Fiscal Year:	FY 2015	**Task Last Updated:**	FY 07/16/2015
PI Name:	Robinson, Stephen K. Ph.D.		
Project Title:	Customized Refresher and Just-In-Time Training for Long-Duration Spaceflight Crews		
Division Name:	Human Research		
Program/Discipline:	NSBRI		
Program/Discipline--Element/Subdiscipline:	NSBRI--Human Factors and Performance Team		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HFBP**:Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	(1) **HSIA**:Risk of Adverse Outcomes Due to Inadequate Human Systems Integration Architecture		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	95616-5270	**Congressional District:**	3
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	2013 HERO NNJ13ZSA002N-Crew Health (FLAGSHIP & NSBRI)
Start Date:	06/01/2014	**End Date:**	05/31/2017
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:	3	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	3	**Monitoring Center:**	NSBRI
Contact Monitor:		**Contact Phone:**	
Contact Email:			
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Flight Assignment:			
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COI Name (Institution):	Oman, Charles Ph.D. (Massachusetts Institute of Technology) Liu, Andrew Ph.D. (Massachusetts Institute of Technology) Byrne, Vicky (Lockheed Martin Astronautics) Mindock, Jennifer (Wyle Laboratories, Inc.)		
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Performance Goal No.:			
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Task Description:	Project Goals: Our overall objective is to develop novel, context-sensitive, and customized onboard training techniques that can be adapted to different tasks and crewmembers, with ability to address both refresher training (for re-acquisition of expert performance) and just-in-time training (for tasks that have not been specifically trained previously, but require the integration of existing astronaut skills). To achieve this objective, we propose to test the hypothesis that multimedia training which is customized for the crewmember can be more efficient than traditional, generic format training for the same measured effectiveness. The project will begin with the development of two tasks that represent typical complex and critical activities that are carried out by astronauts in space relatively infrequently. We will develop a set of training materials that follow the NASA style of briefings, procedures and hands-on practice. Once these tasks are developed, we will conduct an experiment with human subjects to determine if customized, self-made video training materials prove to be better refresher training materials than the generic materials that would typically be used by crewmembers. Subjects will receive initial training and their baseline performance evaluated. After a period of about 6 months, subjects will return to the lab, review the refresher training materials, and be re-evaluated on how well they have retained or re-acquired their task skills. A second experiment will be conducted using the same two representative tasks, but will examine if the customized training materials developed in the first experiment could be used as just-in-time training materials for a new group of subjects with basic training, but no specific training in the given task. In both experiments, we also examine the correlation of subject learning styles with the content of the training materials, to determine whether learning style is a useful characterization for developing customized content. The results of this research project will provide operational guidelines and pedagogy for developing customized video training for astronauts on long-duration missions beyond Earth orbit. Since subject testing has just started, key findings are not yet available. For the coming year, the team will complete the experiment design, procedure development, subject testing, and preliminary analysis of results for Part A of the project (refresher training utilizing subject-produced video training synopses).
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Human exploration of space, especially with reduced real-time ground support due to increased distance from the Earth, will require training capabilities to support autonomous reacquisition of skills. Inadequate states of training are commonly related to skill-based errors such as task execution mistakes. Even in the highly trained military aviation environment, more than half of accidents in a multi-year meta-analysis have been shown to be associated with skill-based errors, and human error in general is widely accepted to contribute to 70% to 80% of all aviation accidents. This research will lead to the reduction of the likelihood of such errors and accidents due to inadequate training. The reduction in error-likelihood directly supports the mitigation of the Human Research Program's Risk of Performance Errors Due to Training Deficiencies. Development, maintenance, and re-acquisition of expertise is central to many types of human endeavor, especially safety-critical ones such as aviation, medicine, human/machine interaction in hazardous environments. Research gains from investigations such as this may thus be broadly applicable outside the world of human spaceflight.
Task Progress:	The first year of the project has focused on the refresher training experiments (Part A of the project), in which subjects are trained in an astronaut-similar task, self-produce a refresher video at the peak of expertise, and return 6 months later to perform the task again using only the refresher video as training. The University of California (UC) Davis task is complex electro-mechanical system repair, and the Massachusetts Institute of Technology (MIT) task is manually control of a space robotic arm. In the first year, the UC Davis section of the research team hired two undergraduate research assistants and two graduate research assistants to help develop the test facilities and tool station, select the mechanical system to be used for the repair task, develop procedures, write subject protocols and instructions, apply for UC Davis Institutional Review Board (IRB) approval, and identify video equipment and tools to purchase. In selecting the repair task, one of the drivers was that the equipment could be put into operation for testing after subject repair. After considering a variety of candidates (air compressor, water pump, cooling system pump, four-barrel carburetor, aircraft magneto, etc), we settled on a gas-powered electrical generator with its integration of mechanical and electrical systems, plus modern design and repair manuals to work from. Also during this first year, the MIT side of the team hired a graduate research assistant, and a freshman undergraduate student. Lynn Geiger (the GRA) traveled to NASA Johnson Space Center (JSC) in August 2014 to participate in a 1 week Generic Robotics Training (GRT) course set up by the Robotics Training Group. We developed an experimental protocol for pilot testing of our customized refresher training for a simulated set of International Space Station (ISS) robotic operations, including the robotic task simulations, training materials including videos and evaluation rubrics. Subjects will be trained to perform two specific robotics tasks and their performance measured to establish a baseline. Training consists of 4 3-hour sessions over three days. To date, 2 pilot subjects were tested at MIT in December and reevaluated 2 months later to develop a preliminary understanding of skill deterioration.. Based on the feedback and responses of these pilot subjects, the protocol and scenarios were modified to increase the overall practice time and increased strategy training to help solidify the subject's understanding. Two more pilot subjects have completed the training and baseline evaluation with the new protocol and will be retested in 6 months. We plan to test 18 additional subjects before the end of the May 2015.
Bibliography Type:	Description: (Last Updated: 04/23/2025)