

Fiscal Year:	FY 2019	Task Last Updated:	FY 01/16/2019
PI Name:	Macias, Brandon Ph.D.		
Project Title:	Prospective Observational Study of Ocular Health in ISS Crews		
Division Name:	Human Research		
Program/Discipline:			
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) 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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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:	FLIGHT	Solicitation / Funding Source:	Directed Research
Start Date:	01/06/2017	End Date:	10/01/2019
No. of Post Docs:		No. of PhD Degrees:	
No. of PhD Candidates:		No. of Master' Degrees:	
No. of Master's Candidates:	4	No. of Bachelor's Degrees:	
No. of Bachelor's Candidates:		Monitoring Center:	NASA JSC
Contact Monitor:	Norsk, Peter	Contact Phone:	
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Flight Program:	ISS		
Flight Assignment:	NOTE: End date changed to 9/30/2019 (original end date was 11/16/2017) per PI (Ed., 10/9/18) NOTE: End date changed to 9/30/2018 (original end date was 11/16/2017) per A. Allcorn and PI (Ed., 10/11/17)		
Key Personnel Changes/Previous PI:	Current PI: Brandon R. Macias ; Former PI: Christian Otto. January 2019 report: Dr. Michael Stenger was added as a co-investigator for his expertise in the area of Spaceflight Associated Neuro-ocular Syndrome (SANS).		
COI Name (Institution):	Gibson, C. Robert O.D. (Coastal Eye Associates--Texas) Sargsyan, Ashot M.D. (KBRwyle, Houston, TX) Alexander, David M.D. (NASA Johnson Space Center) Ploutz-Snyder, Robert Ph.D. (University of Michigan) Riascos-Castaneda, Roy M.D. (University of Texas Medical Branch) Patel, Nimish O.D., Ph.D. (University of Houston) Samuels, Brian M.D., Ph.D. (University of Alabama at Birmingham) Kramer, Larry M.D. (The University of Texas) Lee, Stuart Ph.D. (Wyle Integrated Science and Engineering/NASA Johnson Space Center) Stenger, Michael (NASA Johnson Space Center)		
Grant/Contract No.:	Directed Research		

