Fiscal Year:	FY 2016	**Task Last Updated:**	FY 11/07/2016
PI Name:	Ploutz-Snyder, Lori L. Ph.D.		
Project Title:	Integrated Resistance and Aerobic Exercise Training With Small Compact Exercise Equipment		
Division Name:	Human Research		
Program/Discipline:	NSBRI		
Program/Discipline--Element/Subdiscipline:	NSBRI--Musculoskeletal Alterations Team		
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 (2) **Bone Fracture**:Risk of Bone Fracture due to Spaceflight-induced Changes to Bone (3) **Muscle**:Risk of Impaired Performance Due to Reduced Muscle Size, Strength and Endurance (4) **Osteo**:Risk Of Early Onset Osteoporosis Due To Spaceflight		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	lorips@umich.edu	**Fax:**	FY
PI Organization Type:	UNIVERSITY	**Phone:**	(734) 764-5210
Organization Name:	University of Michigan		
PI Address 1:	OBL 4170, 1402 Washington Hts.		
PI Address 2:	School of Kinesiology		
PI Web Page:			
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:**	2011 Crew Health NNJ11ZSA002NA
Start Date:	09/01/2012	**End Date:**	06/30/2016
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:**	NSBRI
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:	NOTE: End date changed to 6/30/2016 per NSBRI (Ed., 6/29/16) NOTE: End date changed to 8/31/2016 per October 2014 NSBRI report submission (Ed., 10/22/14)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Haddad, Fadia (University of California, Irvine) Caiozzo, Vincent (University of California, Irvine) Adams, Gregory (University of California, Irvine) Ryder, Jeffrey (Universities Space Research Association) Scott, Jessica (Universities Space Research Association) Dillon, Edgar (The University of Texas Medical Branch)		
Grant/Contract No.:	NCC 9-58-MA02801		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	This proposal aims to validate in an analog setting a small compact exercise device for the protection of cardiovascular, muscle, and bone health. This study leverages both currently funded National Space Biomedical Research Institute (NSBRI) and NASA work to bring together for the first time, a promising new exercise device and exercise prescription thus placing this study at a high countermeasure readiness level (moving from 6-7). More specifically, the NSBRI funded M-MED device uses a flywheel to provide loading for either high force-low repetition resistance exercise or low force-high repetition, endurance exercise (rowing). Recent data support M-MED training effectiveness in both ambulatory subjects and over 10 days of muscle unloading using unilateral lower limb suspension model. Accordingly, a new NASA funded exercise prescription study integrating resistance and aerobic training (iRAT) has been effective in the preservation of muscle and cardiovascular function over 14 days of bedrest, but requires the use of 5 different exercise machines. This proposal will combine the M-MED exercise device and the iRAT exercise prescription into a 70 day bedrest study. Outcome measurements related to cardiovascular, muscle and bone health will be obtained and integrated to assess countermeasure effectiveness.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Research Impact: The comparison of a single exercise device to an International Space Station-like suite of exercise devices will inform long duration exploration exercise hardware requirements as well as provide a proof of concept of a exercise efficacy using a single device. Earth Benefits: Developing the most efficient exercise prescription is valuable to a wide population who seek to optimize the health benefits of exercise using as little time as possible. The validation of novel compact exercise hardware may also be useful for other situation where space constraints limit the availability of large scale exercise equipment.
Task Progress:	Final report. Study complete; manuscripts being prepared. Muscle biopsy analyses continue at University of California Irvine.
Bibliography Type:	Description: (Last Updated: 04/29/2023)
Articles in Peer-reviewed Journals	Ploutz-Snyder LL, Downs M, Goetchius E, Crowell B, English KL, Ploutz-Snyder R, Ryder JW, Dillon EL, Sheffield-Moore M, Scott JM. "Exercise training mitigates multi-system deconditioning during bed rest." Med Sci Sports Exerc. 2018 Sep;50(9):1920-8. https://doi.org/10.1249/MSS.0000000000001618 ; PubMed PMID: 29924746 , Sep-2018
Articles in Peer-reviewed Journals	English KL, Downs M, Goetchius E, Buxton R, Ryder JW, Ploutz-Snyder R, Guilliams ME, Scott JM, Ploutz-Snyder LL. "High intensity training during spaceflight: Results from the NASA Sprint Study." npj Microgravity. 2020 Aug 18;6(1):21. https://doi.org/10.1038/s41526-020-00111-x ; PMID: 33574275 , Aug-2020
Articles in Peer-reviewed Journals	Downs ME, Scott JM, Ploutz-Snyder LL, Ploutz-Snyder R, Goetchius E, Buxton RE, Danesi CP, Randolph KM, Urban RJ, Sheffield-Moore M, Dillon EL. "Exercise and testosterone countermeasures to mitigate metabolic changes during bed rest." Life Sci Space Res. 2020 Aug;26:97-104. https://doi.org/10.1016/j.lssr.2020.03.008 ; PMID: 32718692; PMCID: PMC7387751 , Aug-2020
Articles in Peer-reviewed Journals	Scott JM, Downs M, Buxton R, Goetchius E, Crowell B, Ploutz-Snyder R, Hackney KJ, Ryder J, English K, Ploutz-Snyder LL. "Disuse-induced muscle loss and rehabilitation: The National Aeronautics and Space Administration bed rest study." Crit Care Explor. 2020 Dec;2(12):e0269. https://doi.org/10.1097/CCE.0000000000000269 ; PMID: 33251515; PMCID: PMC7688251 , Dec-2020