

<b>Fiscal Year:</b>	FY 2014	<b>Task Last Updated:</b>	FY 04/02/2014
<b>PI Name:</b>	Bloomberg, Jacob J. Ph.D.		
<b>Project Title:</b>	Physiological Factors Contributing to Postflight Changes in Functional Performance (Functional Task Test)		
<b>Division Name:</b>	Human Research		
<b>Program/Discipline:</b>	HUMAN RESEARCH		
<b>Program/Discipline--Element/Subdiscipline:</b>	HUMAN RESEARCH--Biomedical countermeasures		
<b>Joint Agency Name:</b>	<b>TechPort:</b>	No	
<b>Human Research Program Elements:</b>	(1) <b>HHC:</b> Human Health Countermeasures		
<b>Human Research Program Risks:</b>	(1) <b>Sensorimotor:</b> Risk of Altered Sensorimotor/Vestibular Function Impacting Critical Mission Tasks		
<b>Space Biology Element:</b>	None		
<b>Space Biology Cross-Element Discipline:</b>	None		
<b>Space Biology Special Category:</b>	None		
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<b>Organization Name:</b>	NASA Johnson Space Center		
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<b>City:</b>	Houston	<b>State:</b>	TX
<b>Zip Code:</b>	77058-3607	<b>Congressional District:</b>	36
<b>Comments:</b>			
<b>Project Type:</b>	FLIGHT	<b>Solicitation / Funding Source:</b>	Directed Research
<b>Start Date:</b>	06/19/2008	<b>End Date:</b>	11/30/2014
<b>No. of Post Docs:</b>	0	<b>No. of PhD Degrees:</b>	0
<b>No. of PhD Candidates:</b>	2	<b>No. of Master' Degrees:</b>	0
<b>No. of Master's Candidates:</b>	1	<b>No. of Bachelor's Degrees:</b>	0
<b>No. of Bachelor's Candidates:</b>	1	<b>Monitoring Center:</b>	NASA JSC
<b>Contact Monitor:</b>	Norsk, Peter	<b>Contact Phone:</b>	
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<b>Flight Program:</b>	Shuttle/ISS		
<b>Flight Assignment:</b>	ISS NOTE: End date changed to 11/30/2014 per HRP information (Ed., 3/31/15) NOTE: Gap changes per IRP Rev E (Ed., 3/18/14) NOTE: End date changed to 5/5/2015 and Risk/Gaps changed per JSC MTL dtd 11/11/11 (Ed., 11/18/2011) NOTE: End date changed to 3/17/2014 (previously 9/30/13) per JSC (2/2010)		
<b>Key Personnel Changes/Previous PI:</b>			
<b>COI Name (Institution):</b>	Feiveson, Alan ( NASA Johnson Space Center ) Lee, Stuart ( Wyle Laboratories/NASA Johnson Space Center ) Mulavara, Ajitkumar ( USRA ) Peters, Brian ( Wyle Labs/NASA Johnson Space Center ) Platts, Steven ( NASA Johnson Space Center ) Reschke, Millard ( NASA Johnson Space Center ) Ryder, Jeffrey ( USRA ) Spiering, Barry ( Wyle Labs/NASA Johnson Space Center ) Stenger, Michael ( Wyle Labs/NASA Johnson Space Center )		

	Ploutz-Snyder, Lori ( USRA ) Tomilovskaya, Elena ( Institute of Biomedical Problems ) Kozlovskaya, Inessa ( Institute of Biomedical Problems )
<b>Grant/Contract No.:</b>	Directed Research
<b>Performance Goal No.:</b>	
<b>Performance Goal Text:</b>	
<b>Task Description:</b>	<p>Exposure to space flight causes alterations in multiple physiological systems including changes in sensorimotor, cardiovascular, and neuromuscular systems. These changes can affect the ability of crewmembers to perform critical mission tasks immediately after landing on a planetary surface. The overall goal of this project is to determine the effects of space flight on functional tests that are representative of critical mission tasks and to identify the key underlying physiological factors that contribute to decrements in performance. To achieve this goal we developed an interdisciplinary testing regimen (Functional Task Test, FTT) that evaluates both astronaut functional performance and related physiological changes. A set of functional tests were designed to test astronauts in tasks that simulate high priority exploration mission activities. These include ladder climbing, hatch opening, jump down, manual manipulation of objects and tool use, emergency vehicle egress, recovery from a fall, and object translation tasks. Corresponding physiological measures include assessments of postural and gait control, dynamic visual acuity, fine motor control, plasma volume, orthostatic intolerance, upper- and lower-body muscle strength, power, endurance, control, and neuromuscular drive. Crewmembers were tested before and after Shuttle missions. Currently astronauts are participating in this study before and after ISS flights. Data were collected on two sessions before flight, on landing day (Shuttle only) and 1, 6, and 30 days after landing.</p> <p>Using a multivariate regression model we will identify which physiological systems contribute the most to impaired performance on each functional test. This will allow us to identify the physiological systems that play the largest role in decrement in functional performance. Using this information we can then design and implement countermeasures that specifically target the physiological systems most responsible for the altered functional performance associated with space flight.</p>
<b>Rationale for HRP Directed Research:</b>	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.
