

<b>Fiscal Year:</b>	FY 2014	<b>Task Last Updated:</b>	FY 07/23/2014
<b>PI Name:</b>	Platts, Steven H. Ph.D.		
<b>Project Title:</b>	Effects of Long Duration Spaceflight on Venous and Arterial Compliance in Astronauts		
<b>Division Name:</b>	Human Research		
<b>Program/Discipline:</b>	NSBRI		
<b>Program/Discipline--Element/Subdiscipline:</b>	NSBRI--Cardiovascular Alterations Team		
<b>Joint Agency Name:</b>	<b>TechPort:</b>	No	
<b>Human Research Program Elements:</b>	(1) <b>HHC</b> :Human Health Countermeasures		
<b>Human Research Program Risks:</b>	(1) <b>SANS</b> :Risk of Spaceflight Associated Neuro-ocular Syndrome (IRP Rev I)		
<b>Space Biology Element:</b>	None		
<b>Space Biology Cross-Element Discipline:</b>	None		
<b>Space Biology Special Category:</b>	None		
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<b>Organization Name:</b>	NASA Johnson Space Center		
<b>PI Address 1:</b>	Cardiovascular Laboratory		
<b>PI Address 2:</b>	Biomedical Research and Environmental Sciences Division		
<b>PI Web Page:</b>			
<b>City:</b>	Houston	<b>State:</b>	TX
<b>Zip Code:</b>	77058	<b>Congressional District:</b>	36
<b>Comments:</b>			
<b>Project Type:</b>	FLIGHT,GROUND	<b>Solicitation:</b>	2012 Crew Health NNJ12ZSA002N
<b>Start Date:</b>	06/01/2013	<b>End Date:</b>	05/31/2016
<b>No. of Post Docs:</b>	0	<b>No. of PhD Degrees:</b>	0
<b>No. of PhD Candidates:</b>	0	<b>No. of Master' Degrees:</b>	0
<b>No. of Master's Candidates:</b>	0	<b>No. of Bachelor's Degrees:</b>	0
<b>No. of Bachelor's Candidates:</b>	0	<b>Monitoring Center:</b>	NSBRI
<b>Contact Monitor:</b>	<b>Contact Phone:</b>		
<b>Contact Email:</b>			
<b>Flight Program:</b>	Pre/Post Flight		
<b>Flight Assignment:</b>	ISS pre- and postflight		
<b>Key Personnel Changes/Previous PI:</b>			
<b>COI Name (Institution):</b>	Ribeiro, Laura Christine ( Wyle Laboratories ) Westby, Christian ( Universities Space Research Association, Columbia ) Martin, David ( Wyle Laboratories ) Ploutz-Snyder, Robert ( Universities Space Research Association, Columbia ) Lee, Stuart ( Wyle Integrated Sciences and Engineering Group ) Garami, Zsolt ( The Methodist Hospital System ) Stenger, Michael ( Wyle Laboratories )		
<b>Grant/Contract No.:</b>	NCC 9-58-CA03402		
<b>Performance Goal No.:</b>			
<b>Performance Goal Text:</b>			

**Original Project Aims**

The purpose of this proposal is to use non-invasive methodologies (ultrasound) to track changes in venous and arterial compliance in vessels of the head and neck and relate these changes to development of the recently identified Vision Impairment and Intracranial Pressure (VIIP) syndrome in astronauts. The study is composed of four research objectives (bed rest, astronaut ground, astronaut flight, and data mining), which encompass three specific aims.

**Specific Aim I:** To determine whether noninvasive measures of venous and arterial compliance are altered by long-duration spaceflight exposure in ISS astronauts and whether these changes are related to the development of the VIIP syndrome. Hypothesis 1: Venous and arterial compliance in the head and neck will be decreased following long-duration exposure to the environment of spaceflight in International Space Station (ISS) astronauts. Hypothesis 2: Venous and arterial compliance in the arm (used as a control for fluid shifts and pressure redistribution) will not be changed after long-duration spaceflight in ISS astronauts. Hypothesis 3: Astronauts who experience the greatest decreases in vascular compliance also will have more severe cases of the VIIP syndrome as classified by Space Medicine Clinical Practice Guidelines.

**Specific Aim II:** Using 14-days of 6 degrees head-down tilt bed rest as a model of spaceflight, to evaluate the effect of aging on vascular compliance using a subject population similar to younger (25-35 yrs) and older (45-55 yrs) astronaut cohorts. Hypothesis 1: Pre-bed rest vascular compliance in the head and neck will be higher in younger subjects compared to older subjects. Hypothesis 2: Following bed rest, both groups of subjects will decrease vascular compliance in the head and neck, but will decrease more in the older subjects than younger subjects. Hypothesis 3: Subjects in this bed rest study will have more pronounced ocular changes/VIIP symptoms than those in a previous 14-day bed rest study due to the increased sodium content in the diet.

