Fiscal Year:	FY 2024	**Task Last Updated:**	FY 12/18/2023
PI Name:	Tannenbaum, Scott Ph.D.		
Project Title:	A Multi-faceted Approach to Examine Team Adaptation & Resilience within Isolated, Confined, and Extreme Environments		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Behavior and performance		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HFBP**:Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	(1) **BMed**:Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders (2) **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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City:	Albany	**State:**	NY
Zip Code:	12203-6006	**Congressional District:**	20
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	2015-16 HERO NNJ15ZSA001N-Crew Health (FLAGSHIP, NSBRI, OMNIBUS). Appendix A-Crew Health, Appendix B-NSBRI, Appendix C-Omnibus
Start Date:	10/23/2017	**End Date:**	11/22/2023
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	0	**No. of Master' Degrees:**	0
No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
Contact Monitor:	Whitmire, Alexandra	**Contact Phone:**	
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Flight Program:			
Flight Assignment:	NOTE: End date changed to 11/22/2023 per A. Beitman/HFBP (Ed., 2/6/23) NOTE: End date changed to 09/22/2023 per A. Beitman/HFBP (Ed., 2/6/23) NOTE: End date changed to 03/22/2023 per A. Beitman/HFBP (Ed., 2/21/22) NOTE: End date changed to 3/22/2022 per NSSC information (Ed., 3/9/21) NOTE: End date changed to 3/12/2021 per L. Juliette/HRP (Ed., 2/19/2020) NOTE: Change in period of performance and grant number per J. Garrett/JSC HRP (previous 10/1/2016-9/30/2019, grant NNX16AM17G)--Ed., 7/5/18		

Key Personnel Changes/Previous PI:	N/A
COI Name (Institution):	Mathieu, John Ph.D. (The Group for Organizational Effectiveness, Inc.) Maynard, Michael Ph.D. (Safer Healthcare Partners, LLC)
Grant/Contract No.:	80NSSC18K0092
Performance Goal No.:	
Performance Goal Text:	
Task Description:	The success of future long duration exploration missions (LDEM) is likely to be contingent on the crew's ability to adjust in response to environment demands. There has been recent interest in team adaptation and resilience in the scientific community, but researchers have noted the need to clarify those constructs. We propose a program of research to: a) clarify and better understand these constructs, in particular with how they operate in isolated, confined, and extreme (ICE) environments and b) based on that enhanced understanding, develop and test targeted countermeasures designed to boost the adaptability and resilience of LDEM crews. Work conducted by Maynard and colleagues (2015), supplemented by the team resilience work of Alliger et al. (2015) – all members of our research team – provides a "road map" for the proposed research. We plan to examine the impact of different environmental triggers on team adaptation, incorporating an event taxonomy and categorization schema with which to assess experiences and trigger events. This will allow us to index the types of challenges that LDEM crews will confront. We will test a series of related hypotheses using archival data we collected in prior research in the Human Exploration Research Analog (HERA) habitat. We will then examine antecedents and outcomes of adaptation, gathering data in two analog environments. Finally, based on the theoretical and preliminary empirical work, we will develop a team countermeasure designed to promote constructive team adaptation and team resilience, and test those countermeasures in an analog environment. References Alliger, G.M., Cerasoli, C.P., Tannenbaum, S.I., & Vessey, W.B. (2015). Team resilience: How teams flourish under pressure. Organizational Dynamics, 44, 176-184. Maynard, M. T., Kennedy, D. M., & Sommer, S. A. (2015). Team adaptation: A fifteen-year synthesis (1998–2013) and framework for how this literature needs to "adapt" going forward. European Journal of Work and Organizational Psychology, 24, 652-677. Maynard, M. T., Kennedy, D. M., Sommer, S. A., & Passos, A. M. (2015). Team Cohesion: A theoretical consideration of its reciprocal relationships within the team adaptation nomological network. In: E. Salas, Research on Managing Groups and Teams, 17, 83-111.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	There is a need for LDEM crews to adapt and sustain their resilience as a team. Researchers have traditionally examined adaptation and resilience from an individual perspective, but to ensure that Long Duration Exploration Mission (LDEM) crews are ready for the challenges they will face, there is a need to better understand how adaption and resilience operate at the team level. Doing so will allow for the development of validated countermeasures that can be deployed prior to and at appropriate times during a mission, increasing a LDEM crew's ability to handle the stressors associated with ICE environments and enabling them to adjust when unexpected challenges emerge. It addresses the need to learn more about team adaptation and resilience, as well as the need to develop and test potential countermeasures.
