Fiscal Year:	FY 2016	**Task Last Updated:**	FY 04/28/2016
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		
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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:	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:	Overview. In-flight exercise hardware collect data that allow for exploratory analyses to determine if specific performance factors relate to physiological outcomes. The relationship between exercise performance variables and physiological changes during flight has yet to be fully investigated. Identifying the critical performance variables that relate to improved physiological outcomes is vital for creating current and future exercise prescriptions to optimize astronaut health. The specific aims of this project are: 1) To quantify the exercise-related mechanical loading experienced by crewmembers on T2 and ARED during their mission on the International Space Station (ISS); 2) To explore relationships between exercise loading variables, bone, and muscle health changes during the mission; 3) To determine if specific mechanical loading variables are more critical than others in protecting physiology; 4) To develop methodology for operational use in monitoring accumulated training loads during crew exercise programs. This retrospective analysis will be conducted using data from NASA and USOS international partner astronauts that have flown long-duration missions onboard the ISS and have had access to exercise on the T2 and the Advanced Resistive Exercise Device (ARED). General exercise summary metrics will be developed to quantify exercise intensities, volumes, and durations for each subject. Where available, ground reaction force data will be used to quantify mechanical loading experienced by each astronaut. These inflight exercise metrics will be investigated relative to changes in pre- to post-flight MED-B tests related to bone and muscle health to identify which specific variables are related with improved or degraded physiological outcomes. The information generated from this analysis will fill gaps related to typical bone loading characterization, exercise performance capability, exercise volume and efficiency, and importance of exercise hardware. In addition, methods for quantification of exercise loading for use in monitoring the exercise programs during future space missions will be explored with the intent to inform exercise scientists and trainers as to the critical aspects of inflight exercise prescriptions. Study Progress. We have requested, and are in the process of receiving data from the Longitudinal Survey of Astronaut Health (LSAH). Preliminary analyses have started on the data obtained to date.
Bibliography Type:	Description: (Last Updated: 06/04/2024)