**Specific Aim III:** To determine whether previous spaceflight experience or training in high performance jet aircraft predispose astronauts to lower venous compliance and/or the development of the VIIP syndrome. Hypothesis 1: Vascular compliance in the head and neck will be higher in novice crewmembers compared to astronauts with previous flight experience. Hypothesis 2: Astronauts with training as high performance jet aircraft pilots will have lower vascular compliance, even preflight, than non-pilot astronauts and will have a higher incidence/severity of VIIP syndrome (data mining effort).

**Task Description:**

To date, we have not had any reportable results as we have been submitting paperwork and performing pre- data collection tasks to start the four independent but related studies. For the next year, the JSC Cardiovascular Laboratory will make progress on all four components of this study.

**Proposed research milestones for funding year 2**

**Data Mining:** We have received full approval from all necessary boards and individuals to proceed with data release from Lifetime Surveillance of Astronaut Health (LSAH). LSAH has provided a timeline of data release starting May 1, 2014. Data from already consented astronauts will be released in three phases. Astronauts were previously consented as part of a LSAH project to pre-consent to use all their data without stipulations. Remote consenting of astronauts who didn't previously consent without knowledge of the specific study objectives will begin in May 2014. The data from newly consented astronauts or those in-flight during the duration of this study will be provided in later phases of data release. As each data release is received by the JSC Cardiovascular Laboratory, data will be entered into databases and/or spreadsheets, data entry will be verified per Wyle verification procedures, and data mining will be performed on each subset of data.

**Bed Rest:** After we receive General Clinical Research Center Institutional Review Board approval for testing at the Flight Analogs Research Unit at the University of Texas, Medical Branch (UTMB) in Galveston, TX, we plan to recruit up to 10 subjects to participate in bed rest testing. A Test Readiness Review (TRR) package must be completed and TRR board approval received prior to the start of testing at UTMB. A TRR is the final safety review prior to any human testing.

**Ground:** We plan to recruit 8 astronauts that have never flown or astronaut candidates to participate in research at the Cardiovascular Laboratory at the NASA Johnson Space Center in Houston, TX. A TRR package must be completed and TRR board approval received prior to the start of testing.

**Flight:** We plan to submit the flight protocol to the NASA JSC Institutional Review Board in May 2014. A Feasibility Assessment is being performed by the International Space Station Medical Project (ISSMP). Any necessary flight certification of hardware will be initiated by ISSMP. All documentation and presentations required for flight studies will be completed as requested by members of ISSMP. Documentation includes an Experiment Document and an approved TRR package. Presentations include Select for Flight, Astronaut Briefings, and training.

**Rationale for HRP Directed Research:****Research Impact/Earth Benefits:**

Basic research into venous compliance of the head and neck may provide benefits for patients suffering from similar syndromes on Earth, such as Idiopathic Intracranial Hypertension (IIH).

This study consists of 4 separate but interrelated studies.

**Data Mining:** The data mining study is in progress. The JSC Institutional Review Board (IRB) approved the data mining study on December 12, 2013 (expiration - December 31, 2014). The data for use in the data mining study will be provided to the Principal Investigator team by Lifetime Surveillance of Astronaut Health (LSAH). The data that we are requesting is attributable to individual crewmembers to those familiar with the space program. Due to the nature of the data, we presented our data request at the LSAH Advisory Board meeting on February 4, 2014, which was approved by the Advisory Board. Following all necessary approvals, consent of crewmembers was discussed. Approximately 20 astronauts have consented to the use of their data without further information required. Members of LSAH have contacted the study team with a timeline for data release for the currently consented astronauts.

**Task Progress:**

**Bed Rest:** The JSC IRB approved the bed rest study on December 12, 2013 (expiration - December 31, 2014). The JSC Institutional Review Board reviewed the Bed Rest complement at the IRB meeting on April 17, 2014. Many discussions have occurred as to which facility should be used to perform the bed rest study. As of April 28, 2014, half of the subjects will be completed at the Flight Analogs Research Unit at the University of Texas, Medical Branch (UTMB) in

Galveston, TX.

Ground: The JSC IRB approved the study on April 17, 2014 (expiration - April 30, 2015). The International Space Station Medical Project (ISSMP) will assist with recruiting astronauts who have never flown or astronaut candidates.

Flight: The flight study is undergoing review by ISSMP. Prior to accepting flight studies, a Feasibility Assessment is performed. We have met with members of ISSMP to answer questions they had to complete the feasibility assessment. The flight study will be submitted to the JSC IRB shortly.

**Bibliography Type:**

Description: (Last Updated: 03/01/2018)