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| **Fiscal Year:** | FY 2016 | **Task Last Updated:** | FY 01/05/2017 |
| **PI Name:** | Laurie, Steven Ph.D. | | |
| **Project Title:** | Integrative Physiology of VIIP: Cardiopulmonary, Sleep, and Cognitive Function Assessment During Hypercapnic Bed Rest | | |
| **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) **Immune**:Risk of Adverse Health Event Due to Altered Immune Response<br>(2) **SANS**:Risk of Spaceflight Associated Neuro-ocular Syndrome (SANS) | | |
| **Space Biology Element:** | None | | |
| **Space Biology Cross-Element Discipline:** | None | | |
| **Space Biology Special Category:** | None | | |
| **PI Email:** | steven.laurie@nasa.gov | **Fax:** | FY |
| **PI Organization Type:** | NASA CENTER | **Phone:** | 281-244-0029 |
| **Organization Name:** | KBR/NASA Johnson Space Center | | |
| **PI Address 1:** | Cardiovascular and Vision Laboratory | | |
| **PI Address 2:** | 2400 NASA Pkwy | | |
| **PI Web Page:** | | | |
| **City:** | Houston | **State:** | TX |
| **Zip Code:** | 77058-2749 | **Congressional District:** | 36 |
| **Comments:** | | | |
| **Project Type:** | GROUND | **Solicitation / Funding Source:** | 2014-15 HERO NNJ14ZSA001N-MIXEDTOPICS. Appendix E: Behavioral Health & Human Health Countermeasures Topics |
| **Start Date:** | 04/01/2016 | **End Date:** | 06/07/2018 |
| **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 |
| **Contact Monitor:** | Norsk, Peter | **Contact Phone:** | |
| **Contact Email:** | Peter.norsk@nasa.gov | | |
| **Flight Program:** | | | |
| **Flight Assignment:** | | | |
| **Key Personnel Changes/Previous PI:** | | | |
| **COI Name (Institution):** | Hu, Xiao Ph.D. ( University of California, San Francisco )<br>Lathan, Corrinna Ph.D. ( AnthroTronix, Inc. )<br>Lee, Stuart Ph.D. ( Wyle Laboratories, Inc./NASA Johnson Space Center )<br>Lovering, Andrew Ph.D. ( University of Orego )<br>Martin, David M.S. ( Wyle Laboratories, Inc./NASA Johnson Space Center )<br>Ploutz-Snyder, Robert Ph.D. ( Universities Space Research Association )<br>Stenger, Michael Ph.D. ( Wyle Laboratories, Inc./NASA Johnson Space Center ) | | |
| **Grant/Contract No.:** | Internal Project | | |
| **Performance Goal No.:** | | | |

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| **Performance Goal Text:** | |
| **Task Description:** | Over 70% of crew members completing long-duration space flight missions have developed ocular structural and functional changes that characterize the Vision Impairment Intracranial Pressure (VIIP) syndrome, yet no ground-based analogs have successfully replicated these symptoms. Carbon dioxide ($CO_2$) is elevated on the International Space Station (ISS) and has been hypothesized to contribute to the development of VIIP, which may explain why previous ground-based analog studies which have not included elevated $CO_2$ levels in the ambient air have not successfully replicated VIIP. The research outlined in this grant proposal seeks to link physiological changes that occur during exposure to chronic hypercapnia (elevated carbon dioxide, 0.5% $CO_2$ inspired) similar to that occurring on ISS, in subjects undergoing the space flight analog of 6° head-down tilt bed rest, with changes associated with the VIIP syndrome and decrements in cognition, sleep quality, and circadian alignment. Optical coherence tomography, intraocular pressure, cerebral and ocular blood flow, and sensitivity to carbon dioxide will be used to assess the development of VIIP and determine the relationship between physiological changes associated with hypercapnic bed rest and VIIP symptoms. Cognitive function will be assessed using two tools: the Cognition battery currently being tested on ISS crew members, and the Defense Automated Neurobehavioral Assessment, the only FDA-cleared computerized cognitive assessment tool which has been validated in thousands of active military personnel. The American Academy of Sleep Medicine compliant Embletta GOLD Portable Sleep System will be used to assess sleep quality and body temperature measured via telemetry will be used to determine circadian misalignment. This research proposal addresses multiple risks within NASA's Integrated Research Plan, including determining if this unique ground-based analog can simulate VIIP, and if the mild hypercapnic environment represents a threat to behavioral health and performance, sleep quality, and normal circadian rhythm. |
| **Rationale for HRP Directed Research:** | |
| **Research Impact/Earth Benefits:** | |
| **Task Progress:** | New project for FY2016. |
| **Bibliography Type:** | Description: (Last Updated: 05/05/2023) |