Fiscal Year:	FY 2016	**Task Last Updated:**	FY 07/14/2015
PI Name:	Stenger, Michael Ph.D.		
Project Title:	Distribution of Body Fluids during Long Duration Space Flight and Subsequent Effects on Intraocular Pressure and Vision Disturbance		
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:	(1) **Cardiovascular**:Risk of Cardiovascular Adaptations Contributing to Adverse Mission Performance and Health Outcomes (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		
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PI Organization Type:	NASA CENTER	**Phone:**	281-483-1311
Organization Name:	NASA Johnson Space Center		
PI Address 1:	SK3/Biomedical Research and Environmental Sciences Division		
PI Address 2:			
PI Web Page:			
City:	Houston	**State:**	TX
Zip Code:	77058	**Congressional District:**	22
Comments:	NOTE Aug 2018: Previously with KBRwyle at Johnson Space Center		
Project Type:	Flight	**Solicitation / Funding Source:**	2011 Crew Health NNJ11ZSA002NA
Start Date:	10/01/2012	**End Date:**	09/30/2018
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:	Norsk, Peter	**Contact Phone:**	
Contact Email:	Peter.norsk@nasa.gov		
Flight Program:	ISS		
Flight Assignment:	ISS NOTE: End date is 9/30/2018 per PI (Ed., 7/8/15) NOTE: Risk/Gap changes per IRP Rev E (Ed., 3/24/14)		
Key Personnel Changes/Previous PI:	October 2014 report: Steven S. Laurie, Ph.D., was added as co-investigator. Steven Platts, Ph.D., is no longer CoInvestigator as of November 2014.		
COI Name (Institution):	Johnston, Smith (NASA Johnson Space Center) Lee, Stuart (Wyle Laboratories, Inc.) Martin, David (Wyle Laboratories, Inc.) Ploutz-Snyder, Robert (Universities Space Research Association, Columbia) Smith, Scott (NASA Johnson Space Center) Soller, Babs (Reflectance Medical Inc.) Westby, Christian (Universities Space Research Association, Columbia) Laurie, Steven Ph.D. (Wyle)		

Grant/Contract No.:	Internal Project
Performance Goal No.:	
Performance Goal Text:	
Task Description:	The central objective of the proposed work is to determine the magnitude of the headward fluid shift during long duration space flight and to measure the subsequent compartmentalization of this fluid. The second objective is to determine if individual responses to this space flight-induced fluid shift are correlated with the individual differences in the space flight-induced change in intraocular pressure and visual acuity. Finally, the third objective is to compare the space flight fluid shift/distribution with that which occurs in head-down tilt bed rest, a terrestrial analog of space flight deconditioning. In order to determine the effect of space flight on the headward fluid shift and subsequent redistribution across fluid compartments, biochemical, ultrasound, and other non-invasive cardiovascular measures will be performed before launch, during flight, and after landing. Total body water, extracellular, and intracellular fluid volume will be determined by biochemical dilution techniques. Ultrasound will be used to assess upper vs. lower body interstitial fluid and vein diameter changes, cerebral blood flow, optic nerve sheath diameter, and central venous pressure. Near infrared spectroscopy will be used to measure lower vs. upper body local tissue hydration, and total peripheral resistance will be calculated from noninvasively acquired blood pressure and cardiac output. It is currently unclear why only some astronauts experience vision disturbances with space flight. It is hypothesized that astronauts respond differently to the fluid shift in-flight and that this impacts changes in intraocular / intracranial pressure and vision changes. The goal of this study is to test this hypothesis. In doing so, this proposal directly addresses the Integrated Research Plan Gap Cardiovascular (CV)7: How are fluids redistributed in-flight? and Gap Vision Impairment and Intracranial Pressure (VIIP)1: What is the etiology of visual acuity and ocular structural and function changes seen in-flight and post-flight? The research proposed here will determine the effect of long duration space flight on fluid shifts and subsequent redistribution across fluid compartments and attempt to discern the contribution of these adaptations to changes in intraocular / intracranial pressure and vision disturbances. NOTE: This study was merged with investigations from Dr. Alan Hargens (Fluid distribution before, during and after prolonged space flight) and Dr. Scott Dulchavsky (Microgravity associated compartmental equilibration) resulting in a comprehensive study titled “Fluid Shifts Before, During and After Prolonged Space Flight and Their Association with Intracranial Pressure and Visual Impairment” (short title: Fluid Shifts).
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Knowledge gained from this study may inform medical professionals treating and studying patients suffering from idiopathic intracranial hypertension, a debilitating condition with some characteristics in common with that experienced by astronauts.
Task Progress:	PI team personnel, along with the ISSMP (International Space Station (ISS) Medical Project) Flight Projects manager, travelled to Moscow in April 2015 to finalize the procedures and logistics of performing operations in the Russian segment. Testing and training have been initiated to enable “free-floating” of the Optical Coherence Tomography (OCT) device for in-flight measurements. Prior work by members of our group tested the feasibility of using the OCT scanner in free-float (without the use of the chin rest and stage); parabolic flights were conducted in November 2013 that established that this mode was feasible. This information opened up options for scanning locations other than the Maintenance Work Area (MWA) which would include scanning in the Russian Service Module while in Chibis. An inflight free-float practice run was performed in April 2015 prior to inflight data collection in May 2015. Three feasibility subjects were studied in the fall of 2014, allowing the Principal Investigator Team to finalize the study protocol, maximizing data collection and crew time efficiency. All training sessions and preflight baseline data collection (BDC) have been completed for both one year mission crewmembers (including one cosmonaut); training and preflight BDC has also been completed for the one year mission US backup crewmember and ground-based “TWINS” study participant. These include MRI (magnetic resonance imaging), dilution measures, ultrasound, OCT, tonometry, NIRS (near-infrared spectroscopy), CCFP (cerebral and cochlear fluid pressure), and OAE (otoacoustic emission) measures. The early inflight (FD45) testing on our first two crewmembers, including dilution measures and baseline imaging measures, were performed in the USOS segment, followed by three days of testing in the Russian segment while utilizing the Chibis lower body negative pressure (LBNP) device. Our team attended the NASA Human Research Program (HRP) Investigators’ Workshop in Galveston, TX in January 2015, presenting a poster on the Fluid Shifts (FS) project and participating in many VIIP related sessions and discussions. We also presented a project status at the Aerospace Medical Association Annual Meeting in Orlando, FL, in May of 2015 during a VIIP panel presentation. PI team personnel performed multiple interviews/media events for the Fluid Shifts project. In February, for Lori Meggs from Space Station Live; in March with Lorie Abadie, Chuck Lloyd and Amy Blanchett from Education and Outreach; in April with Pat Ryan from Space Station Livem; in June with Stephanie Schierholz and Julie Robinson at the Kennedy Space Center for the SpaceX CRS-7 pre-launch Tech Briefing.
Bibliography Type:	Description: (Last Updated: 05/20/2022)