Z, Miletti KM, Menendez A, Grunberg MH, Floyd MAM, Bleacher JE, Euskirchen ES, Edgar C, Caldwell BJ, Shiro B, Binsted K. "A portable miniaturized laser heterodyne radiometer (mini-LHR) for remote measurements of column CH4 and CO2." Appl Phys B. 2019 Oct 21;125(211):11. https://doi.org/10.1007/s00340-019-7315-8; PMID: 31920221; PMCID: PMC6951259, Oct-2019	
Articles in Peer-reviewed Journals	Barnard A, Engler ST, Binsted K. "Mars habitat power consumption constraints, prioritization, and optimization." Journal of Space Safety Engineering. 2019 Dec;6(4):256-64. <u>https://doi.org/10.1016/j.jsse.2019.10.006</u> , Dec-2019	