Fiscal Year:	FY 2020	**Task Last Updated:**	FY 03/17/2021
PI Name:	Marshall-Goebel, Karina 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:	(1) **SANS**:Risk of Spaceflight Associated Neuro-ocular Syndrome (IRP Rev I)		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Comments:	New affiliation as of fall 2018: KBR/NASA Johnson Space Center, Cardiovascular and Vision Laboratory, Houston; previously at Massachusetts General Hospital		
Project Type:	GROUND	**Solicitation / Funding Source:**	Directed Research
Start Date:	08/21/2020	**End Date:**	08/20/2024
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:			
Key Personnel Changes/Previous PI:			
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Grant/Contract No.:	Directed Research		

Performance Goal No.:	
Performance Goal Text:	
Task Description:	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 is needed to prevent SANS. Exposure to 30 days of strict 6 degree head-down tilt (HDT) bedrest has been shown to result in optic disc edema, a hallmark sign of SANS in 2/3rds of subjects and thus, NASA will utilize this platform to test various countermeasures for SANS. This study will include a control group exposed to 30 days of strict 6 degree HDT, and a posture control group that is upright during the day and supine at night. Another 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. An additional group of subjects will be exposed to 6 hours of upright posture per day, and 6 degree HDT for the remaining 18 h/day to determine if daily exposure to 6 hours total of upright posture, the equivalent of a gold standard countermeasure, is sufficient to prevent SANS, 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. Specific Aims: 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. This bedrest study will be implemented in the envihab facility at the German Aerospace Center (DLR) in Cologne, Germany.
Rationale for HRP Directed Research:	The Element recommended this task be implemented as a directed task due to the highly constrained nature of this research, which brings to maturation work that was recently completed in a precursor study (the Venous Congestion Countermeasure Study, VCCM). In the VCCM study, this combined team of investigators, comprised of Johnson Space Center (JSC) personnel and external experts, tested different combinations of mechanical countermeasures in a laboratory setting of acute posture changes in order to determine the most efficacious mechanical countermeasure. The identified countermeasure now needs to be tested on subjects exposed to 30-days of strict 6º head-down tilt (HDT) bedrest, with an expectation that this will ultimately lead to testing of the countermeasure during spaceflight. Time constraints are a secondary rationale, as the bedrest study is slated to start in the spring of 2021, and NASA's Research Operations Integration Element requires the proposed science immediately in order to finalize implementation.
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2020.
Bibliography Type:	Description: (Last Updated: 07/08/2021)