

<b>Fiscal Year:</b>	FY 2020	<b>Task Last Updated:</b>	FY 11/22/2019
<b>PI Name:</b>	Macias, Brandon Ph.D.		
<b>Project Title:</b>	Investigating Structure and Function of the Eye		
<b>Division Name:</b>	Human Research		
<b>Program/Discipline:</b>			
<b>Program/Discipline--Element/Subdiscipline:</b>			
<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 (SANS)		
<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>PI Organization Type:</b>	NASA CENTER	<b>Phone:</b>	281-483-2026
<b>Organization Name:</b>	NASA Johnson Space Center		
<b>PI Address 1:</b>	Johnson Space Center Cardiovascular and Vision Laboratory		
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<b>City:</b>	Houston	<b>State:</b>	TX
<b>Zip Code:</b>	77058	<b>Congressional District:</b>	36
<b>Comments:</b>	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.		
<b>Project Type:</b>	FLIGHT	<b>Solicitation / Funding Source:</b>	2017-2018 HERO 80JSC017N0001-BPBA Topics in Biological, Physiological, and Behavioral Adaptations to Spaceflight. Appendix C
<b>Start Date:</b>	01/30/2019	<b>End Date:</b>	09/30/2025
<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>	NASA JSC
<b>Contact Monitor:</b>	Norsk, Peter	<b>Contact Phone:</b>	
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<b>Flight Program:</b>			
<b>Flight Assignment:</b>	NOTE: End date changed to 9/30/2025 per PI (Ed., 12/21/19)		
<b>Key Personnel Changes/Previous PI:</b>	November 2019 report--Key Personnel Added to Project Team: Larry Kramer, Charles Gibson. Key Personnel Removed from Project Team: Jocelyn Dunn.		
<b>COI Name (Institution):</b>	Brunstetter, Tyson O.D., Ph.D. ( U.S. Navy (Detailed to NASA Johnson Space Center) ) Feiveson, Alan Ph.D. ( NASA Johnson Space Center ) Hargens, Alan Ph.D. ( University of California, San Diego ) Huang, Alex M.D., Ph.D. ( Doheny Eye Institute ) Karanjia, Rustum M.D., Ph.D. ( Doheny Eye Institute ) Laurie, Steven Ph.D. ( KBR/NASA Johnson Space Center ) Martin, Bryn Ph.D. ( University of Idaho, Moscow ) Sadda, Srinivas M.D. ( Doheny Eye Institute ) Smith, Scott Ph.D. ( NASA Johnson Space Center ) Zwart, Sara Ph.D. ( University of Texas, Galveston ) Loerch, Linda M.S. ( NASA Johnson Space Center )		

