

Fiscal Year:	FY 2016	Task Last Updated:	FY 07/20/2016
PI Name:	Buckey, Jay C. M.D.		
Project Title:	Autonomous Behavioral Health Countermeasures for Spaceflight		
Division Name:	Human Research		
Program/Discipline:	NSBRI		
Program/Discipline--Element/Subdiscipline:	NSBRI--Neurobehavioral and Psychosocial Factors Team		
Joint Agency Name:	TechPort:	Yes	
Human Research Program Elements:	(1) HFBP :Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	(1) Bmed :Risk of Adverse Behavioral Conditions and Psychiatric Disorders		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Comments:	Address updated 9/2008		
Project Type:	GROUND	Solicitation:	2013 HERO NNJ13ZSA002N-Crew Health (FLAGSHIP & NSBRI)
Start Date:	06/01/2014	End Date:	05/31/2017
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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:	7	Monitoring Center:	NSBRI
Contact Monitor:	Contact Phone:		
Contact Email:			
Flight Program:			
Flight Assignment:	NOTE: Element change to Human Factors & Behavioral Performance; previously Behavioral Health & Performance (Ed., 1/18/17)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Hegel, Mark Ph.D. (Dartmouth College) Loeb, Lorie M.A. (Dartmouth College)		
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Over several years with National Space Biomedical Research Institute (NSBRI) support, the investigator team (in collaboration with others) has developed a suite of behavioral health countermeasures called the Virtual Space Station (VSS) designed for use by astronauts. The programs include conflict management training, depression treatment, and stress management modules. Each of these modules has been tested in relevant settings: The conflict content has been tested for usability and acceptability with astronauts. The stress management module has been evaluated in a randomized trial with business and law students. The 6-session, depression treatment module has been tested in a Phase II trial at Dartmouth with depressed employees, and in a randomized controlled trial in Boston. Currently, the VSS contains a validated suite of products that have been designed for ultimate use by astronauts. Our objective is to expand and customize the VSS for implementation with astronauts to provide a clinically validated tool to autonomously administer behavioral health countermeasures.

During this reporting year, we have made progress on each of our three specific aims: Aim #1: Customize the Virtual Space Station (VSS) program for use by astronauts by evaluating the program in an isolated environment and collecting detailed information on program use, including user choices, ease of navigation, usability, and acceptability.

In this reporting year we have deployed the VSS in three space analog environments: The Hawaii Space Exploration Analog and Simulation (HI-SEAS) Mars Analog in both the 8-month and 12-month missions, the Canada Forces Alert Arctic Station, and South Pole Station in Antarctica for use as a treatment resource. Each of these environments is isolated and confined with limited communication and access to the outside world. We established each of these analog evaluations independently, and are continuing to work through the NASA-NSF (National Science Foundation) research channels to employ the VSS as a research tool in the Antarctic.

Task Description:

Aim #2: Modify the existing VSS conflict management program to add enhanced conflict resolution content and an integrated behavioral health assessment. We have designed and built the integrated behavioral health assessment and it has been reviewed by our research colleagues at the NASA Johnson Space Center. We will begin integrating it into the current VSS and seeking feedback from the astronaut population for acceptability. We are also in the process of expanding the VSS Conflict resolution content with a conflict management component. We have completed the script, set film dates, and sought actors to complete the content. The scene will be designed so participants can choose a path through a simulated conflict, similar to the current Conflict content, which has been well received. The content incorporates negotiation techniques to guide users through techniques for achieving better conflict outcomes. The VSS is in the process of being converted to a web-based format, with the Conflict and Depression modules fully converted. We are beginning to transition the program to a permanent, secure server so it can be hosted online. This allows greater flexibility and easier deployment, as well as alleviating compatibility and continuity issues.

