Fiscal Year:	FY 2020	**Task Last Updated:**	FY 10/22/2020
PI Name:	Strangman, Gary E Ph.D.		
Project Title:	Operational Performance Effects and Neurophysiology in Partial Gravity (OPEN-PG)		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
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:	02129-2020	**Congressional District:**	7
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2019 HERO 80JSC019N0001-FLAGSHIP & OMNIBUS: Human Research Program Crew Health. Appendix A&B
Start Date:	09/01/2020	**End Date:**	08/31/2022
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
Contact Monitor:	Stenger, Michael	**Contact Phone:**	281-483-1311
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Ivkovic, Vladimir Ph.D. (Massachusetts General Hospital) Zhang, Quan Ph.D. (Massachusetts General Hospital)		
Grant/Contract No.:	80NSSC20K1500		
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Task Description:	Background: Understanding human performance under various partial-gravity loadings is critical to NASA's crewed mission strategies. For example, current vehicle and mission designs for Mars landings require the crew to use robotic teleoperation within 24 hours of landing—unaided from Earth—to connect landing craft power systems with pre-positioned power generators. This design requires the crew to perform a complex sensorimotor operation in order to maintain life support, as soon as possible after a gravitational transition, in an unfamiliar partial-gravity setting. Unfortunately, there remains limited knowledge about how the sensorimotor system is affected by exposure to both partial gravity and gravity transitions. Addressing these gaps will in part require integrated assessment of operational and sensorimotor performance alongside neurovestibular and neurophysiological responses during exposure to various gravitational loads. Hypotheses: (Hyp1) We predict a monotonic but non-linear relationship between Robotics On-Board Trainer-r (ROBoT-r) performance and gravitational load, with larger departures from 1g leading to more impaired performance. (Hyp2) Behavioral alterations will be paralleled by physiological changes at different gravity loads, including activation of prefrontal and vestibular cortex, and autonomic nervous system activation. (Hyp3) Ground-based challenges to the vestibular system will induce detectable neurophysiological responses, and the amplitude of these responses (i.e., an indicator of individual "sensitivity" to these provocations) will help (3a) predict neurophysiological responses in-flight, and (3b) predict behavioral performance in flight. Our project involves three closely interrelated specific aims: Aim 1: Characterize and quantify changes in operationally-relevant sensorimotor and vestibular performance as a function of gravitational load. Aim 2: Characterize and quantify changes in physiology—particularly in brain function and autonomic activation during behavioral performance—as a function of gravitational load. Aim 3: Develop a model to predict behavioral performance and neurophysiological responses under different gravitational loads based on preflight ground testing data. Deliverables: Overall, our project will characterize (1) operationally-relevant performance and (2) neurophysiological responses as a function of gravity load, as well as (3) providing models to predict performance and neurophysiological impacts of partial gravity based on preflight-data. This work has the potential to identify individuals who are particularly resilient to altered gravity, and will be key for planning future exploration-class missions where survival will depend on the operational capabilities of astronauts in partial-gravity environments. Significance: The proposed parabolic flights are an excellent platform to help fill critical knowledge gaps regarding human exposure to fractional-gravity conditions. Our project will specifically address gaps regarding operational performance, neurophysiological status, individual sensitivity to gravitational loading, as well as prediction of behavioral performance and physiological responses to partial gravity. In addition to filling key gaps surrounding human performance of operationally-relevant tasks in partial gravity, this work may provide a method to help identify crewmembers who are particularly resilient for performing particular tasks under novel gravity loadings.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2020.
Bibliography Type:	Description: (Last Updated: 03/29/2024)