<b>Research Impact/Earth Benefits:</b>	<p>This study will identify which physiological systems contribute the most to impaired performance on mission critical functional tasks. This will allow us to identify the physiological systems that play the largest roles in decrements in overall functional performance. Using this information we can design and implement countermeasures that specifically target the physiological systems most responsible for the altered functional performance associated with space flight. In terms of Earth benefits this research will provide a better understanding of the underlying physiological mechanisms that contribute to changes in functional performance. For example, in the elderly population activities of daily living are often impaired by multifactorial physiological causes. The information obtained from this interdisciplinary study will aid in identifying the relative contributions of sensorimotor, cardiovascular, and muscle function on comprehensive performance outcomes. This has direct application in the design of clinical interventions and rehabilitation programs that can target specific systems responsible for decline in functional performance.</p>
<b>Task Progress:</b>	<p>Summary of Progress</p> <p>To date we have completed data collection on 7 Shuttle crewmembers and 12 ISS crewmembers.</p> <p>The remaining ISS subject will return in May, 2014 completing the subject complement of 13.</p> <p>Completed individual crewmember postflight data debriefs.</p> <p>Completed crew Informed Consent Briefing for the 1-year ISS flight.</p> <p>Selected to be featured in the 2011 Annual Report for the Human Research Program.</p> <p>Completed and submitted the Shuttle Interim FTT Report (79 pages).</p> <p>Presented Shuttle FTT data at the NASA/JSC Human System Risk Board (March 28, 2012).</p> <p>Completed the Mid-Term Data Review (May 17, 2013).</p> <p>To date we have completed 4 peer reviewed papers and 40 abstracts/presentations.</p> <p>Forward work includes completing data collection on ISS subjects (n=13). Once all the data are collected we will be able to create a multivariate regression model to describe the relationship between the physiological changes associated with space flight and decrement in functional task performance along with a comparison of recovery rates between short and long-duration crewmembers. This will allow us to identify the prime physiological factors that contribute most to alteration in functional task performance. This information will then be used to inform the design of targeted countermeasure systems to mitigate these physiological changes leading to improved task performance.</p>
<b>Bibliography Type:</b>	Description: (Last Updated: 05/21/2021)
<b>Abstracts for Journals and Proceedings</b>	<p>Reschke M, Ploutz-Snyder L, Kofman I, Cerisano J, Fisher E, Bloomberg J, Tomilovskaya E, Rukavishnikov I, Kozlovskaya I. "Postural responses associated with space flight and ground-based analogs." 19th IAA Humans in Space Symposium, Cologne, Germany, July 7-13, 2013.</p> <p>19th IAA Humans in Space Symposium, Cologne, Germany, July 7-13, 2013. Abstract #252. , Jul-2013</p>

Abstracts for Journals and Proceedings	Peters B, Bloomberg JJ, Mulavara A. "Dynamic visual acuity: Measuring a different source of visual impairment." National Space Biomedical Research Institute Symposium Towards Integrated Countermeasures, Houston, TX, August 28, 2013. Presented at the National Space Biomedical Research Institute Symposium Towards Integrated Countermeasures, Houston, TX, August 28, 2013. , Aug-2013
