Fiscal Year:	FY 2018	**Task Last Updated:**	FY 02/07/2018
PI Name:	Laurie, Steven Ph.D.		
Project Title:	Integrative Physiology of VIIP: Cardiopulmonary, Sleep, and Cognitive Function Assessment During Hypercapnic Bed Rest		
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) **Immune**:Risk of Adverse Health Event Due to Altered Immune Response (2) **SANS**:Risk of Spaceflight Associated Neuro-ocular Syndrome (SANS)		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	steven.laurie@nasa.gov	**Fax:**	FY
PI Organization Type:	NASA CENTER	**Phone:**	281-244-0029
Organization Name:	KBR/NASA Johnson Space Center		
PI Address 1:	Cardiovascular and Vision Laboratory		
PI Address 2:	2400 NASA Pkwy		
PI Web Page:			
City:	Houston	**State:**	TX
Zip Code:	77058-2749	**Congressional District:**	36
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2014-15 HERO NNJ14ZSA001N-MIXEDTOPICS. Appendix E: Behavioral Health & Human Health Countermeasures Topics
Start Date:	04/01/2016	**End Date:**	09/30/2019
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:	2	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
Contact Monitor:	Norsk, Peter	**Contact Phone:**	
Contact Email:	Peter.norsk@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: Extended to 9/30/2019 per PI (Ed., 1/7/2019) NOTE: Extended to 9/30/2018 per JSC HHC element info (Ed., 2/5/18)		
Key Personnel Changes/Previous PI:			

COI Name (Institution):	Hu, Xiao Ph.D. (University of California, San Francisco) Lathan, Corrinna Ph.D. (AnthroTronix, Inc.) Lee, Stuart Ph.D. (KBRwyle/NASA Johnson Space Center) Lovering, Andrew Ph.D. (University of Oregon) Martin, David M.S. (KBRwyle./NASA Johnson Space Center) Stenger, Michael Ph.D. (NASA Johnson Space Center) Young, Millennia Ph.D. (NASA Johnson Space Center) Smith, Scott M Ph.D. (NASA Johnson Space Center) Zwart, Sara Ph.D. (University of Texas Medical Branch/NASA Johnson Space Center)
Grant/Contract No.:	Internal Project
Performance Goal No.:	
Performance Goal Text:	
Task Description:	As of 2016, ~40% of crew members completing long-duration space flight missions have developed ocular structural or functional changes that characterize the Spaceflight Associated Neuro-ocular Syndrome (SANS) (formerly, Visual Impairment, Intracranial Pressure syndrome (VIIP)), yet no ground-based analogs have successfully replicated these symptoms. Carbon dioxide (CO2) is elevated on the International Space Station (ISS) and has been hypothesized to contribute to the development of SANS, which may explain why previous ground-based analog studies which have not included elevated CO2 levels in the ambient air have not successfully replicated SANS. The research outlined in this grant proposal seeks to link physiological changes that occur during exposure to chronic hypercapnia (elevated carbon dioxide, 0.5% CO2 inspired) similar to that occurring on ISS, in subjects undergoing the space flight analog of 6° head-down tilt bed rest, with changes associated with the SANS syndrome and decrements in cognition, sleep quality, and circadian alignment. Optical coherence tomography, intraocular pressure, cerebral and ocular blood flow, and sensitivity to carbon dioxide will be used to assess the development of SANS and determine the relationship between physiological changes associated with hypercapnic bed rest and SANS symptoms. Cognitive function will be assessed using two tools: the Cognition battery currently being tested on ISS crew members, and the Digital Automated Neurobehavioral Assessment, the only FDA-cleared computerized cognitive assessment tool that has been validated in thousands of active military personnel. The Philips Respironics Alice PDx Sleep System will be used to assess sleep quality and core body temperature will be measured to determine circadian misalignment. This research proposal addresses multiple risks within NASA's Integrated Research Plan, including determining if this unique ground-based analog can simulate SANS, and if the mild hypercapnic environment represents a threat to behavioral health and performance, sleep quality, and normal circadian rhythm.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Research conducted as part of this experiment was unique to the International Space Station environment due to the elevated ambient CO2. However, understanding the role of a chronic headward fluid shift on ocular pathology will provide new insight into mechanisms of ocular diseases on Earth.
Task Progress:	The Principal Investigator team successfully delivered all hardware to the German Aerospace Center (DLR) :envihab facility and completed training for all essential personnel during a site visit in August of 2017 and returned to DLR to oversee baseline data collection (BDC) during the first 2 weeks of pre-bedrest testing, which started Oct 2, 2017. All data collection was completed between October 2 and December 4, 2017. We developed and oversaw a data transfer plan which required daily data transfers to our team in order to verify data quality, provide real-time feedback to test operators if necessary, and improve the accuracy of data management on secure servers at Johnson Space Center. This was complemented by Matlab programs written by the PI team that enabled data visualization and preliminary analysis of data to assist with data verification. Sleep, circadian rhythm, and hypercapnic ventilatory response data collected for our co-investigators were then transferred to them for analysis.
Bibliography Type:	Description: (Last Updated: 05/05/2023)