Fiscal Year:	FY 2013	**Task Last Updated:**	FY 05/05/2014
PI Name:	Schubert, Michael Ph.D.		
Project Title:	Sensorimotor Assessment and Rehabilitation Apparatus: Procedures and Equipment		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Biomedical countermeasures		
Joint Agency Name:		**TechPort:**	Yes
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **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:	21287-6921	**Congressional District:**	7
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	2009 Crew Health NNJ09ZSA002N
Start Date:	08/01/2013	**End Date:**	07/31/2014
No. of Post Docs:		**No. of PhD Degrees:**	
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:**	NASA JSC
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):			
Grant/Contract No.:	NNX10AO19G		
Performance Goal No.:			
Performance Goal Text:			
	NOTE (Ed., 5/5/2014): Continuation (with Michael Schubert as new PI) of "Sensorimotor Assessment and Rehabilitation Apparatus: Procedures and Equipment" due to previous PI Shelhamer's move ; same grant number and period of performance (8/1/2010-7/31/2014) in NASA Shared Services Center information. UPDATED NOTE (Ed., 6/13/2018): For Task Book purposes, period of performance with Schubert will be 8/1/2013-7/31/2014. Long-duration flight leads to sensorimotor problems which can be critical during landing, rendezvous, and operations on other planetary surfaces. While specific sensorimotor effects have been identified, it is not known which ones have the most adverse impact, or how best to assess them and apply appropriate rehabilitation procedures. NASA's current goal in addressing this situation is to develop a means to assess sensorimotor function rapidly with a portable device, so that an astronaut can make a determination as to whether or not he or she is impaired enough to affect mission safety or		

Task Description:	success before undertaking a demanding task (piloting, landing, reentry, egress, EVA, tele-operation, etc.). Accordingly, the goal of this project is to develop a portable hand-held device that will allow a single crewmember to assess his/her sensorimotor function in no more than 20 minutes. This is to be accomplished with a judicious choice of which sensorimotor functions to assess, and careful design to obtain the maximum data in the minimum time. The device and procedures being developed to meet these requirements are based on a tablet computer and body-mounted motion-sensor units. Through a set of simple software routines, a rapid assessment of sensorimotor capabilities will be made. The final device will be small, require little power and space, and provide what is essentially a self-contained sensorimotor lab/clinic. We term this device and its embedded software the Sensorimotor Assessment and Rehabilitation Apparatus (SARA). SARA has been designed to measure the following functional behaviors that are relevant to safe and effective functioning and are also affected by long-duration space flight: 1. Vestibulo-ocular function during pitching head movements (eye movements in response to head movements, a direct measure of vestibular function and canal-otolith integration, and highly relevant for gaze stabilization). We continue to refine our method of subjective nulling of apparent visual motion during head movement (vestibulo-ocular nulling: VON). 2. Vestibulo-ocular function as mediated by the otolith organs. We use a binocular display with lines set by the subject to appear collinear or parallel, to measure vertical skew and disconjugate torsion, which are measures of otolith asymmetry. 3. Postural control, by measuring body sway with eyes closed. This test is enhanced by having the subject make pitching head movements. 4. Locomotion, by measuring alterations in the coupling between pitching head movements and vertical body motions during walking.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Our sensorimotor assessment apparatus has been implemented on a tablet computer and motion sensors with Bluetooth wireless link. This provides real-time data acquisition and processing of three linear accelerometers and three rate sensors from each of three sensors. This meets the need for rapid non-invasive screening of vestibular and sensorimotor function in settings where special expertise and equipment is not available. Applications include assessment of passengers before and after parabolic and sub-orbital flight, assessment/rehabilitation of vestibular patients away from specialized centers, and assessment of crew immediately on return from ISS (on R+0 in Russia). Possible uses for SARA: • Go / No-Go decision before demanding task: o After landing (moon, Mars, NEO), o Before EVA (deep space); • Data on acute deficits upon return from long-duration stay on ISS: o Inform countermeasure priorities; • On board ISS: o Before EVA, o Correlate assessment with performance; • Field use: rapid evaluation with minimal resources: o Centrifuge studies, o Before/after suborbital flight, o Immediately upon return from ISS – to evaluate sensorimotor disturbances and inform countermeasure development (R+0 testing); • Lab adaptation studies: o Multi-system approach, o Determination of individual “sensorimotor signature”, o How do systems interact during perturbations and adaptation.
Task Progress:	New project for FY2013. NOTE (Ed., 6/13/2018): Continuation of "Sensorimotor Assessment and Rehabilitation Apparatus: Procedures and Equipment" (Mark Shelhamer was Principal Investigator (PI)) due to Mark Shelhamer's move in 2013. See Shelhamer (original PI) for previous reports.
Bibliography Type:	Description: (Last Updated: 12/07/2023)