Task Book Report Generated on: 04/26/2024

P. Name:   Hargens, Alan R. Ph.D.	Fiscal Year:	FY 2019	Task Last Updated:	FY 03/15/2019
Project Title:         Self-Generide LBNP for Deep-Space Missions         Image: Program/Discipline:           Program/Discipline:         Fergram/Discipline:           Program/Discipline:         Fergram/Discipline:           Element/Subtheighne:         Joint Agency Name:         TechPort: Yes           Joint Agency Name:         New Program Einists: (1) HHCHman Health Countermeasures:           Human Research Program Risks:         (1) HCHman Health Countermeasures:           Space Biology Cross-Element         None           Space Biology Special Category:         None           P1 Email:         Abarcosótiosed câts         Part PY           Di Organization Type:         UniVFRISITY         Phone: 88-534-7837           Organization Type:         UniVFRISITY         Phone: 88-534-7837           Organization Same:         University of Cultifornia, San Diego           P1 Address 1:         A Joina Cultifornia, San Diego           P1 Address 2:         Page Mission Same Page Page Page Page Page Page Page Pag	PI Name:	Hargens, Alan R. Ph.D.	*	
Division Nume:   Human Research   Program/Discipline:   Program/Discipline:   Program/Discipline-   Program/Discipline-   Program/Discipline-   Program/Discipline-   Program/Discipline-   Program/Discipline-   Program (Discipline-   Program (Discipline-   Program (Program (Progr	Project Title:			
Program/Discipline:           Freemen/Suddiscipline:         TechPort:         Yes           Joint Agency Name:         TechPort:         Yes           Human Research Program Elements:         (1) SHANSRik of Spaceflight Associated Neuro-ocular Syndrome (SANS)           Space Biology Cross-Element:         None           Space Biology Cross-Element:         None           Space Biology Specification (Program Elements)         None           PI Email:         aboremations dedu         Fax: FV           PI Organization Type:         UNIVERSITY         Phore: 888-534-7837           PI Address 1:         Alonan Clinical and Translational Research Institute         PL Address 1:           PI Address 2:         4942 Medical Center Drive/0863         State: CA           PI Web Page:         City:         La Jola         State: CA           City:         La Jola         State: CA           Zip Code:         29037-0863         Congressional District: 52           Commentate         Cross-Commentate: 52         Project Type:         GROUND         Solicitation / Funding Lories in Biological, Physiological, and Source: Appendix C           No. of Psto Does:         No. of Psto Does: Appendix C         No. of Psto Does: Appendix C           No. of Psto Does: Appendix C         No. of Bacchelor's Candidates: Appendi				
Program/Discipline-  Elements/Subdiscipline-  John Agency Name: TechPort: Yes   Minimal Research Program Elements: (1) HIIC-Human Health Countermeasures: Human Research Program Elements: (1) HIIC-Human Health Countermeasures: Human Research Program Risks: (1) SANS-Risk of Spaceflight Associated Neuro-ocular Syndrome (SANS)	Division Name:	Human Research		
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Space Biology Cross-Element   Discipline:   Space Biology Special Category:   None	Human Research Program Risks:	(1) SANS:Risk of Spaceflight Associated Neuro-ocular Syndrome (SANS)		
Discipline:   None   Space Biology Special Category:   UNIVERSITY	Space Biology Element:	None		
PI Email:		None		
Pl Organization Type: UNIVERSITY Phone: 858-534-7837 Organization Name: University of California, San Diego PI Address 1: Altman Clinical and Translational Research Institute PI Address 2: 9452 Medical Center Drive/0863 PI Web Page: City: La Jolla State: CA Zip Code: 92037-0863 Congressional District: 52 Comments:  Project Type: GROUND Solicitation / Funding Topics in Biological, Physiological, and Source: Behavioral Adaptations to Spaceflight. Appendix C Voice State Congressional District: 52  Start Date: 01/31/2019 End Date: 01/30/2022 No. of Post Does: No. of PhD Degrees: No. of Master's Candidates: No. of Master' Degrees: No. of Master's Candidates: No. of Bachelor's Degrees: No. of Bachelor's Candidates: No. of Bachelor's Degrees: No. of Bachelor's Candidates: Norsk@masa.gov Flight Program: Flight Assignment: Key Personnel Changes/Previous PI: COI Name (Institution): Friend, James Ph.D. (University of California, San Diego) Lee, Stuart Ph.D. (Wyle Laboratories, Inc:/NASA Johnson Space Center) Macias, Banndon Ph.D. (Wyle Laboratories, Inc:/NASA Johnson Space Center) Macias, Banndon Ph.D. (Wyle Laboratories, Inc:/NASA Johnson Space Center) Linda M.S. (NASA Johnson Space Center) Performance Goal No.:	Space Biology Special Category:	None		
Organization Name: University of California, San Diego  PI Address 1: Altman Clinical and Translational Research Institute  PI Address 2: 9452 Medical Center Drive/0863  PI Web Page:  City: La Jolla State: CA  Zip Code: 92037-0863 Congressional District: 52  Comments:  Project Type: GROUND Solicitation / Funding Pehavioral Adaptations to Spaceflight. Appendix C  Start Date: 01/31/2019 End Date: 01/30/2022  No. of Post Docs: No. of PhD Candidates: No. of Bachelor's Degrees: No. of PhD Candidates: No. of Bachelor's Degrees: No. of Bachelor's Candidates: No. of Bachelor's Degrees: No. of Sachelor's Candidates: No. of Sachelor's Contact Monitor: Norsk, Peter Contact Monitor: Norsk, Peter Contact Email: Peter. norsk@nasa.gov  Flight Program: Flight Assignment: Key Personnel Changes/Previous Pl. Lee, Stuart Ph.D. (University of California, San Diego) Lee, Stuart Ph.D. (Wyle Laboratories, Inc./NASA Johnson Space Center)  Grant/Contract No.: 80NSSC19K0409  Ferformance Goal No.:	PI Email:	ahargens@ucsd.edu	Fax:	FY
PI Address 1: Altman Clinical and Translational Research Institute  PI Address 2: 9452 Medical Center Drive/0863  PI Web Page:  City: La Jolla State: CA  Zip Code: 92037-0863 Congressional District: 52  Comments:  Project Type: GROUND Solicitation / Funding Source: Biological, Physiological, and Behavioral Adaptations to Spaceflight. Appendix C  Start Date: 01/31/2019 End Date: 01/30/202  No. of Pst Docs: No. of PhD Candidates: No. of PhD Degrees: No. of PhD Candidates: No. of Bachelor's Degrees: No. of Bachelor's Degrees: No. of Bachelor's Candidates: No. of Bachelor's Degrees: No. of PhD Degrees: No. of PhD Degrees: No. of PhD Degrees: No. of B	PI Organization Type:	UNIVERSITY	Phone:	858-534-7837
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Task Description:

