

Fiscal Year:	FY 2023	Task Last Updated:	FY 11/17/2022
PI Name:	Lee, Stuart M.C. Ph.D.		
Project Title:	Defining the Relation Between Biomarkers of Oxidative and Inflammatory Stress and Atherosclerosis Risk in Astronauts During and After Long-Duration 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) Cardiovascular: Risk of Cardiovascular Adaptations Contributing to Adverse Mission Performance and Health Outcomes		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	77058-2749	Congressional District:	36
Comments:			
Project Type:	FLIGHT	Solicitation / Funding Source:	2010 Crew Health NNJ10ZSA003N
Start Date:	03/01/2016	End Date:	08/09/2024
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
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Flight Program:	ISS		
Flight Assignment:	ISS NOTE: End date changed to 08/09/2024 per C. Ribeiro/HHC, HRP (Ed., 1/4/24) NOTE: End date changed to 12/31/2023 per C. Ribeiro/HHC, HRP (Ed., 8/26/22) NOTE: End date changed to 8/31/2023 per HRP, HHC Element (Ed., 8/12/21)		
Key Personnel Changes/Previous PI:	August 2019 report: Steven Laurie, Ph.D. is CoInvestigator. January 2017: Remove Dr. Rob Ploutz-Snyder as CoInvestigator; Add: Dr. Alan Feiveson as Collaborator.		
COI Name (Institution):	Smith, Scott Ph.D. (NASA Johnson Space Center) Feiveson, Alan Ph.D. (Collaborator: NASA Johnson Space Center) Stenger, Michael (NASA Johnson Space Center) Laurie, Steven Ph.D. (KBR/NASA Johnson Space Center)		
Grant/Contract No.:	Internal Project		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	<p>NOTE: Continuation of "Defining the Relation Between Biomarkers of Oxidative and Inflammatory Stress and Atherosclerosis Risk in Astronauts During and After Long-Duration Spaceflight" ; previous Principal Investigator was Dr. Steven Platts, until March 2016.</p> <p>Atherosclerosis is the major contributor to cardiovascular disease-related morbidity and mortality. Research indicates that many of the risk factors commonly associated with atherosclerosis contribute to endothelial dysfunction, a process which presents early in life before angiographic evidence of disease and precedes the clinical manifestation of many cardiovascular disease-related disorders. In an effort to compensate for the initial risk factor-related disruptions to homeostasis, there is a compensatory upregulation of atheroprotective mechanisms. However, in the absence of appropriate risk factor management, these defense mechanisms may become overwhelmed and less able to reestablish normal function. Key systems that help maintain vascular homeostasis and are susceptible to differential deleterious alterations include those that help balance levels of oxidative and inflammatory stress. New evidence suggests that long-duration spaceflight may promote oxidative and inflammatory stress through mechanisms such as radiation exposure, diet, physical inactivity, and psychological stress. However, there are no data supporting a causal link between biomarkers of oxidative and inflammatory stress and indices of vascular endothelial dysfunction in spaceflight. As such, we proposed to examine the relation between biomarkers of oxidative and inflammatory stress and well-established measures of vascular endothelial dysfunction (flow mediated dilation (FMD)) and carotid intima-media thickness (cIMT) in astronauts before, during, and after long duration spaceflight.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>It is well known that inflammation is a key contributor to the development of atherosclerosis. There also is emerging work showing the link with oxidative damage. This work may contribute to general clinical science by showing the interactions of multiple stressors in a unique environment (spaceflight).</p>
Task Progress:	<p>All pre-, in-, and immediate postflight data have been collected and analyzed. A manuscript describing these results has been published (Lee SMC et al. Arterial structure and function during and after long-duration spaceflight. J Appl Physiol. 129:108-123, 2020), and a response (Lee SMC et al. Reply to Greaves et al. J Appl Physiol. 129:113, 2020) to a "Letter to the Editor" (Greaves DK, Robertson AD, Patterson CA, Au JS, Hughson RL. Evidence for increased cardiovascular risk to crew during long duration space missions. J Appl Physiol. 129:1111-1112, 2020 regarding this manuscript has also published.</p> <p>Most astronauts continue to participate in postflight data collections, scheduled to extend to 5 years after landing, although some have not been consistently available at the planned increments after landing due to retirement from the astronaut corps (n=6) or limited travel opportunities coming from international partner organizations (n=5). To date, 8 astronauts participated in data collection through 5 years after landing, and 2 astronauts have participated in testing only through the 3-year postflight test. Two astronauts discontinued their participation after the 1-year data collection. The Research and Operations Integration Element (ROI) is working to schedule the remaining 3 subjects for the 5-year post-landing data collection, one of whom has been scheduled for December 2022.</p> <p>Results from this study and previous reports have been used to inform the design of the NASA Standard Measures Study as well Human System Risk Board-defined risk, "Risk of Cardiovascular Adaptations Contributing to Adverse Mission Performance and Health Outcomes" and are included in the corresponding Human Research Program Evidence Report that was drafted in 2022.</p>
Bibliography Type:	Description: (Last Updated: 02/22/2024)
Abstracts for Journals and Proceedings	<p>Lee SMC, Martin D, Ribeiro LC, Smith SM, Zwart SR, Ferguson C, Laurie SS, Macias BR. "Indices of Cardiovascular Disease Risk in Astronauts after Long-duration Spaceflight in Low Earth Orbit" NASA Human Research Program Investigators' Workshop, To the Moon: The Next Golden Age of Human Spaceflight, Galveston, TX, February 7-9, 2023.</p> <p>NASA Human Research Program Investigators' Workshop, To the Moon: The Next Golden Age of Human Spaceflight, Galveston, TX, February 7-9, 2023. , Feb-2023</p>