Fiscal Year:	FY 2018	**Task Last Updated:**	FY 11/02/2017
PI Name:	Reschke, Millard F Ph.D.		
Project Title:	Recovery of Functional Performance Following Long Duration Space Flight (Field Test)		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Biomedical countermeasures		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **Cardiovascular**:Risk of Cardiovascular Adaptations Contributing to Adverse Mission Performance and Health Outcomes (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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City:	Houston	**State:**	TX
Zip Code:	77058-3607	**Congressional District:**	36
Comments:			
Project Type:	FLIGHT,GROUND	**Solicitation / Funding Source:**	Directed Research
Start Date:	10/22/2013	**End Date:**	10/31/2021
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:	0	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
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Flight Program:	PostFlight		
Flight Assignment:	ISS Postflight studies		
Key Personnel Changes/Previous PI:	None		
COI Name (Institution):	Kozlovskya, Inessa M.D. (Institute of Biomedical Problems Russian Academy of Sciences)		
Grant/Contract No.:	Directed Research		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The Field Test (FT) proposal represents a joint effort between the Neuroscience and Cardiovascular Laboratories at the Johnson Space Center and the Institute of Biomedical Problems Sensorimotor Laboratory and Cardiovascular Laboratory, Moscow, Russia. The primary goal of this proposal is to determine functional performance in long duration space flight crews beginning as soon after landing as possible (< 2 hr) with one to three immediate follow-up measurements on the day of landing. This goal has both sensorimotor and cardiovascular elements with an evaluation of NASA's new compression garment with the Russian traditional Kentavr garment. In addition to the immediate post-landing collection of data, post-flight data will be acquired beginning approximately 24 hr following landing and continue until full functional sensorimotor and cardiovascular responses have returned to preflight normative values. It is recognized that the level of functional deficit will be most profound during the acquisition of gravity loads and immediately after landing when the demands for crew intervention for emergency operations will be greatest. Clearly measureable performance parameters such as ability to perform a seat egress, recover from a fall or the ability to see clearly when walking, and related physiological data (orthostatic responses) are required to provide an evidence base for characterizing programmatic risks and variability among crewmembers. Overall, these early functional and related physiological measurements will allow for the establishment of a sensorimotor and cardiovascular recovery time constant that has not been previously captured in over 50 years of space flight. Specific Aims: 1. Quantify functional performance from measurements on long duration crewmembers taken as close in time to landing as possible. 2. Develop a recovery timeline of functional performance on long duration crewmembers. 3. Determine the efficacy of U.S. and Russian compression garments as countermeasures for alleviating orthostatic intolerance.
Rationale for HRP Directed Research:	This research is directed because it contains highly constrained research, which requires focused and constrained data gathering and analysis that is more appropriately obtained through a non-competitive proposal.
Research Impact/Earth Benefits:	This task requires that functional measures of performance be made initially at the landing site of the Soyuz spacecraft. This requirement has resulted in the development of tasks and recording instrumentation that are compatible with relatively harsh environments. Our team has been successful in developing a set of instrumentation that makes measurement of the required tasks possible, ensuring that performance measurements can be accomplished accurately and in a timely fashion. To ensure that data could be collected on both astronauts and cosmonauts immediately after landing the research has been divided into two investigative efforts: (1) a Pilot Field Test and (2) the full Field Test. The full Field Test will begin with the first U.S. International Space Station one year mission (42S).
Task Progress:	9/13/17 Task Progress for Field Test: Pilot Studies: A total of 18 crewmembers (11 United States Orbital Segment [USOS] and 7 cosmonauts) from eight Expeditions completed the dataset for the Pilot Field Test (PFT) study, which consisted of performing three simple tasks as soon after landing as possible: Sit-to-Stand, Recovery from Fall, and Tandem Heel-to-Toe Walk. Tests were conducted in either the medical tent at the Soyuz landing site, or at the Karaganda/Kustanai airport in Kazakhstan (KZ). After demonstrating successful data collections at the landing site, two additional PFT sessions were added to the R+0 postflight schedule: one at the refueling airport in Scotland and the other at the Johnson Space Center Astronaut Crew Quarters. Eight of the 11 USOS astronauts were tested at all three locations on landing day. Additionally, data were collected in the medical tent on all three returning crewmembers for two separate Expeditions, demonstrating that multiple crewmembers can be tested on the same mission at the Soyuz landing site. Field Test: The Field Test (FT), being a joint US/Russian study, has been faced with many logistical challenges. Therefore, a second US FT operator was dispatched to KZ and introduced to all of the stakeholders involved in crew return activities in KZ (in the medical tent) and Norway (at the airport), and was trained as a back-up operator to conduct these high profile tasks. Also, the US FT team continued to conduct demonstrations and training sessions for the assigned flight surgeons before each landing so they could assist in the field and other remote locations as needed. Finally, single operator training and certification was completed for several laboratory members in preparation for supporting parallel data collections on 2 USOS crewmembers in the field and remote locations. The team began investigating new motion capture methods so that "skeleton" videos of crew performance can be created for use in presentations and reports without compromising subject identity, including Microsoft Kinect and machine learning post-video analysis. The Kinect method can also serve as a backup when traditional video is occluded. To date, a total of eleven 6-month crewmembers (four USOS and seven cosmonauts) have completed the FT. In addition, two One-Year mission crewmembers (one USOS and one cosmonaut) and one 9.5-month crewmember (USOS) have also completed the FT. The FT team has consistently demonstrated that it is possible to conduct the entire test (9 tasks) in the tent/airport in KZ and at the refueling station where time is greatly constrained, including: 1) Gaze Nystagmus, 2) Sit-to-Stand, 3) Recovery from Fall, 4) Dysmetria, 5) Eye/Hand Coordination, 6) Force Discrimination, 7) Seat Egress Obstacle, 8) Tandem Heel to Toe Walk, 9) Push Test, and 10) Dynamic Visual Acuity (DVA is not collected in KZ).
Bibliography Type:	Description: (Last Updated: 06/28/2023)
Articles in Peer-reviewed Journals	Goel R, Kofman I, Jeevarajan J, De Dios Y, Cohen HS, Bloomberg JJ, Mulavara AP. "Using low levels of stochastic vestibular stimulation to improve balance function." PLoS One. 2015 Aug 21;10(8):e0136335. eCollection 2015. http://dx.doi.org/10.1371/journal.pone.0136335 ; PubMed PMID: 26295807; PubMed Central PMCID: PMC4546608 , Aug-2015

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Books/Book Chapters	Harm DL, Reschke M, Wood SJ. "Spatial orientation and motion perception in microgravity." in "Cambridge Handbook of Applied Perception Research. Cambridge Handbooks in Psychology." Ed. R.R. Hoffman, et al. New York, NY: Cambridge University Press, 2015. p. 912-929. http://www.academia.edu/25549853/Spatial_Orientation_and_Motion_Perception_in_Microgravity , Jan-2015
Books/Book Chapters	Reschke MF, Clément G, Thorson SL, Harm DL, Mader TH, Dudley AM, Wood SJ, Bloomberg JJ, Mulavara AP, Gibson CR, Williams DR. "Neurology." in "Space physiology and medicine: From evidence to practice." Ed. A. Nicogossian et al. New York: Springer, 2016. p. 245-282. https://doi.org/10.1007/978-1-4939-6652-3_9 , Oct-2016