Fiscal Year:	FY 2009	**Task Last Updated:**	FY 02/19/2010
PI Name:	De Witt, John Ph.D.		
Project Title:	Ground-based Biomechanical Analyses of Resistance Exercise Using the Advanced Resistive Exercise Device		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Biomedical countermeasures		
Joint Agency Name:		**TechPort:**	Yes
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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Organization Name:	Wyle/NASA Johnson Space Center		
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PI Web Page:			
City:	Houston	**State:**	TX
Zip Code:	77058	**Congressional District:**	22
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	Directed Research
Start Date:	07/13/2009	**End Date:**	10/29/2010
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:	Meck, J@n	**Contact Phone:**	281-244-5405
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Flight Program:			
Flight Assignment:	NOTE: Received extension until 10/29/2010, per PI; original end date was 7/02/2010 (10/7/10)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Ploutz-Snyder, Lori (USRA/NASA Johnson Space Center) Scott-Pandorf, Melissa (Wyle/NASA Johnson Space Center) English, Kirk (NASA Johnson Space Center) Guilliams, Mark (Wyle/NASA Johnson Space Center) Newby, Nate (Wyle/NASA Johnson Space Center)		
Grant/Contract No.:			
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The new integrated resistance and aerobic training study (iRATS) exercise prescription is being designed using ground-based evidence with the intent of increasing the loads experienced by the musculoskeletal system during in-flight exercise. Prescription optimization is dependent upon a complete understanding of exercise biomechanics in order to include exercises that are most beneficial to increasing crewmember health. Furthermore, variations in exercise biomechanics of specific exercises, such as the range of motion during the performance of the parallel squat, could have large influences upon the loads experienced by the musculoskeletal system. A detailed biomechanical analysis is required to determine which variations lead to the greatest site-specific joint loading forces and can be used to inform the optimal exercise prescription. The objective of this program is to determine the joint loads that occur during exercise in microgravity on the Advanced Resistive Exercise Device (ARED). The goal is to determine the best exercises for use during crewmember exercise during long-term missions. There are various complexities with performing in-flight investigations. In order to maximize the potential for the most relevant data to be collected with minimal impact on crew time, we propose a two-phase program. Biomechanical analyses need to occur during actual exercise in microgravity to ensure optimal application of the results. However, since crew time is limited, ground-based evaluations should occur prior to in-flight data collection to ensure that the analyses performed on ISS are completed as efficiently as possible. We propose to complete the analysis in three phases. Phase 1, which is detailed in this proposal, will involved a detailed data collection on ground while subjects perform squat and deadlift exercise on the ARED. Variations of each exercise, including resistance level and placement of the feet, hands, and range of motion will be examined to quantify the specific condition that optimizes joints loads. A computational model will be used to analyze joint loads and torques during each exercise. Six subjects (3 M/3 F) of small, medium, and large body types as described by NASA anthropometric standards will be used as subjects. The purpose of this investigation is to quantify the joint loading that occurs during typical resistance exercise on the ARED. The goal is to determine a subset of exercises that show the greatest potential for maximizing health benefits to inform a future proposal that will include a biomechanical analysis of exercise on the ISS using the subset of exercises determined during phase 2.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2009. [Ed. note: project added to Task Book in February 2010 when information received from JSC]
Bibliography Type:	Description: (Last Updated: 02/11/2021)