Fiscal Year:	FY 2021	**Task Last Updated:**	FY 08/31/2021
PI Name:	McLaughlin, Anne Ph.D.		
Project Title:	Cognitive Aid Design Using Augmented Reality to Support Attention		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	Yes
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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Zip Code:	27695-7650	**Congressional District:**	4
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	2019 HERO 80JSC019N0001-FLAGSHIP & OMNIBUS: Human Research Program Crew Health. Appendix A&B
Start Date:	08/20/2020	**End Date:**	08/19/2022
No. of Post Docs:	0	**No. of PhD Degrees:**	1
No. of PhD Candidates:	0	**No. of Master' Degrees:**	1
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 8/19/2022 per L. Barnes-Moten/JSC and NSSC information (Ed., 8/2/21)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Byrne, Vicky M.S. (KBR/NASA Johnson Space Center) Coleman, Maribeth Ph.D. (Georgia Tech Research Corporation)		
Grant/Contract No.:	80NSSC20K1715		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	We propose to research and develop a cognitive aid to support performance of rare tasks, tasks that cannot be trained at length prior to flight, and any task that would be adversely affected by distraction or attention overload. Many of these tasks are complex, occur in cramped or filled environments, and require detection of patterns, incorporation of feedback into the next steps of the task, and high focus of attention. A preliminary list of these tasks across the 12 phases of an expedition to Mars can be found in the 2018 NASA final report by Stuster, Adolf, Byrne, and Greene. Some previously developed cognitive aids have incorporated augmented reality elements (such as the NASA supported IDEAS (Integrated Display and Environmental Awareness System) and NASA Sidekick)). Cognitive aids with augmented reality elements support attention by adding to the environment: this includes alarms, screen movement, highlighting, and other attention-capture methods. We focus our study and development of novel augmented reality incorporated into a cognitive aid: de-emphasis of auditory and visual clutter and distractions. The term for this type of aid is Diminished Reality (DR). This form of aid targets the cognitive processes most likely to be affected by long-term spaceflight: difficulty focusing, inhibiting distractors, and locating spatial information crucial to the task. DR displays and interaction techniques will be developed by Human–computer interaction (HCI) researchers and graduate students in human factors psychology. Prototypes will be tested with human subjects on the complex task of setting up novel medical equipment, an appropriately complex task listed in the 2018 Mars Expedition Task List. An advanced prototype will be user-tested by space-knowledgeable individuals at Johnson Space Center. Deliverables will include a prototype of the aid and generalized principles and guidelines for future incorporation of de-emphasis augmentations into cognitive aids. Stuster, J, Adolf J, Byrne V, Greene M. (2018). Human exploration of Mars: Preliminary lists of crew tasks. NASA/CR-2018-220043. https://
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	This work will benefit the field of psychology by adding to the literature on the impact of stressors, interruptions, and distractions on human performance of complex, novel tasks. This work will benefit the field of computing by investigating these effects in the new technology of "diminished reality" (DR). Similar to augmented reality, DR uses computers and displays to change the appearance of the physical world. In DR, this means by altering or removing objects or sounds. This alteration occurs with various diminishment methods, from outright erasure to desaturation to blurring or to semi-transparency. Auditory stimuli are treated similarly, ranging from silence to diminishment of volume or changes in the spatial nature of the audio. The outcomes of our research will be to inform the design of DR technologies so that they may support work in space or on the ground -- anywhere that diminishment of distraction is desirable.
Task Progress:	In the last year we have sought to overcome the challenges brought by a worldwide pandemic, namely that we could not travel nor test our research designs in person or in a laboratory. To do this we have developed a new testing platform that allows remote testing of AR/VR/DR [augmented reality (AR), virtual reality (VR), diminished reality (DR)] designs. This testing platform can be used for future studies, either when in person testing is not possible or when it is desirable to reach populations that have difficulty coming into a laboratory. We have created this platform using Unity-3D where the virtual world can be viewed by anyone with a smartphone and a cardboard headset. The software is networked to an interface managed by the experimenter. Another challenge is the low interactivity of VR viewers such as Google Cardboard. To allow interaction in our environment, we will use a Wizard of Oz method to control what occurs in the participant's VR viewer through the experimenter interface. The participant will believe that they are controlling the environment via voice commands, but actually their voice commands will be enacted by the experimenter who hears them through a videoconference and then executes the desired action on the interface. The building of this platform and the VR environment and experimental stimuli it contains has consumed the majority of the work in this first year. Other activities in the past year include completing a final research design with all variables specified and the methods of randomization and counterbalancing confirmed. One of the measures needed for the project was a scenario-specific situation awareness questionnaire that had to be created from the scenarios built for the study. To build these scenarios, we needed to gather background research on stimuli present in medical emergencies and on the International Space Station (ISS). To do this, we conducted in depth task analyses. Each of these was then created in the VR environment. To place the participant in a "scenario," we also had to build that scenario, which meant writing and revising a script with enough tasks and stimuli outside of the main task that we could ensure it was sufficiently distracting (but also informative). Once the script was written, it was recorded by actors on the research team and VR models were either added or built to populate the scenarios. We also had to ensure that each scenario had the same amount of time and events to make them comparable.
Bibliography Type:	Description: (Last Updated: 07/10/2023)
Abstracts for Journals and Proceedings	Murph I, McDonald M, Richardson K, Wilkinson M, Robertson S, Karunakaran A, Gandy Coleman M, Byrne V, McLaughlin AC. "Using affordable at home VR to evaluate training methods for medical devices." Human Factors and Ergonomics Society International Symposium on Human Factors and Ergonomics in Health Care, Virtual, April 12-16, 2021. Abstracts. Human Factors and Ergonomics Society International Symposium on Human Factors and Ergonomics in Health Care, Virtual, April 12-16, 2021. , Apr-2021
Dissertations and Theses	McDonald M. "Thesis: Diminished reality in complex environments." M.S. thesis, NC State University, Raleigh, NC, May 2021. , May-2021