Fiscal Year:	FY 2010	**Task Last Updated:**	FY 08/08/2013
PI Name:	Lee, Stuart M.C. Ph.D.		
Project Title:	Hypovolemia as a model of space flight: cardiovascular exercise effects and countermeasures		
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) **Aerobic**:Risk of Reduced Physical Performance Capabilities Due to Reduced Aerobic Capacity		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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PI Organization Type:	NASA CENTER	**Phone:**	281-483-3726
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City:	Houston	**State:**	TX
Zip Code:	77058-2749	**Congressional District:**	36
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	Directed Research
Start Date:	06/01/2009	**End Date:**	06/30/2010
No. of Post Docs:		**No. of PhD Degrees:**	
No. of PhD Candidates:	2	**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:	Norsk, Peter	**Contact Phone:**	
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Flight Program:			
Flight Assignment:	NOTE: End date changed to 6/30/2010, per JSC info (08/2010) NOTE: End date changed to 05/14/2010 per JSC info; previous end date was 12/15/2009 (2/26/2010) NOTE: End date changed to 12/15/2009 per JSC info; previous end date was 11/16/09 (11/17/09)		
Key Personnel Changes/Previous PI:	Key personnel: Meghan Everett, University of Houston, coordinated exercise laboratory participation. Christine Ribeiro, Wyle Integrated Science and Engineering, coordinated Cardiovascular Laboratory participation. David Martin, Wyle Integrated Science and Engineering, coordinated analysis of echocardiographic data.		
COI Name (Institution):	Platts, Steven H. (Human Adaptations and Countermeasures Office) Soller, Babs R. (University of Massachusetts Medical School)		
Grant/Contract No.:	Directed Research		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Reduced exercise capacity, orthostatic tolerance, and plasma volume are common observances following space flight and bed rest. Dr. Steve Platts of the Johnson Space Center Cardiovascular Laboratory investigated the relationship between orthostatic hypotension and plasma volume by pharmacologically inducing hypovolemia in normal healthy subjects. The Exercise Physiology and Countermeasures (ExPC) Project and the Cardiovascular Discipline sought to extend this work to gain an improved understanding of the factors involved in decreased exercise capacity. Following orthostatic testing in normal and hypovolemic conditions, subjects recruited by Dr. Platts's team volunteered to perform a graded cycle exercise test to volitional fatigue to determine peak oxygen consumption (VO2pk). Oxygen consumption, heart rate, rating of perceived exertion, and blood pressure were measured per standard laboratory protocols. Additionally, echocardiographic measures of stroke volume, blood lactate, plasma catecholamines, and peripheral muscle metabolism by near infrared spectroscopy were measured. Data from these testing sessions has been used to assist in understanding the factors associated with reduced exercise capacity after space flight, serve as a basis of comparison for responses to similar tests after space flight and bed rest; and aided in the continued development of near infrared spectroscopy as a non-invasive metabolic measurement system for space flight and extravehicular activities.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The primary focus of this project was to determine the contribution of space-flight induced plasma volume loss on post-flight aerobic exercise capacity. Also, as part of this project near infrared spectroscopy (NIRS), a measure of local tissue oxygenation and an index of metabolism, was assessed an adjunct measure of the response to exercise and for its sensitivity to changes in body fluid status.
Task Progress:	(Ed. note: updated 8/8/2013; original report 1/4/2011). The data collection for this project was completed with 12 subjects (8 men, 4 women) participating in exercise testing in both the normovolemic and hypovolemic conditions. In summary, IV furosemide resulted in plasma volume losses in these subjects which were comparable to those observed following long-duration space flight. However, the decrease in aerobic capacity (peak oxygen consumption) was only one half to one third of that observed after space flight. Therefore, space flight-induced decrease in plasma volume contributes to but does not fully explain post-flight reductions in exercise capacity. Because previous reports have suggested that inflight exercise countermeasures can mitigate these losses, other factors related to space flight-induced deconditioning likely contribute to the remaining portion of the post-flight decrease in exercise capacity. A report of these findings was delivered to the Exercise Physiology and Countermeasures Project, and a manuscript is in preparation for potential publication in a peer-reviewed scientific journal. The pharmacological countermeasures portion of this project was canceled before data collection for that arm of the study was initiated. Therefore, there are no exercise tolerance data related to effects of pharmacological interventions for orthostatic intolerance.
Bibliography Type:	Description: (Last Updated: 02/22/2024)
Abstracts for Journals and Proceedings	Lee SMC, Everett ME, Ribeiro LC, Martin DS, Westby CM, Stenger MB, Soller BR, Platts SH. "Pharmacologically-induced hypovolemia as a model of post-space flight aerobic capacity." 18th International Academy of Astronautics Humans in Space Symposium, Houston, TX, April 11-15, 2011. 18th IAA Humans in Space Symposium, Houston, TX, April 11-15, 2011. , Apr-2011
Abstracts for Journals and Proceedings	Lee SMC, Everett ME, Crowell JB, Westby CM, Soller BR. "NIRS-derived tissue oxygen saturation and hydrogen ion concentration following bed rest." 58th Annual Meeting of the American College of Sports Medicine, Denver, CO, May 31-June 4, 2011. Medicine & Science in Sports & Exercise 2011 May;43(5 Suppl):823. http://dx.doi.org/10.1249/01.MSS.0000402293.26570.88 , May-2011
Abstracts for Journals and Proceedings	Soller BR, Lee SMC, Zou F, Scott P, Ellerby GEC, Everett ME, Crowell JB. "Evaluation of skeletal muscle oxygenation during exercise after bed rest and reconditioning." 18th International Academy of Astronautics Humans in Space Symposium, Houston, TX, April 11-15, 2011. 18th IAA Humans in Space Symposium, Houston, TX, April 11-15, 2011. , Apr-2011