Fiscal Year:	FY 2021	**Task Last Updated:**	FY 05/19/2021
PI Name:	Downs, Meghan Ph.D.		
Project Title:	Temporal Changes in Astronauts' Muscle and Cardiorespiratory Physiology Pre, During, and Post Spaceflight		
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) **Aerobic**:Risk of Reduced Physical Performance Capabilities Due to Reduced Aerobic Capacity (2) **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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PI Organization Type:	NASA CENTER	**Phone:**	281-483-0863
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Zip Code:	77586-4145	**Congressional District:**	36
Comments:			
Project Type:	FLIGHT	**Solicitation / Funding Source:**	2017-2018 HERO 80JSC017N0001-BPBA Topics in Biological, Physiological, and Behavioral Adaptations to Spaceflight. Appendix C
Start Date:	12/01/2018	**End Date:**	06/06/2021
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:	Stenger, Michael	**Contact Phone:**	281-483-1311
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Flight Program:			
Flight Assignment:	NOTE: End date changed to 6/6/2021 per change in PI per HHC/HRP (Ed., 9/20/21)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Abercromby, Andrew Ph.D. (NASA Johnson Space Center) Ade, Carl Ph.D. (Kansas State University) Barstow, Thomas Ph.D. (Kansas State University) Feiveson, Alan Ph.D. (NASA Johnson Space Center) Martin, David M.S. (Wyle Laboratories, Inc./NASA Johnson Space Center) Ryder, Jeffrey Ph.D. (NASA Johnson Space Center) Rivas, Eric Ph.D. (KBR/NASA Johnson Space Center)		
Grant/Contract No.:	Internal Project		
Performance Goal No.:			

Performance Goal Text:	
Task Description:	Quantification of astronauts' changes in cardiorespiratory fitness and muscle performance and size in parallel with monitoring of pre and in-flight lifestyle habits (i.e., exercise training, nutritional intake, and sleep patterns) is needed to develop countermeasures and technologies for monitoring and mitigating crew health and performance risks during exploration class missions. The research proposed herein will temporally profile changes in astronauts' cardiorespiratory fitness and muscle mass, strength, and endurance over the course of spaceflight missions ranging from 2 months, 6 months, and up to 1 year in duration. Additionally, a statistical based extrapolation will provide predictions for changes associated with exploration missions 2-3 years in duration. To accomplish these objectives, lower and upper body muscle strength, power, and endurance will be measured using a well validated test battery consisting of leg extension, leg press, isokinetic, bench press tests, and isometric mid-thigh pull test. Muscle size will be assessed pre, in, and post-flight using well validated magnetic resonance imaging (MRI) and ultrasound imaging techniques. Cardiorespiratory fitness and related parameters will be tested pre, in, and post-flight using traditional VO2peak test and critical power test protocols paired with non-invasive assessments of oxygen consumption, cerebral and muscle oxygenation and perfusion. Ambulatory and in-flight exercise, nutrition, and sleep will be monitored using a variety of commercial technologies and in-flight assessment tools. This proposal specifically addresses the temporal effects of spaceflight on changes in cardiorespiratory fitness and muscle function, both critical parameters in maintaining the ability to perform mission critical tasks and enabling safe human space exploration beyond low Earth orbit. Integration of data collected during the pre and in-flight periods will lead to a better understanding of how to optimize exercise and non-exercise countermeasures to maintain crew health, safety, and performance during the exploration era. NOTE: Project ended June 2021 and continues with new Principal Investigator, Dr. Eric Rivas.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	It is well established exercise has many health benefits. This research will improve our understanding about the variability fitness improvements and how they change over time. Understanding this will improve exercise prescriptions for athletic and clinical populations on Earth.
Task Progress:	This was a new project in 2018. During FY 2019 Institutional Review Board (IRB) protocol and consent forms were submitted and approved. During the FY 2020, SpacePhys was selected for flight as part of CIPHER's (Complement of Integrated Protocols for Human Exploration Research) complement of studies (formerly referred to as the integrated One Year Mission project). The feasibility assessment, select for flight, CIPHER kick off, and Op Nom were completed during this time. Revisions to IRB documentations were completed. This included revisions to the protocol and consent form submissions and were approved. Ultrasound leg guide protocol types v2 were completed. In addition, new equipment was purchased (Oxiplex and Physioflow). Data management plan was developed. NOTE: Project ended June 2021 and continues with new Principal Investigator, Dr. Eric Rivas, using the same title. See that project for subsequent reporting.
Bibliography Type:	Description: (Last Updated:)