	We developed research protocols and measurement tools for conducting studies in two analog environments, the Hawai'i Space Exploration Analog and Simulation (HI-SEAS) and NASA™ Human Exploration Research Analog (HERA) environment, as well as an analogous field environment, Deep Sea Saturation Dive (SAT) teams. The contextualized surveys developed for each environment are designed to collect data about key adaptation factors, including for example trigger events, challenges encountered, adaptation responses, performance data as well as overall perceptions of the mission. We analyzed weekly data from a HI-SEAS crew over an 8-month-long mission. We also collected daily data from 20 SAT dive teams during their 28-day undersea missions that described 734 unique team and taskwork-related challenges and related adjustments. We content analyzed the data and identified 734 unique events for the response focus (e.g., individual, dyad, collective, full team in chamber, external team) and the response action (e.g., troubleshooting, changed roles/positions, discussed interpersonal relationships, sought/received assistance from others). We collected data in the HERA C5 and HERA C6 missions on a triweekly basis. From 933 descriptions, we coded the nature and focus of the challenges reported by the crews (a total of 691 unique challenges; 363 task-related, 280 crew-related, and 48 mixed). We also coded their adaptations and conducted statistical analyses. Our analysis clarified the nature of challenges in Isolated, Confined, and Extreme (ICE) environments. Specifically, across the three settings, challenges appear to fall into four primary categories: • Personal Needs: Physical, boredom, family-home, food-individual, internet-personal • Living Environment: Noise-sleep, space, heat-humidity, scheduling, food-collective • Interpersonal: e.g., between crew members • Taskwork: Work, task scheduling, internet work A close examination of the HERA campaigns 5 and 6 crews' data suggests that challenges occur throughout the mission, but different types of challenges are more predominant at different mission phases. Across the three settings, we identified 19 types of responses or adaptations to challenges. These fell into seven categories including a No Action category (i.e., doing nothing either intentionally or by giving up). Adapting Strategies (e.g., troubleshooting, adjusted work process, lessons learned) and Adapting Actions (e.g., adjusted effort, physical change, changed roles) were the two most deployed response categories, but the pattern of responses differed across analogs. The differences that were exhibited made sense, because the types of challenges experienced, and the nature of the mission varied across the three analogs. Crews adapted less effectively to more disruptive challenges, particularly Task-related ones. They reported handling recurring (more frequently occurring) Task and Interpersonal challenges less effectively, perhaps an indication of frustration with being unable to resolve them satisfactorily when they initially

Task Progress:	emerged. This highlights the importance of dealing with challenges, and in particular interpersonal challenges, when they arise, rather than allowing them to fester or drain a team's adaptability. A key focus of this research was to test whether it is possible to "inoculate" crews against future challenges so they can navigate them more effectively. We designed a countermeasure where crew members discussed potential challenges and agreed on how to handle them if they arise during their mission. HERA 6 crews completed the countermeasure near the beginning of their mission, while HERA 5 crews did not. In HERA 6, crews completed the countermeasure during their first week in the habitat, discussing how they intend to handle potential challenges that might emerge during the mission. Their scenarios addressed challenges related to sleep, workload, boredom, meals, living space, and courtesy/respect and asked them to create agreements about how to handle them. At the halfway point in the mission, two crews received a "nudge" to review their agreements. We found that crews that participated in this structured adaptation inoculation exercise were less adversely impacted by challenges that emerged over the course of a mission. In sum, this short (one-hour), simple (no "training" needed), team-led countermeasure showed meaningful results across a six-week mission. Participants believed that future space crews would benefit from this type of exercise. In general, crews reported that they handled challenges more effectively when the adaptation processes they deployed aligned with the nature of the challenge, but other adaptation processes worked at times as well. The countermeasure was designed to ensure team psychological safety. For each scenario, crew members were first encouraged to describe their own related experiences in prior teams, and then to discuss what they would do if this type of scenario emerged during their mission. Discussing other team experiences and a hypothetical problem is far less threatening (more psychologically safe) than working through a "real" challenge that pops up during a mission (e.g., a crew member is keeping others up at night). It appears that discussing "what-if" scenarios in a psychologically safe manner can make it easier to work through real challenges later. The countermeasure was also intended to promote crew autonomy. This was a team-led exercise, with the team "owning" the process and creating their own agreements. As such, it is the type of exercise that sets the stage for subsequent self-management and autonomy, which will be particularly important in future long-duration exploration missions.
Bibliography Type:	Description: (Last Updated: 02/02/2024)
Abstracts for Journals and Proceedings	Maynard MT, Mathieu JE, Kennedy DM, Tannenbaum S, Levy J. "An "in depth" examination of longitudinal team resilience – Performance relations in ICE conditions." 83rd Annual Meeting of the Academy of Management, Boston, Massachusetts, August 4-8, 2023. Abstracts. 83rd Annual Meeting of the Academy of Management, Boston, Massachusetts, August 4-8, 2023. , Aug-2023
Abstracts for Journals and Proceedings	Tannenbaum SI, Maynard MT, Mathieu JE, Kennedy DM, Levy J, Beard R. "Challenging events and crew response effectiveness among deep sea divers." 2023 NASA Human Research Program Investigators' Workshop, Galveston, Texas, February 7-9, 2023. Abstract. 2023 NASA Human Research Program Investigators' Workshop, Galveston, Texas, February 7-9, 2023. , Feb-2023