

Fiscal Year:	FY 2023	Task Last Updated:	FY 08/30/2022
PI Name:	Macias, Brandon Ph.D.		
Project Title:	Mechanical and Gravitational Countermeasures to Ocular Changes During Strict Head-Down Tilt Bedrest		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
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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Comments:	NOTE: Became civil servant fall 2020; previously KBR/NASA Johnson Space Center. Prior to that until 2016, was at the University of California, San Diego.		
Project Type:	GROUND	Solicitation / Funding Source:	Directed Research
Start Date:	08/26/2022	End Date:	09/30/2025
No. of Post Docs:		No. of PhD Degrees:	
No. of PhD Candidates:		No. of Master' Degrees:	
No. of Master's Candidates:		No. of Bachelor's Degrees:	
No. of Bachelor's Candidates:		Monitoring Center:	NASA JSC
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Flight Program:			
Flight Assignment:	NOTE: End date changed to 09/30/2025 per C. Ribeiro/NASA-JSC. (Ed., 11/27/23). Original end date was 08/20/2024. NOTE: Project start date updated due to P.I. change to B. Macias. Information per C. Ribeiro/NASA-JSC. (Ed. 8/29/22).		
Key Personnel Changes/Previous PI:	March 2023 Update: Laura Pardon, Ph.D. has left NASA and is no longer with the project (Ed., 1/3/24). August 2022 report: Scott Greenwald, Ph.D. has left NASA and is no longer with the project (Ed., 8/29/22). June 2022 report: CoInvestigators Alan Hargens, Jessica Jasien, and Benjamin Levine are no longer with the project (Ed., 7/22/22).		
COI Name (Institution):	Brunstetter, Tyson O.D., Ph.D. (NASA Johnson Space Center) Huang, Alex M.D., Ph.D. (Doheny Eye Institute) Kramer, Larry M.D. (University of Texas Health Science Center at Houston) Laurie, Steven Ph.D. (KBR/NASA Johnson Space Center) Lee, Stuart Ph.D. (KBR/NASA Johnson Space Center) Lovering, Andrew Ph.D. (University of Oregon) Martin, Bryn Ph.D. (Alcyone Therapeutics Inc.) Young, Millennia Ph.D. (NASA Johnson Space Center) Lytle, Jason (KBR/NASA Johnson Space Center)		
Grant/Contract No.:	Directed Research		

Performance Goal No.:	
Performance Goal Text:	
Task Description:	<p>The Spaceflight Associated Neuro-ocular Syndrome (SANS) is associated with structural and functional ocular and brain changes and develops in ~2/3rds of astronauts during long-duration spaceflight. Although the etiology of SANS is unknown, a weightlessness-driven headward fluid redistribution relative to the upright position on Earth is hypothesized to be a primary initiating factor. A countermeasure that can successfully reverse this headward fluid shift for multiple hours per day may be needed to prevent SANS. Exposure to 30 days of the spaceflight analog strict 6 degree head-down tilt (HDT) bedrest induces the development of optic disc edema, a hallmark sign of SANS, in 2/3 of subjects; thus, NASA will utilize this platform to test the effectiveness of various countermeasures to prevent or reduce the development of SANS findings. This study will include a control group exposed to 30 days of strict 6 degree HDT. A second group of subjects will be exposed to 6 hours of 25 mmHg lower body negative pressure (LBNP), daily, during 30 days of strict 6 degree HDT bedrest. A third group of subjects will be exposed to 6 hours of upright posture per day, and 6 degree HDT for the remaining 18 h/day. This will help determine if daily exposure to 6 hours total of upright posture, fully reversing the headward fluid for the same duration of use as the LBNP group, is sufficient to prevent SANS findings, and thus can direct future countermeasure studies with respect to the duration needed to successfully prevent SANS. We will assess multiple cerebral, vascular, and ocular outcome measures to determine the effects of 30 days strict 6 degree HDT bedrest, and the ability of daily 6 hour exposure to LBNP or upright positioning to prevent these changes.</p> <p>Specific Aims:</p> <ol style="list-style-type: none"> 1. To determine if daily exposure to actual (upright posture) and simulated (LBNP) hydrostatic pressure gradients prevents ocular and cerebral structural changes during 30 days of strict 6° head-down tilt bedrest. 2. To determine if daily exposure to actual (upright posture) and simulated (LBNP) hydrostatic pressure gradients prevents ocular functional changes during 30 days of strict 6° head-down tilt bedrest. 3. To determine if daily exposure to actual (upright posture) and simulated (LBNP) hydrostatic pressure gradients prevents vascular and cerebrospinal fluid changes during 30 days of strict 6° head-down tilt bedrest. <p>This bedrest study will be implemented in the :envihab facility at the German Aerospace Center (DLR) in Cologne, Germany.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	<p>Continuation of "Mechanical and Gravitational Countermeasures to Ocular Changes During Strict Head-Down Tilt Bedrest" with Dr. Macias as new Principal Investigator (PI). Former PI was Dr. Marshall-Goebel. March 2023 Update on Task Status (Ed., 1/3/24)</p> <p>Data collection has been completed for campaigns 3 (January-March 2023) and campaign 4 preparations are underway (planned data collection May-July 2023). In campaign 3, 6 subjects in each of the Control and Exercise plus thigh cuff groups completed data collection, with 12 additional subjects being planned for campaign 4. In this reporting period, personnel from the Cardiovascular and Vision Laboratory (CVL) traveled to the German Aerospace Center (DLR) to provide in-person training sessions to DLR staff and to oversee baseline data collection (BDC) on the 12 subjects who participated in campaign 3 of the study. Key aspects of training included countermeasure protocol development and new ultrasound targets of the femoral artery and vein related to the new thigh cuff countermeasure. The majority of data has been received by the CVL, with a few final pieces expected in the coming weeks. Data analysis was accelerated for optical coherence tomography (OCT) outcomes and the new ultrasound targets. Hand entry of multiple outcome variables has also been initiated.</p>
Bibliography Type:	Description: (Last Updated: 04/04/2024)
Abstracts for Journals and Proceedings	<p>Lytle JR, Laurie SS, Marshall-Goebel K, Lee SMC, Miller A, Martin D, Young M, Macias BR. "Cardiovascular responses to daily use of lower body negative pressure during 30 days of strict head-down tilt bedrest." American Physiology Summit, Long Beach, CA, April 20-23, 2023.</p> <p>Abstracts. American Physiology Summit, Long Beach, CA, April 20-23, 2023. , Apr-2023</p>
Abstracts for Journals and Proceedings	<p>Laurie SS, Pardon LP, Marshall-Goebel K, Lytle J, Martin D, Huang AS, Martin BA, Young M, Lee SMC, Lovering AT, Kramer LA, Macias BR. "Mechanical and gravitational countermeasures to ocular changes during strict head-down tilt bedrest: The SANS countermeasure bedrest study." 2023 NASA Human Research Program Investigators' Workshop, "To the Moon: The Next Golden Age of Human Spaceflight", Galveston, TX, February 7-9, 2023.</p> <p>Abstracts. 2023 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>