Performance Goal No.:	
Performance Goal Text:	
Task Description:	<p>NOTE: Continuation of "Prospective Observational Study of Ocular Health in ISS Crews" with new Principal Investigator Dr. Brandon Macias. Previous PI was Dr. Christian Otto, who moved in January 2017.</p> <p>Spaceflight-associated neuro-ocular syndrome (SANS) is characterized by changes in astronauts' vision (hyperopic shifts) and eye structure (optic disc edema, choroidal folds, globe flattening, and cotton wool spots). This risk is termed Spaceflight Associated Neuro-ocular Syndrome (SANS), formally called Visual Impairment/Intracranial Pressure (VIIP), by NASA. The purpose of this study is to characterize and quantify the ocular, neurological, and cardiovascular changes associated with the development of SANS before, during, and after long-duration International Space Station (ISS) missions. The data collected will augment Medical Requirements Integration Documents (MRID) requirements and testing performed during scheduled exams. In addition, the frequency of in-flight and postflight testing will be increased to quantify the temporal profile of our outcome measures. In short, preflight, in-flight, and postflight measures include: tonometry, ocular ultrasound, brain blood flow, funduscopy, visual acuity, OCT; while brain and ocular magnetic resonance imaging (MRI), and eye exams including fundus exams and cycloplegic refraction will be conducted preflight and postflight. Moreover, blood pressure and cardiac output will be collected preflight, in-flight, and postflight to assess systemic vascular compliance.</p> <p>Expected Outcomes</p> <ol style="list-style-type: none"> 1. Significant in-flight change in at least one or more of the following variables will occur: visual acuity, intraocular pressure, optic disc edema (papilledema), chorioretinal folds, optic nerve sheath distention, optic nerve tortuosity, optic nerve-to-sheath ratio, globe flattening, and retinal "cotton-wool spots." In addition, these variables will return to pre-flight values during the postflight recovery period. 2. It is expected that if an in-flight or postflight measure deviates from preflight baseline measures, it may have a prolonged recovery to baseline (preflight values) that is positively associated with severity. <p>Specific Aims</p> <p>Characterize the temporal profile of ocular, neurological, and cardiovascular variables associated with the development of SANS before, during, and after long-duration ISS missions.</p> <p>See also: http://www.nasa.gov/</p>
Rationale for HRP Directed Research:	<p>This research is directed because it contains highly constrained research and there is insufficient time. This research is highly constrained because it is proposing additional data collections of MRID measures pre-, in-, and postflight. Since the co-investigative team collects the MRID data, they are the best source to collect this data as well. Due to the visibility of this risk, there is pressure to characterize the visual changes associated with spaceflight in order to begin to identify the underlying cause. The results of this study will help define and frame the new Risk of Microgravity-Induced Visual Impairment/Intracranial Pressure.</p>
Research Impact/Earth Benefits:	<p>Terrestrial Benefits:</p> <ol style="list-style-type: none"> 1. Advances in the tools and techniques as part of this SANS research will benefit terrestrial clinical populations. 2. Identifying the cause(s) and risk factors for the SANS syndrome will also inform the cause(s) and risk factors for these terrestrial conditions.
Task Progress:	<p>We have made significant progress over the review period. We have updated and maintained our "Ocular Health" NASA IRB (Institutional Review Board) documents. Thirteen ISS crewmembers participated in the inflight medical surveillance exams and the additional testing specific to this experiment, including the One-Year mission crewmembers. All data collection is complete. Pre- and postflight evaluations included functional eye measures (cycloplegic refraction and visual fields); structural eye measures (funduscopy, optical coherence tomography [OCT], ocular ultrasound, and optical biometry); intraocular pressure (IOP, tonometry); cardiovascular function (via ultrasound with concurrent ECG and blood pressure); blood flow velocity in the middle cerebral artery (MCA) (including an estimate of noninvasive intracranial pressure measured with transcranial Doppler); and magnetic resonance imaging (MRI) to assess eye and optic nerve structure and cerebrospinal fluid flow. In-flight measures included visual acuity, amsler grid, IOP, OCT imaging of the posterior eye, funduscopy, ocular ultrasound, cardiovascular function, and blood flow velocity in the MCA. The primary data analysis is complete.</p> <p>Currently, we are conducting more detailed analysis of key variables that demonstrate significant spaceflight induced changes. Moreover, we are working to integrate the study results across the physiologic systems studied. Currently, multiple manuscripts are being drafted for publication in peer-reviewed journals. Preliminary results were recently reported by Dr. Macias at the 2018 Human Research Program (HRP) Workshop.</p>
Bibliography Type:	Description: (Last Updated: 04/04/2024)
Abstracts for Journals and Proceedings	<p>Macias BR. "Spaceflight associated neuro-ocular syndrome during exploration missions." Invited Talk. The Ohio State University, Biomedical Engineering Seminar Series Presentation, Columbus, OH, October 2018. The Ohio State University, Biomedical Engineering Seminar Series Presentation, Columbus, OH. (Invited), October 2018. , Oct-2018</p>
Abstracts for Journals and Proceedings	<p>Laurie S. "Spaceflight associated neuro-ocular syndrome." Invited Talks: The Ohio State University, Ophthalmology Grand Rounds Presentation, Columbus, OH, October 2018. Invited Talks: The Ohio State University, Ophthalmology Grand Rounds Presentation, Columbus, OH, October 2018. , Oct-2018</p>

Abstracts for Journals and Proceedings	Macias BR, Balasubramanian S, Huang A, Liu JHK, Lee SMC, Laurie S, Feiveson A, Stenger MB. "Fluid Shift Induced Alterations of the Optic Nerve Head and Peripapillary Choroid Assessed using Optical Coherence Tomography." Association for Research in Vision and Ophthalmology Meeting, Baltimore, Maryland, April 2017. Association for Research in Vision and Ophthalmology Meeting, Baltimore, Maryland, April 2017. , Apr-2017
Abstracts for Journals and Proceedings	Sass A, Rohr J, Stenger M, Macias B, Sargsyan A, Martin B. "Automated method to quantify 3D geometric alterations of the optic nerve and sheath in astronauts." 33rd Annual Meeting of the American Society for Gravitational and Space Research, Seattle, WA, October 25-28, 2017. 33rd Annual Meeting of the American Society for Gravitational and Space Research, Seattle, WA, October 25-28, 2017. , Oct-2017
Abstracts for Journals and Proceedings	Rohr J, Sass A, Sater S, Aldrink B, Stenger M, Macias B, Ethier C, Sargsyan A, Martin B. "Inter-operator Reliability Assessment of Optic Nerve Tortuosity in Long-duration Flight Astronauts." 33rd Annual Meeting of the American Society for Gravitational and Space Research, Seattle, WA, October 25-28, 2017. 33rd Annual Meeting of the American Society for Gravitational and Space Research, Seattle, WA, October 25-28, 2017. , Oct-2017
Abstracts for Journals and Proceedings	Macias BR, Otto C, Ploutz-Snyder R, Sargsyan A, Alexander D, Kramer L, Riascos R, Samuels B, Gibson C, Patel N, Lee S, Laurie S, Stenger M. "Prospective Observational Study of Ocular Health in ISS Crews – The Ocular Health Study." 2018 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 22-25, 2018. 2018 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 22-25, 2018. , Jan-2018