This Ground-Based proposal will evaluate a novel, self-generated Lower Body Negative Pressure (LBNP) device as a countermeasure to prevent Spaceflight Associated Neuro-Ocular Syndrome (SANS). This device is ideal for off-normal conditions in space craft when power is low. The self-generated LBNP device was invented and published by our team almost 20 years ago and is presently on the Chinese Space Station Tiangong One. This concept is very timely now with NASA's need to provide a SANS countermeasure while at the same time, providing physiologically-integrated exercise hardware that is safe, low mass, low volume, low power, and simple for deployment on a small, confined deep-space vehicle. Previous ground-based tests of the self-generated LBNP device document that the maximum footward force at the peak of the exercise cycle is over 110 kg and pressure within the cylinder concomitantly decreases by over 25 mm Hg below ambient to help counteract SANS, maintain aerobic capacity and the musculoskeletal system. This proposal is a logical extension of our previous ground-based simulations validating the self-generated LBNP device to re-introduce daily gravitational pressures and footward reaction forces. Furthermore, it extends our ongoing International Space Station (ISS) project "Fluid Distribution Before, During and After Prolonged Space Flight," demonstrating short-term LBNP by the Russian Chibis Suit to reduce venous congestion in the neck. We will use state-of-the-art, non-invasive technologies and imaging to prove efficacy of our self-generated LBNP device by quantifying cerebral volumes, pressures, and compliance along with visual deficits and ocular remodeling in 16 healthy female and male volunteers during parabolic flight and ground simulations of microgravity. We will determine dose-response efficacy of self-generated LBNP and accompanying shoulder-vest and footward mechanical loads to re-introduce diurnal effects of gravitational stress. Our self-generated LBNP device is very timely now with NASA's need to provide an integrated countermeasure for SANS and musculoskeletal (MS) losses, while at the same time providing physiologically-integrated exercise hardware that is safe, low mass, low volume, no power, and simple for deployment in a confined deep-space vehicle. Taken together, we therefore propose low-level, almost daily application of self-generated LBNP as an integrated countermeasure to reintroduce diurnal cycles of gravitational fluid and pressure variability to preserve cerebral, ocular, cardiovascular, and musculoskeletal health, relevant to 2011 Decadal priorities AH6 ("Studies should be done to develop and test new prototype exercise devices, and to optimize physical activity paradigms/prescriptions targeting multi-system countermeasures") and CC2 ("Determine whether artificial gravity is needed as a multi-system countermeasure, and whether continuous large radius AG is needed, or intermittent short radius AG is sufficient. Human studies in ground labs are essential to establish dose response relationships, and adequate gravity level, gradient, RPM, duration and frequency"). A self-generated LBNP device will go from a Technology Readiness Level of 7 or 8 to 9. Exercise within LBNP is at Countermeasure Readiness Level of 7 and will go to 8 or 9.

Rationale for HRP Directed Research:

Research Impact/Earth Benefits:

**Task Progress:** 

New project for FY2019.

**Bibliography Type:** 

Description: (Last Updated: 10/31/2023)