Fiscal Year:	FY 2018	**Task Last Updated:**	FY 09/19/2018
PI Name:	Ploutz-Snyder, Lori L. Ph.D.		
Project Title:	Gravitational Dose and Multi-system Physiologic Response		
Division Name:	Human Research		
Program/Discipline:			
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) **Muscle**:Risk of Impaired Performance Due to Reduced Muscle Size, Strength and Endurance (3) **SANS**:Risk of Spaceflight Associated Neuro-ocular Syndrome (SANS)		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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City:	Ann Arbor	**State:**	MI
Zip Code:	48109-2013	**Congressional District:**	12
Comments:	Previously at Universities Space Research Association/NASA Johnson Space Center until July 2016.		
Project Type:	GROUND	**Solicitation / Funding Source:**	2015-16 HERO NNJ15ZSA001N-Artificial Gravity. Appendix D: NASA HRP Artificial Gravity Opportunity
Start Date:	07/26/2016	**End Date:**	07/25/2019
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:	Norsk, Peter	**Contact Phone:**	
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Laurie, Steven Ph.D. (Wyle Laboratories, Inc.) Lee, Stuart Ph.D. (Wyle Laboratories, Inc.) Martin, David M.S. (Wyle Laboratories, Inc.) Ploutz-Snyder, Robert Ph.D. (Universities Space Research Association) Scott, Jessica Ph.D. (NASA Johnson Space Center) Stenger, Michael Ph.D. (Wyle Laboratories, Inc.) Arbeille, Philippe M.D., Ph.D. (CNES (Centre national d'études spatiales))		
Grant/Contract No.:	NNX16AO73G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Artificial gravity (AG), by substituting for the missing gravitational cues and loading in space, offers significant promise as an effective, efficient multi-system countermeasure against virtually all of the identified risks associated with bone loss, muscle weakening, cardiovascular deconditioning, and sensorimotor disturbances. However, the optimal AG load required for maintaining normal physiological function is unknown. Furthermore even with an AG capability exercise is very likely to remain in the countermeasure suite as it provides additional physiological and psychological benefits. Two important early steps in understanding AG are to evaluate how AG interacts with exercise and how this interaction is influenced by partial gravity between 0 and 1 G. Parabolic flight creates the only condition that allows assessment of the effects of partial gravity between 0 and 1 G in humans without the need for launching into space. On this basis, we contend that parabolic flight research with a range of gravitational loads provides a unique model to characterize the relationships among gravitational dose, exercise, and the acute physiologic responses of the sensorimotor, cardiovascular, cerebrovascular, and ocular systems. Ultimately, this information will help to identify the optimal operating range of AG on exploration class missions. It is possible that AG levels below 1 G could be used with exercise supplementing the additional required loading potentially reducing the engineering requirements of future AG-compatible living quarters. The objective of this grant is to identify the AG dose-physiological response relationship. This proposal involves a multidisciplinary collaboration between investigators at Johnson Space Center who bring collective expertise in cardiovascular physiology, exercise physiology, muscle physiology, sensorimotor function, and statistical analysis. The proposal is arranged in four individual projects that are integrated together to complement each other and maximize data sharing. The overall aim of the study is: Specific Aim: Characterize the relationship between gravitational dose and acute physiologic responses of the cardiovascular, cerebrovascular, ocular, muscular, and sensorimotor systems.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	There is little understanding of the effects of gravity on the human body apart from zero G and one G; we know nearly nothing about partial gravity in between 0-1. It is important to understand whether there are thresholds of gravity, above which, blood flow to the head is relatively normal. If, for example, blood flow to the head was the same at both 0.5 and 1.0 G this would allow for the development of countermeasures (such as artificial gravity) to be developed more easily and with less resource use.
Task Progress:	Nine subjects were exposed to 1-G, 0.75-G, 0.50-G, and 0.25-G during parabolic flight flown by Novespace, Inc. (Bordeaux-Mérignac, France) as part of the first International Space Life Sciences Working Group Campaign in June 2018. Measurements included: Internal jugular vein pressure (VeinPress GmbH, Switzerland) and area (VividQ, GE Health Care, Chicago, IL), inferior vena cava internal diameter, intraocular pressure (Triggerfish, Sensimed, Switzerland), and beat-to-beat finger blood pressure (Finapres Medical Systems, Amsterdam-Zuidoost, Netherlands). Accelerometer data provided by Novespace and collected by our group independently (APDM, Inc; Portland, OR) were used to indicate the respective partial-gravity epochs within which data were analyzed.
Bibliography Type:	Description: (Last Updated: 04/29/2023)