Aim #3: Enhance the VSS program to include a mood enhancement system that allows users to experience immersive relaxing situations using virtual reality (VR). We have developed several virtual reality scenes in-house: Fall in New England, an Urban Retreat filmed around Houston public spaces, an indoor Control scene for experimental evaluation, and a Microgravity scene filmed on a parabolic flight campaign. We have also purchased several natural scenes filmed in Ireland, Bavaria, and Australia. All VR films greater than 15 minutes in length are on deployment in our analog environments. We have also performed a lab-based evaluation using physiologic measures to validate the use of VR for stress reduction and relaxation.

Rationale for HRP Directed Research:

Anyone can develop behavioral health problems. Factors such as confinement, under- or over- work, sleep loss, and monotony can combine to worsen interpersonal tensions or even lead to frank depression. Additionally, behavioral health problems are some of the most common and costly problems in the workplace. Conflicts can arise with a resulting loss of trust and teamwork. A chronic dispute between people can destroy team functioning and lead to errors or lack of situational awareness. Suppressed anger or frustration can erupt unexpectedly and create potentially hazardous situations. Programs that can deliver behavioral health countermeasures autonomously, confidentially, and at a place and time of the user's choosing, would have many applications. Computer-based behavioral health countermeasures can offer an autonomous way for anyone to address psychological and interpersonal issues. Content within the VSS has been tested in trials with business and law students, and with depressed adults. The depression program has been evaluated for acceptability for an elderly population. The VSS provides a personalized experience seen in live therapies, while also lowering the barrier to use by being convenient and removing stigma. Furthermore, these kinds of treatments can be implemented in many different environments where there is limited access to behavioral health, such as in military, polar, or culturally-isolated settings. Virtual reality offers immersive experiences that mimic real-life exposure to nature and other relaxing settings. The final product from this research will provide an integrated, autonomous approach to behavioral health. The assessment component will begin with the assumption that any issues are minor and transient, and can guide the user to a variety of options both within and outside of the program (movies/distraction, music, meals, photo/hobby, call home, VR retreat). For moderate severity problems, the program includes a variety of self-assessment tools the user can try, and offers programs to assist with conflict and/or stress management. For high-severity problems, the program includes a validated 6-session depression treatment program based on problem solving therapy.

Research Impact/Earth Benefits:

In this reporting year we have deployed the VSS to three space analog environments: The HI-SEAS Mars Analog for both the 8-month and 12-month missions, the Canada Forces Alert Arctic Station, and South Pole Station in Antarctica for use as a treatment resource. Each of these environments is isolated and confined with limited communication and access to the outside world. We established each of these analog evaluations independently, and are continuing to work through the NASA-NSF research channels to employ the VSS as a research tool in the Antarctic. We have designed and built the integrated behavioral health assessment and it has been reviewed by our research colleagues at the NASA Johnson Space Center. We will begin integrating it into the current VSS and seeking feedback from the astronaut population for acceptability. We are also in the process of expanding the VSS Conflict resolution content with a conflict management component. We have completed the script, set film dates, and sought actors to complete the content. The scene will be designed so participants can choose a path through a simulated conflict, similar to the current Conflict content, which has been well received. The content incorporates negotiation techniques to guide users through techniques for achieving better conflict outcomes. The VSS is in the process of being converted to a web-based format with the conversion completed for the Conflict and Depression modules. We are beginning to transition the program to a permanent, secure server so it can be hosted online. This allows greater flexibility and easier deployment, as well as alleviating compatibility and continuity issues.

Task Progress:

We have developed several virtual reality scenes in-house: Fall in New England, an Urban Retreat filmed around

	Houston public spaces, an indoor Control scene for experimental evaluation, and a Microgravity scene, filmed on a parabolic flight campaign. We have also purchased several natural scenes filmed in Ireland, Bavaria, and Australia. All VR films greater than 15 minutes in length are on deployment in our analog environments. We have also performed a lab-based evaluation using physiologic measures to validate the use of VR for stress reduction and relaxation.
Bibliography Type:	Description: (Last Updated: 04/16/2019)
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