Fiscal Year:	FY 2013	**Task Last Updated:**	FY 10/24/2012
PI Name:	Bloomberg, Jacob J. Ph.D.		
Project Title:	Developing Predictive Measures of Sensorimotor Adaptability to Produce Customized Countermeasure Prescriptions		
Division Name:	Human Research		
Program/Discipline:	NSBRI		
Program/Discipline--Element/Subdiscipline:	NSBRI--Sensorimotor Adaptation Team		
Joint Agency Name:		**TechPort:**	Yes
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **HSIA**:Risk of Adverse Outcomes Due to Inadequate Human Systems Integration Architecture (2) **Sensorimotor**:Risk of Altered Sensorimotor/Vestibular Function Impacting Critical Mission Tasks		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	77058-3607	**Congressional District:**	36
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2011 Crew Health NNJ11ZSA002NA
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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:**	NSBRI
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
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Task Description:	A targeted research area described in the current NASA Research Announcement is to: "Develop a pre-flight sensorimotor adaptability assessment program that will identify those individuals who are likely to experience difficulty with gravitational transitions and sensorimotor adaptation and validate interventions or countermeasures." In response to this call the goals of this project are to: 1) develop a set of predictive measures capable of identifying individual differences in sensorimotor adaptability, and 2) use this information to design sensorimotor adaptability training countermeasures that are customized for each crewmember's individual sensory bias and adaptive capacity. We have been developing a sensorimotor adaptability (SA) training program to facilitate rapid adaptation to novel gravitational environments. Information from this proposed study will allow us to customize the SA training program based on a crewmember's individual sensory biases and adaptive capacity optimizing the efficacy of the countermeasure prescription. To achieve these goals we will pursue the following specific aims: Aim 1: Determine whether behavioral metrics of individual sensory bias predicts sensorimotor adaptability. For this aim, subjects will perform tests that will delineate individual sensory bias in tests of visual, vestibular and proprioceptive function. They will then be tested to determine if these metrics predict how quickly they adapt to a novel discordant sensory environment. Aim 2: Determine if individual capability for strategic and plastic-adaptive responses predicts sensorimotor adaptability. The transition from one sensorimotor state to another consists of two main mechanisms: strategic and plastic-adaptive. Strategic modifications represent immediate and transitory changes in control that are employed to deal with short-term changes in the prevailing environment. If these changes are prolonged then plastic-adaptive changes are evoked that modify central nervous system function to automate new behavioral responses. For this aim, each subject's strategic and plastic-adaptive motor learning abilities will be assessed using two tests of locomotor function designed specifically to delineate both mechanisms. Subjects will then be tested to determine if these measures predict how quickly they adapt to a novel discordant sensory environment. Aim 3: Develop predictors of sensorimotor adaptability using brain structural and functional metrics. We will measure individual differences in regional brain volumes (structural MRI), white matter integrity (diffusion tensor imaging, or DTI), functional network integrity (resting state functional connectivity MRI), and sensorimotor adaptation task-related functional brain activation (functional MRI). Subjects will then be tested to determine if these metrics predict how fast they behaviorally adapt to a novel discordant sensory environment. Aim 4: Determine if individualized training prescriptions based on predictive metrics can be used to optimize sensorimotor adaptability training countermeasures. To achieve this aim we will examine a test case focusing on improving adaptive performance of visually dependent subjects. Subjects identified in Aim 1 as being visually dependent with reduced adaptive capability will receive individualized training prescriptions designed to reduce their dependence on vision and increase their ability to use vestibular information for control of movement. As part of a specialized training program, subjects will walk on a treadmill-motion base system while experiencing discordant visual scenes along with increased support surface motion. During this training subjects will receive stimuli to enhance vestibular signal detection to aid in dynamic balance control. Training efficacy will be assessed by comparing the performance of trained and control subjects on how quickly they adapt to a novel discordant sensory environment.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2013.
Bibliography Type:	Description: (Last Updated: 05/21/2021)