Fiscal Year:	FY 2022	**Task Last Updated:**	FY 04/14/2022
PI Name:	Stahn, Alexander Ph.D.		
Project Title:	Mars Adaptive Training Integrative Knowledge System (MATRIKS) to Improve Operational Performance and Its Neural Basis for Spaceflight		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HFBP**:Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2020-2021 HERO 80JSC020N0001-HHP, OMNIBUS3 Human Research Program: Human Health & Performance Appendix E; Omnibus3-Appendix F
Start Date:	12/17/2021	**End Date:**	03/31/2026
No. of Post Docs:		**No. of PhD Degrees:**	
No. of PhD Candidates:		**No. of Master' Degrees:**	
No. of Master's Candidates:		**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 changed to 03/31/2026 per NSSC information (Ed., 5/16/22).		
Key Personnel Changes/Previous PI:			
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Performance Goal Text:	
Task Description:	Future long-duration space expeditions will be one of the most difficult, dangerous, and dynamic operations in history, ranging from Earth orbit operations to planetary and universe exploration. With prolonged mission durations, spaceflight crews will become increasingly dependent on onboard technologies for knowledge acquisition and maintenance. It is expected that not all skills and knowledge required for these missions can be retained and retrieved based on pre-mission training alone. With the present proposal, we will target NASA’s particular interest in assessing a Mars Adaptive TRaining Integrative Knowledge System (MATRIKS) as a countermeasure that is based on scientific principles of learning, retention, and transfer that are most relevant to spaceflight operations. The system leverages a previously developed and validated workstation that simulates a rendezvous and docking maneuver using real spacecraft flight dynamics. It is designed to (1) train and improve sensorimotor skills relevant for inflight and post-landing operational tasks; (2) feature an autonomous and adaptive training approach that does not rely on feedback from flight operations on the ground; (3) maximize the transfer of mission-relevant motor skills; (4) allow the assessment of the neural circuitry underlying the task; and (5) deliver the training in a motivating and meaningful way to astronauts. Using NASA’s high-fidelity Human Exploration Research Analog (HERA) we will identify if, and to what extent, MATRIKS will improve operational performance using the NASA Robotics On-board Trainer for Research (ROBoT-r) and promote transfer to general cognitive performance (Cognition battery) and distinctive visuo-spatial tasks critical for telerobotic tasks (Spatial Cognition battery). Using state-of-the-art multi-modal neuroimaging, we will also target NASA’s particular interest in assessing the brain structural changes and the neural circuitry of key brain networks expected to be relevant for spaceflight-related performance. By performing a subset of the MATRIKS spacecraft docking in the Magnetic Resonance Imaging (MRI) scanner, we will also be able to provide valuable information regarding NASA’s target in identifying the neural circuitry associated with operationally relevant tasks. The expected significance of this project relates to its relevance for facilitating effective countermeasure tools to acquire and retain operational skills that are critical for exploration class missions. The project is designed to be integrated into a Virtual NASA Specialized Center of Research (VNSCOR) promoting maximal synergies between the validation of the proposed adaptive training system, other countermeasures relevant to enhancing sensorimotor performance, and animal models applying an adaptive training program to stimulate motor performance and its neural circuitry. At the conclusion of the research, we will have (1) defined and demonstrated the use of a neuroscience-based, adaptive training integrative knowledge system to potentially mitigate visuo-spatial and sensorimotor brain changes associated with prolonged isolation and confinement to reduce the likelihood or impact of potential decrements in human performance capabilities during long-duration space missions; (2) performed an integrative assessment and testing of the adaptive visuo-motor training system based on meaningful tasks relevant to spaceflight in a high-fidelity spaceflight analog, and including the identification of potential interactions with other mission-relevant operational training procedures; and (3) identified specific brain structural and functional region changes in response to the proposed adaptive visuo-motor training program.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY 2022.
Bibliography Type:	Description: (Last Updated: 02/16/2022)