Fiscal Year:	FY 2015	**Task Last Updated:**	FY 10/29/2014
PI Name:	Jagodnik, Kathleen Ph.D.		
Project Title:	Improving the Efficacy of Resistive Exercise Microgravity Countermeasures for Musculoskeletal Health and Function using Biomechanical Simulation (Postdoctoral Fellowship)		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	NSBRI--Musculoskeletal Alterations Team		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	44026	**Congressional District:**	10
Comments:	NOTE (Ed., May 2016): Administrative affiliation is Baylor College of Medicine, Center for Space Medicine, which administers the fellowship. Fellowship work is being performed at NASA Glenn.		
Project Type:	GROUND	**Solicitation:**	2014 NSBRI-RFA-14-02 First Award Fellowships
Start Date:	03/01/2015	**End Date:**	02/28/2017
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:**	NSBRI
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:	NOTE: Start/End dates changed to 3/1/2015 and 2/28/2017, respectively (original start/end dates were 12/1/2014 and 11/30/2016, respectively) per NSBRI (Ed., 7/27/15)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Lewandowski, Beth Ph.D. (MENTOR/ NASA Glenn Research Center)		
Grant/Contract No.:	NCC 9-58-PF04105		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	POSTDOCTORAL FELLOWSHIP Spaceflight subjects astronauts to microgravity conditions, and extended exposure to these environments causes muscle atrophy and loss of bone density that can lead to loss of function during missions, as well as harmful effects that endure after return to Earth. Resistive exercise is an essential microgravity countermeasure that has been shown to mitigate the harmful effects of reduced gravity on the human musculoskeletal system. The Hybrid Ultimate Lifting Kit (HULK) device (ZIN Technologies, Inc.) has recently been developed to provide astronauts with a range of resistive exercises within a mission-ready footprint. Among the movements permitted by the HULK device, the deadlift is central to an effective exercise regimen, as it works the leg, hip, torso, and back muscles, which often suffer the most significant declines during spaceflight missions. The ability to model the deadlift movement in a simulated environment will permit the development of customized prescriptions of exercise on the HULK device for astronauts, through analysis of variations in device configuration and human posture, stance, grip, and cadence, resulting in the prediction of configuration that will result in optimal countermeasure exercise. Gravity in the simulated environment can be reduced in order to predict the system modifications necessary to achieve optimal exercise results in a microgravity environment, without requiring the collection of data during spaceflight, which is expensive and difficult to acquire. In pursuit of a predictive musculoskeletal model that will ultimately permit the prescription of device configuration properties and human exercise techniques to achieve effective deadlift exercise on the HULK device, we propose to create a descriptive musculoskeletal model based on collected human motion capture data. Recorded human data will be used to create a full-body musculoskeletal model using the OpenSim software platform. Analyses will be performed using this musculoskeletal simulation, and we will compare the model's evaluations against experimental values of deadlift performance. Sensitivity of the model to its key parameters, as well as verification and validation analyses, will be performed to assess the ability of the model to provide useful information for the purpose of optimizing deadlift exercise training on the HULK device.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	0
Task Progress:	New project for FY2015.
Bibliography Type:	Description: (Last Updated: 09/01/2017)