	<p>Lee, Stuart Ph.D. ( KBR/NASA Johnson Space Center )  Gibson, Charles O.D. ( Coastal Eye Associates )  Kramer, Larry M.D. ( University of Texas Health Science Center, Houston )</p>
<b>Grant/Contract No.:</b>	Internal Project
<b>Performance Goal No.:</b>	
<b>Performance Goal Text:</b>	
<b>Task Description:</b>	<p>This proposal will identify if ocular structure and function alterations occur at a greater frequency and magnitude during one-year missions compared to six-month and six-week expeditions and whether the recovery profile is dependent upon mission duration. In addition, this project will determine if changes in vascular structure and function are greater after one-year missions and contribute to alterations in ocular structure and function. The identification of structural and functional changes will provide NASA the information necessary to inform the risk posture for future interplanetary expeditions with duration of up to three years and to identify possible countermeasures.</p> <p><b>SPECIFIC AIMS</b></p> <p>Conducting Spaceflight Associated Neuro-ocular Syndrome (SANS) research on one-year, six-month, and short-duration (2-month) crew members will enable us to objectively generate data to help NASA determine if and how SANS symptoms worsen with mission duration. These new data from longer missions will enable us to develop a non-linear trend model that can be extrapolated to make predictions for even longer missions, up to three years, and therefore help NASA to define the risk posture for future interplanetary expeditions, and to identify possible countermeasures by the following specific aims:</p> <p>Specific Aim 1: To determine if ocular structural changes develop to a greater degree (frequency or magnitude) during long-duration one-year spaceflight missions compared to findings during shorter length missions and if recovery is prolonged after longer missions.</p> <p>Specific Aim 2: To determine if ocular vascular structure is altered to a greater degree during long-duration one-year spaceflight missions, and if recovery is more prolonged.</p> <p>Specific Aim 3: To determine if ocular function is altered to a greater degree during long duration one-year spaceflight missions, and the recovery profile.</p> <p>Specific Aim 4: To determine if measures of vascular structure and function are altered to a greater degree during long-duration one-year spaceflight missions and if these vascular adaptations correlate with alterations in ocular structure and function.</p> <p><b>RELEVANCE &amp; MAP TO HUMAN RESEARCH ROADMAP</b></p> <p>This multi-project proposal is in response to NASA research announcement Human Exploration Research Opportunities (HERO), 80JSC017N0001-BPBA, Appendix C, Topic 1: Analyses of the Temporal Nature of Human Adaptation to Long-Duration Low-Earth Orbit Mission Virtual NASA Specialized Center of Research (VNSCOR). This proposal addresses multiple Human Research Program (HRP) Integrated Research Plan Gaps, including: SANS1: We do not know the etiological mechanisms and contributing risk factors for ocular structural and functional changes seen in-flight and postflight. SANS12: We do not know whether ground-based analogs and/or models can simulate Space Associated Neuro-ocular Syndrome.</p>
<b>Rationale for HRP Directed Research:</b>	
<b>Research Impact/Earth Benefits:</b>	<p>The Investigating Structure and Function of the Eye (iSAFE) research study will advance NASA's understanding of Spaceflight Associated Neuro-ocular Syndrome (SANS), an important human health and performance risk, by quantifying how ocular alterations develop as a function of spaceflight duration and identifying causative mechanisms.</p> <ul style="list-style-type: none"> <li>• Results from this study are anticipated to lead to a temporal model of SANS progression during long-term missions and to inform the development of countermeasures.</li> </ul> <p>• Given the unique environment of the International Space Station (ISS), commonly used ophthalmic instruments are being implemented in novel operational environments. This work may lead to clinical practice adopting these new hardware, software, or protocol elements, benefiting patients on Earth.</p> <p>• SANS shares characteristics with several terrestrial ophthalmic diseases, such as papilledema, and iSAFE study results could provide new insights into mechanisms underlying these conditions.</p>
<b>Task Progress:</b>	<p>Within this reporting period NASA Institutional Review Board (IRB) approval was obtained. The Principal Investigator (PI) team on this project is working with NASA Research Operations and Integration Element to integrate this project with the other selected one year mission projects. In addition, for the standard duration 6-month mission group, the Research Operations and Integration feasibility assessment is complete and this mission group received select for flight approval by the Human Research Program Control Board. We acquired intraocular pressure, visual fields, and electroretinogram hardware for ground baseline data collection. In collaboration with Research Operations and Integration, we conducted initial training activities for the visual fields and electroretinogram hardware with the vendor.</p>
<b>Bibliography Type:</b>	Description: (Last Updated: 02/26/2024)
<b>Articles in Peer-reviewed Journals</b>	<p>Huang AS, Stenger MB, Macias BR. "Gravitational influence on intraocular pressure: Implications for spaceflight and disease." J Glaucoma. 2019 Aug;28(8):756-64. Epub 2019 May 31. <a href="https://doi.org/10.1097/IJG.0000000000001293">https://doi.org/10.1097/IJG.0000000000001293</a> ; PubMed <a href="https://pubmed.ncbi.nlm.nih.gov/31162175/">PMID: 31162175</a>; PubMed Central <a href="https://pubmed.ncbi.nlm.nih.gov/PMC6786882/">PMCID: PMC6786882</a> , Aug-2019</p>

## Articles in Peer-reviewed Journals

Stenger MB, Laurie SS, Sadda SR, Sadun AA, Macias BR, Huang AS. "Focus on the optic nerve head in spaceflight-associated neuro-ocular syndrome." *Ophthalmology*. 2019 Dec;126(12):1604-6. <https://doi.org/10.1016/j.ophtha.2019.09.009> ; PubMed [PMID: 31759496](#) , Dec-2019