Fiscal Year:	FY 2017	**Task Last Updated:**	FY 09/19/2018
PI Name:	Ploutz-Snyder, Lori L. Ph.D.		
Project Title:	Exploring the Relationship between In-flight Training Load Data and Musculoskeletal Health Outcomes		
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) **Muscle**:Risk of Impaired Performance Due to Reduced Muscle Size, Strength and Endurance		
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:	FLIGHT	**Solicitation / Funding Source:**	2013 HERO NNJ13ZSA002N-Crew Health OMNIBUS
Start Date:	10/01/2014	**End Date:**	09/30/2017
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
Contact Monitor:	Norsk, Peter	**Contact Phone:**	
Contact Email:	Peter.norsk@nasa.gov		
Flight Program:	ISS		
Flight Assignment:	Postflight data from ISS NOTE: Extended to 9/30/2017 per HRP (Ed., 1/23/17) NOTE: Extended to 10/1/2016, from original end date of 9/30/2015, per PI (Ed., 7/14/15)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	De Witt, John Ph.D. (Wyle Laboratories, Inc.) Hanson, Andrea Ph.D. (Wyle Laboratories, Inc.) Peters, Brian Ph.D. (Wyle Laboratories, Inc.) Scott-Pandorf, Melissa Ph.D. (Wyle Laboratories, Inc.)		
Grant/Contract No.:	Internal Project		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Crewmembers perform exercise programs during long-duration spaceflight to counter the detrimental effects of extended microgravity exposure. Training programs include treadmill, resistance, and cycle ergometer exercise. Exercise is performed daily by each crewmember, although volume, duration, and intensity differ across individuals. Comparison of pre- to post-flight testing measures indicates that bone, muscle, and metabolic health changes vary between individuals. In this retrospective analysis, we intend to obtain the pre- and post-flight MEDB5.2 outcome measures related to bone and muscle for all crewmembers that have completed missions on the International Space Station using the Advanced Resistive Exercise Device (ARED) and T2 as their resistance and treadmill exercise devices. We intend to quantify the amount of axial loading experienced by an individual throughout their mission on ARED and T2. The results of this study will allow the identification of critical parameters that are related to exercise program success and allow for prescription optimization.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Understanding how loading across multiple exercise modes influences fitness outcomes could help enhance the effectiveness and efficiency of exercise programs on Earth, especially in situations of resource (time, space, equipment, etc.) constraints.
Task Progress:	The purpose of this investigation was to identify the in-flight external loading factors that are associated with maintenance of skeletal muscle strength and bone mineral density during long duration spaceflight. We hypothesized that 1) Subjects who accumulated the highest magnitude ground reaction forces as normalized by body weight sustained on a week by week basis though Treadmill and resistance exercise will have protected BMD (bone mineral density) at the hip better than others in the sample group; 2) Subjects who accumulated high external loads early in their mission will have demonstrated better bone health outcomes; and 3) Subjects who accumulate greater external loading and exercise volume relative to their body weight on a week by week basis via treadmill and resistance exercise will experience the least change in muscle strength and may experience increased muscle strength as measured by isokinetic and isometric strength testing pre and post flight.
Bibliography Type:	Description: (Last Updated: 04/29/2023)
Articles in Peer-reviewed Journals	Hackney KJ, Downs ME, Ploutz-Snyder L. "Blood flow restricted exercise compared to high load resistance exercise during unloading." Aerosp Med Hum Perform. 2016 Aug;87(8):688-96. https://doi.org/10.3357/AMHP.4566.2016 ; PubMed PMID: 27634603 , Aug-2016
Articles in Peer-reviewed Journals	Hackney KJ, Scott JM, Hanson AM, English KL, Downs ME, Ploutz-Snyder LL. "The astronaut-athlete: Optimizing human performance in space." J Strength Cond Res. 2015 Dec;29(12):3531-45. Review. https://doi.org/10.1519/JSC.0000000000001191 ; PubMed PMID: 26595138 , Dec-2015
Articles in Peer-reviewed Journals	Scott JM, Feiveson AH, English KL, Spector ER, Sibonga JD, Lichar Dillon E, Ploutz-Snyder L, Everett ME. "Effects of exercise countermeasures on multisystem function in long duration spaceflight astronauts." npj Microgravity. 2023 Feb 3;9:11. https://doi.org/10.1038/s41526-023-00256-5 ; PMID: 36737441; PMCID: PMC9898566 , Feb-2023