Fiscal Voar	EV 2016	Task Last Undated:	EV 02/01/2017
PI Nama:	FY 2016 Task Last Opdated: FY 02/01/2017		
Project Title:	Cowings, Patricia S. Ph.D.		
rioject fille.	rie-night framing of Autonomic Responses for Mitiga	ating the Effects of Spath	ar Disorientation During Spaceringht
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline Element/Subdiscipline:	HUMAN RESEARCHBiomedical countermeasures		
Joint Agency Name:	Т	echPort:	Yes
Human Research Program Elements:	(1) HHC :Human Health Countermeasures		
Human Research Program Risks:	(1) Sensorimotor: Risk of Altered Sensorimotor/Vestib	oular Function Impacting	Critical Mission Tasks
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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PI Organization Type:	NASA CENTER	Phone:	650-604-5724
Organization Name:	NASA Ames Research Center		
PI Address 1:	Human Systems Integration Division (TH)		
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PI Web Page:	http://humansystems.arc.nasa.gov/		
City:	Moffett Field	State:	CA
Zip Code:	94035	Congressional District:	18
Comments:			
Project Type:	Ground	Solicitation / Funding Source:	2013 HERO NNJ13ZSA002N-Crew Health OMNIBUS
Start Date:	10/01/2014	End Date:	02/28/2016
No. of Post Docs:		No. of PhD Degrees:	
No. of PhD Candidates:	Ν	lo. of Master' Degrees:	
No. of Master's Candidates:	1	No. of Bachelor's Degrees:	1
No. of Bachelor's Candidates:	7	Monitoring Center:	NASA ARC
Contact Monitor:	Whitmire, Alexandra	Contact Phone:	
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Flight Program:			
Flight Assignment:	NOTE: End date change to 2/28/2016 from original end date of 9/30/2015, per A. Chu/ARC (Ed., 9/30/15)		
Key Personnel Changes/Previous PI:	Patricia S. Cowings: PI, William B. Toscano: Co-I		
COI Name (Institution):	Toscano, William Ph.D. (NASA Ames Research Center)		
Grant/Contract No.:	Internal Project		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Space motion sickness is characterized by symptoms of spatial disorientation, nausea, and vomiting. It affects approximately 70% of the crew during space travel and symptoms are commonly treated with intramuscular injections of promethazine. However, this countermeasure has had limited effectiveness and produces unwanted side-effects that include drowsiness and impaired performance. This study addresses PRD Risks: Risk of Therapeutic Failure due to Ineffectiveness of Medication; Risk of Impaired Control of Spacecraft, Associated Systems and Immediate Vehicle Egress due to Vestibulari/Sensorimotor Alterations Associated with Spaceflight. Integrated Research Plan (IRP) Gap SM11: Can crewmember spatiomotor abilities be more accurately predicted and countermeasures and training techniques developed to mitigate spatial disorientation during spaceflight? The purpose of the proposed research is to evaluate an alternative countermeasure for mitigating symptoms without the side effects commonly observed with anti-motion sickness medications. Autogenic-Feedback Training Exercise (AFTE) is a 6-hour physiological training program that has proven to be a highly efficient and effective method for enabling people to monitor and voluntarily control up to 20 of the irow nphysiological responses, thereby suppressing motion sickness symptoms. In an earlier flight study, three astronauts were given AFTE during preflight training and three other astronauts participated as controls and were given a pharmacologic treatment. Shuttle crews were required to record data during launch, waking hours on mission days 1 to 3, and during reentry. They were required to practice AFTE for 15-minute inflight and apply control if symptoms occurred. Our findings indicate that 2 of the 3 astronauts receiving AFTE were successful at controlling symptoms in flight, while 2 of 3 controls were severely debilitated despite given anti-motion sickness medications. Specific Objectives: 1) To determine individual baselines of physiological responses and toler		
Rationale for HRP Directed Research:			
Research Impact/Earth Benefits:	The training used to mitigate the effects of spatial disorientation during a simulated Orion re-entry test, can also mitigate symptoms of motion sickness on Earth. Training benefits have been demonstrated with dysautonomia patients as well as other biomedical problems. This training can benefit people with behavioral problems (e.g., anxiety, depression, sleep deprivation) and has been shown to improve performance in extreme environments.		
Task Progress:	NASA has identified a potential risk to future astronauts during re-entry of some vehicles like Orion; where medications to control symptoms of dizziness or nausea may not be effective for all crew and often lead to adverse side effects. For example, Orion's re-entry will potentially produce large cross-coupled angular accelerations, which will have significant impacts on crew, including their ability to operate the vehicle and egrees. Thus, the purpose of this study, led by Dr. Patricia Cowings at Ames Research Center, was to test the ability of a 6-hr physiological training procedure, Autogenic-Feedback Training Exercise (AFTE), to help astronauts adapt to spaceflight and re-adapt to Earth to mitigate these effects. Twenty subjects were randomly assigned to two groups AFTE (N=10) and Control (N=10) and were matched for motion sickness susceptibility and gender. Physiological measures recorded were: heart rate, respiration, muscle activity of arms and legs, skin conductance, blood pressure, peripheral blood flow, cardiac output, and stroke volume. Procedures for all subjects included: a standard rotating chair test to determine initial motion sickness susceptibility; four exposures to a simulated Orion re-entry test in the rotating chair once per week; three training sessions on consecutive days for a manual performance task. In addition, treatment subjects were given two hours of AFTE training before simulated Orion re-entry test 2, 3, and 4 (total 6-hours). A standard diagnostic scale was used to evaluate motion sickness symptom severity on all tests.		
Bibliography Type:	Description: (Last Updated: 11/08/2023)		
Articles in Peer-reviewed Journals	Cowings PS, Toscano WB, Reschke MF, Tsehay A. "Psychophysiological assessment and correction of spatial disorientation during simulated Orion spacecraft re-entry." Int J Psychophysiol. 2018 Sep;131:102-12. Epub 2018 Mar 2. <u>https://doi.org/10.1016/j.ijpsycho.2018.03.001</u> ; PubMed <u>PMID: 29505848</u> , Sep-2018		
NASA Technical Documents	Cowings PS, Toscano W, Reschke MF, Gebreyesus F, Rocha C. "Autogenic-Feedback Training Exercise (AFTE) Mitigates the Effects of Spatial Disorientation to Simulated Orion Spacecraft Re-entry: Individual Differences." Moffett Field, CA : NASA Ames Research Center, 2017. NASA/TM—2017–219511. <u>https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20170006194.pdf</u> , Mar-2017		