Abstracts for Journals and Proceedings	Bloomberg JJ, Ballard KL, Batson CD, Buxton RE, Feiveson AH, Kofman IS, Lee SMC, Miller CA, Mulavara AP, Peters BT, Phillips T, Platts SH, Ploutz-Snyder LL, Reschke MF, Ryder JW, Stenger MB, Taylor LC, Wood SJ. "Preliminary Results from the Functional Task Test (FTT) Flight and Bed Rest Studies." National Space Biomedical Research Institute Symposium Towards Integrated Countermeasures, Houston, TX, August 28, 2013. Presented at the National Space Biomedical Research Institute Symposium Towards Integrated Countermeasures, Houston, TX, August 28, 2013. , Aug-2013
Abstracts for Journals and Proceedings	Reschke MF, Bloomberg JJ, Wood SJ, Mulavara AP, Kozlovskaya IB, Tomilovskaya ES, Rukavishnikov IV, Fomina EV, Platts SH, Stenger MB, Lee SMC, Feiveson AH. "Recovery of functional sensorimotor performance following long duration space flight (Field Test)." National Space Biomedical Research Institute Symposium Towards Integrated Countermeasures, Houston, TX, August 28, 2013. Presented at the National Space Biomedical Research Institute Symposium Towards Integrated Countermeasures, Houston, TX, August 28, 2013. , Aug-2013
Abstracts for Journals and Proceedings	Kofman IS, Reschke MF, Cerisano JM, Fisher EA, Tomilovskaya EV, Kozlovskaya IB, Bloomberg JJ. "Postural responses following space flight and ground based analogs." XIVth Conference on Space Biology and Aerospace Medicine, Moscow, Russia, October 28-30, 2013. XIVth Conference on Space Biology and Aerospace Medicine, Moscow, Russia, October 28-30, 2013. , Oct-2013
Abstracts for Journals and Proceedings	Madansingh S, Bloomberg JJ. "Understanding the effects of spaceflight on head-trunk coordination during waking and obstacle avoidance." Canadian Space Summit 2013, Ottawa, Canada, November 14-15, 2013. Canadian Space Summit 2013, Ottawa, Canada, November 14-15, 2013. , Nov-2013
Abstracts for Journals and Proceedings	Bloomberg JJ, Ballard KL, Batson CD, Buxton RE, Feiveson AH, Kofman IS, Lee SMC, Miller CA, Mulavara AP, Peters BT, Phillips T, Platts SH, Ploutz-Snyder LL, Reschke MF, Ryder JW, Stenger MB, Taylor LC, Wood SJ. "Body unloading associated with space flight and bed-rest impacts functional performance." 2014 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-13, 2014. 2014 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-13, 2014. <a href="http://www.hou.usra.edu/meetings/hrp2014/pdf/3163.pdf">http://www.hou.usra.edu/meetings/hrp2014/pdf/3163.pdf</a> , Feb-2014
Abstracts for Journals and Proceedings	Madansingh S, Miller CA, Mulavara AP, Peters BT, Reschke MF, Bloomberg JJ. "Understanding the effects of spaceflight on head-trunk coordination during walking and obstacle avoidance" 2014 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-13, 2014. 2014 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-13, 2014. <a href="http://www.hou.usra.edu/meetings/hrp2014/pdf/3245.pdf">http://www.hou.usra.edu/meetings/hrp2014/pdf/3245.pdf</a> , Feb-2014
Articles in Peer-reviewed Journals	Deshpande N, Tourtillott BM, Peters BT, Bloomberg JJ. "Dynamic visual acuity (DVA) during locomotion for targets at near and far distances: Effects of aging, walking speed and head-trunk coupling." J Vestib Res. 2013 Jan 1;23(4):195-201. <a href="http://dx.doi.org/10.3233/VES-130500">http://dx.doi.org/10.3233/VES-130500</a> ; PubMed <a href="https://pubmed.ncbi.nlm.nih.gov/24284599/">PMID: 24284599</a> , Jan-2013
Papers from Meeting Proceedings	Miller C, Peters B, Kofman I, Brady R, Phillips T, Batson C, Mulavara A, Feiveson A, Reschke M, Bloomberg JJ. "A comparison of torso stability between bed rest subjects and astronauts during tandem walk: Preliminary findings." 37th Annual Meeting of the American Society of Biomechanics, Omaha, NE, September 4-7, 2013. 37th Annual Meeting of the American Society of Biomechanics, Omaha, NE, September 4-7, 2013. <a href="http://www.asbweb.org/conferences/2013/abstracts/171.pdf">http://www.asbweb.org/conferences/2013/abstracts/171.pdf</a> , Sep-2013