Fiscal Year:	FY 2016	**Task Last Updated:**	FY 05/10/2016
PI Name:	Platts, Steven H. 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:	HUMAN RESEARCH		
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:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Organization Name:	NASA Johnson Space Center		
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PI Address 2:	Biomedical Research and Environmental Sciences Division		
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City:	Houston	**State:**	TX
Zip Code:	77058	**Congressional District:**	36
Comments:			
Project Type:	FLIGHT	**Solicitation / Funding Source:**	2010 Crew Health NNJ10ZSA003N
Start Date:	10/01/2011	**End Date:**	02/29/2016
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 2/29/2016 due to PI change to Stuart M.C. Lee (Ed., 5/10/16) NOTE: End date is 5/10/2022 per R. Brady/HHC element/JSC (Ed., 10/8/15)		
Key Personnel Changes/Previous PI:	none		
COI Name (Institution):	Lee, Stuart M.S. (Wyle Science, Technology, and Engineering Group) Ploutz-Snyder, Robert Ph.D. (Universities Space Research Association) Smith, Scott Ph.D. (NASA Johnson Space Center) Stenger, Michael Ph.D. (Wyle Science, Technology, and Engineering Group) Westby, Christian Ph.D. (Universities Space Research Association)		
Grant/Contract No.:	Internal Project		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	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 propose 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.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	It is well known that inflammation is a key contributor to the development of atherosclerosis. There is also 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).
Task Progress:	METHODS To meet the objectives of the study, 12 astronauts will be studied before, during, and up to 5 years after long duration missions aboard the International Space Station (ISS). Biomarkers of oxidative and inflammatory stress, some of which we have previously shown to be elevated with spaceflight, will be measured from blood and urine samples taken before, during and after spaceflight. Arterial structure and function will be assessed before, during, and after spaceflight using standard clinical ultrasound measures that are well-established clinical indices of atherosclerosis risk. Pre- and post-flight ultrasound measures will be obtained in the laboratory by trained sonographers, and astronauts will obtain ultrasound images on-orbit with real-time guidance from experts on the ground using remote guidance. This is the first study to assess immediate and long-term risk for atherosclerosis using biochemical, structural and functional measures before, during, immediately after, and up to five years after spaceflight. Additionally, data from one subject on NASA's first one-year mission will be shared with a complementary project in the suite of Twins Studies, entitled Metabolomic and genomic markers of atherosclerosis as related to oxidative stress, inflammation, and vascular function in twin astronauts. NNJ13ZSA002N-TWINS: Differential Effects on Homozygous Twin Astronauts Associated with Differences in Exposure to Spaceflight Factors. RESULTS Ten astronauts have participated in pre-flight testing, seven have completed in- and immediate post-flight testing (R+5), and four have participated in testing at R+365. No crewmember has participated in testing at R+3 years. Ultrasound data analysis is in progress. Analysis of blood and urine samples predicated on delivery of in-flight samples has been delayed due to re-entry vehicle availability. DISCUSSION Samples from pre-flight data collections have been archived so that they may be batch processed with in- and post-flight samples. Inflight data collection is in progress; timing of the analysis of inflight samples will be dependent upon return of the samples from the ISS. Data sharing of relevant measurements collected as medical requirements or part of a complementary studies will be leveraged to inform the study results. NOTE: Stuart M. C. Lee has taken over the project as of March 2016. Project continues with the same title with Dr. Lee as the Principal Investigator.
Bibliography Type:	Description: (Last Updated: 03/01/2018)
Abstracts for Journals and Proceedings	Lee SMC, Stenger MB, Smith SM, Zwart SR, Laurie SS, Ploutz-Snyder RJ, Platts SH. "Defining the relationship between biomarkers of oxidative and inflammatory stress and the risk for atherosclerosis in astronauts during and after long duration space flight." 2016 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 8-11, 2016. 2016 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 8-11, 2016. , Feb-2016
Abstracts for Journals and Proceedings	Lee SMC, Westby CM, Stenger MB, Smith SM, Zwart SR, Rana B, Ploutz-Snyder RJ, Platts SH. "Defining the relationship between biomarkers of oxidative and inflammatory stress and the risk for atherosclerosis in astronauts during and after long duration space flight." 2015 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 13-15, 2015. 2015 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 13-15, 2015. , Jan-2015
Significant Media Coverage	Lee SMC with Lori Meggs (NASA Public Affairs). "Space Station Live: The Heart of the Matter. Video interview with CoInvestigator Stuart M.C. Lee." Video interview, July 8, 2015. https://www.youtube.com/watch?v=GQsD4qmwhzk , Jul-2015