Task Book Report Generated on: 04/25/2024

Project Title: Ground-based Biomechanical Analyses of Resistance Exercise Using the Advanced Resistive Exercise Device Division Name: Human Research Program Discipline: HUMAN RESEARCH—Biomedical countermeasures Element Subdiscipline: None TechPort: Yes Tuman Research Program Riskis: (I) Muscle Risk of Impaired Performance Due to Reduced Muscle Size, Strength and Endurance Space Biology Cross-Element Subdiscipline: None None Space Biology Cross-Element Discipline: None Plemai: Individual Subdiscipline: Indiv			
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Division Name: Human Research Program/Discipline: HUMAN RESEARCH Program/Discipline- Element/Subdiscipline: HUMAN RESEARCH Florent/Subdiscipline: HUMAN RESEARCH-Biomedical countermeasures    Human Research Program Elements:   None	PI Name:	De Witt, John Ph.D.	
Program/Discipline: IIUMAN RESEARCH Program/Discipline- Element/Subdiscipline- Element/Subdiscipline- Element/Subdiscipline- Element/Subdiscipline- Element/Subdiscipline- Element/Subdiscipline- Element/Subdiscipline- HUMAN RESEARCH-Biomedical countermeasures  Human Research Program Elements: (1) HIICHuman Health Countermeasures  Human Research Program Risks: (1) Husele/Risk of Impuired Performance Due to Reduced Muscle Size, Strength and Endurance  Space Biology Flement: None  Space Biology Element: None  Space Biology Element: None  Space Biology Special Category: None  Plemail: phone: Space Space Center  Plemail: phone: Space Center  Typicate Space Space Center  Space Biology Special Category: phone: Space Center  None of Post Docs: Space Center	Project Title:	Ground-based Biomechanical Analyses of Resistance Exercise Using the Advanced Res	istive Exercise Device
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Human Research Program Elements: (I) HHC-Human Health Countermeasures  Human Research Program Risks: (I) MustleRisk of Impaired Performance Due to Reduced Muscle Size, Strength and Endurance  Space Biology Element: None  Space Biology Special Category: None  PI Email: john k.dewittérinasa.sov Fax: FY  PI Organization Type: NASA CENTER Phone: (281) 483-8939  Organization Name: Wyle/NASA Johnson Space Center  PI Address 1: Human Adaptation and Countermeasures/NK  PI Address 2: 1290 Hercules Drive  PI Web Page:  City: Houston State: TX  Zip Code: Congressional District: 22  Comments:  Project Type: GROUND Solicitation / Funding Source: Directed Research  Start Date: 07/13/2009 End Date: 10/29/2010  No. of Phot Decretical Control of Phone: No. of Phot Degrees: No. of Phot Degrees: No. of Bachelor's Degrees: No. of Bachelor's Candidates: No. of Bachelor's Degrees: No. of Bachelor's Candidates: No. of Bachelor's Degrees: No. of Bachelor's Candidates: No. of	Program/Discipline Element/Subdiscipline:	HUMAN RESEARCHBiomedical countermeasures	
Human Research Program Risks:  (1) Muscle Risk of Impaired Performance Due to Reduced Muscle Size, Strength and Endurance  Space Biology Cross-Element  Space Biology Special Category:  None  PI Email:  john k.dewitt@mass.gov  Fax: FY  PI Organization Type:  NASA CENTER  Phone: (281) 483-8939  Organization Name:  Wyle/NASA Johnson Space Center  PI Address 1:  Human Adaptation and Countermeasures/SK  PI Address 2:  1290 Hercules Drive  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 Pab Dess:  No. of PhD Degress:  No. of Master's Candidates:  No. of Master' Degress:  No. of Master's Candidates:  No. of Master's Candidates:  No. of Bachelor's Candidates:	Joint Agency Name:	TechPort:	Yes
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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.

**Task Description:** 

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:** 

New project for FY2009.

**Task Progress:** 

[Ed. note: project added to Task Book in February 2010 when information received from JSC]

Bibliography Type: Description: (Last Updated: 02/11/2021)