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| <b>Fiscal Year:</b>                                    | FY 2021   | <b>Task Last Updated:</b>                 | FY 06/02/2021  |
| <b>PI Name:</b>  | Marshall-Goebel, Karina Ph.D.   |   |  |
| <b>Project Title:</b>                                  | Characterization of Jugular Venous Blood Flow during Acute Fluid Shifts   |   |  |
| <b>Division Name:</b>                                  | Human Research  |   |  |
| <b>Program/Discipline:</b>                             |   |   |  |
| <b>Program/Discipline--<br/>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>Cardiovascular:</b> Risk of Cardiovascular Adaptations Contributing to Adverse Mission Performance and Health Outcomes   |   |  |
| <b>Space Biology Element:</b>                          | None  |   |  |
| <b>Space Biology Cross-Element<br/>Discipline:</b>     | None  |   |  |
| <b>Space Biology Special Category:</b>                 | None  |   |  |
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| <b>PI Organization Type:</b>                           | NASA CENTER   | <b>Phone:</b>                             | 281-792-9996   |
| <b>Organization Name:</b>                              | NASA Johnson Space Center   |   |  |
| <b>PI Address 1:</b>                                   | Mail Code SK111   |   |  |
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| <b>PI Web Page:</b>                                    |   |   |  |
| <b>City:</b>   | Houston   | <b>State:</b>                             | TX   |
| <b>Zip Code:</b>                                       | 77058   | <b>Congressional<br/>District:</b>        | 36   |
| <b>Comments:</b>                                       | New affiliation as of spring 2022: NASA Johnson Space Center; Human Physiology, Performance, Protection & Operations (H-3PO) Laboratory New affiliation as of fall 2018: KBR/NASA Johnson Space Center, Cardiovascular and Vision Laboratory, Houston; previously at Massachusetts General Hospital |   |  |
| <b>Project Type:</b>                                   | GROUND  | <b>Solicitation /<br/>Funding Source:</b> | 2019 HERO 80JSC019N0001-FLAGSHIP & OMNIBUS: Human Research Program Crew Health. Appendix A&B |
| <b>Start Date:</b>                                     | 08/01/2020  | <b>End Date:</b>                          | 11/01/2022   |
| <b>No. of Post Docs:</b>                               | <b>No. of PhD Degrees:</b>  |   |  |
| <b>No. of PhD Candidates:</b>                          | <b>No. of Master'<br/>Degrees:</b>  |   |  |
| <b>No. of Master's Candidates:</b>                     | <b>No. of Bachelor's<br/>Degrees:</b>   |   |  |
| <b>No. of Bachelor's Candidates:</b>                   | <b>Monitoring Center:</b> NASA JSC  |   |  |
| <b>Contact Monitor:</b>                                | Stenger, Michael  | <b>Contact Phone:</b>                     | 281-483-1311   |
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| <b>Flight Program:</b>                                 |   |   |  |
| <b>Flight Assignment:</b>                              | NOTE: End date changed to 11/1/2022 per C. Ribeiro/HHC/JSC (Ed., 5/18/21)   |   |  |
| <b>Key Personnel Changes/Previous PI:</b>              | June 2021 report: Millennia Young, Jason Lytle, Jessica Jasien, and Laura Pardon were added as co-investigators to this project; Nathaniel Mercaldo and Linda Loerch are no longer working on the project.  |   |  |

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| <b>COI Name (Institution):</b>                | Greenwald, Scott Ph.D. ( KBR/NASA Johnson Space Center )<br>Laurie, Steven Ph.D. ( KBR/NASA Johnson Space Center )<br>Lee, Stuart Ph.D. ( KBR/NASA Johnson Space Center )<br>Macias, Brandon Ph.D. ( NASA Johnson Space Center )<br>Martin, David M.S. ( KBR/NASA Johnson Space Center )<br>Young, Millennia Ph.D. ( NASA Johnson Space Center )<br>Lytle, Jaon Ph.D. ( KBR/NASA Johnson Space Center )<br>Jasien, Jessica Ph.D. ( KBR/NASA Johnson Space Center )<br>Pardon, Laura O.D., Ph.D. ( KBR/NASA Johnson Space Center )   |
| <b>Grant/Contract No.:</b>                    | Internal Project  |
| <b>Performance Goal No.:</b>                  |   |
| <b>Performance Goal Text:</b>                 |   |
| <b>Task Description:</b>                      | Cerebral venous congestion leading to decreased cerebral venous outflow is hypothesized to contribute to the development of the spaceflight associated neuro-ocular syndrome (SANS) in astronauts. Recently, our team discovered that chronic exposure to weightlessness can result in stagnant or retrograde blood flow in the internal jugular vein (IJV) during long-duration missions onboard the International Space Station (ISS). While venous stasis was observed in the Fluid Shifts study after 50 days of spaceflight, it is unknown if this is an immediate effect of weightlessness. Characterizing the temporal profile of the headward fluid shift that occurs secondary to weightlessness is crucial as IJV blood flow stasis could be a significant risk for civilian commercial spaceflight, lunar missions, and exploration class missions in addition to ISS missions. Thus, we will utilize 2D and Doppler ultrasonography to investigate cerebral venous drainage pathways during acute weightlessness via parabolic flight to determine the temporal profile of cerebral venous congestion.  |
| <b>Rationale for HRP Directed Research:</b>   |   |
| <b>Research Impact/Earth Benefits:</b>        |   |
| <b>Task Progress:</b>                         | This study has been assigned to the 162nd Novespace parabolic flight campaign, scheduled to occur in October, 2021. In this reporting period, we were assigned to a Novespace technical point of contact and we prepared and coordinated our parabolic flight study in association with the European Space Agency (ESA) and Novespace. We completed the experimental safety data package – a comprehensive document required by Novespace that describes the experiment, its implementation and protocol, and safety practices. The team also developed data collection procedures, designed the layout of the experiment in the plane (i.e., positions of subjects relative to the sonographers and equipment) and trained multiple operators on the use of the hardware and data collection protocol. We designed the rack units and equipment mounting brackets per Novespace's strict design criteria for parabolic flight. Finally, we conducted multiple simulations to prepare the team for the flights.<br><br>We have received approval from the NASA Institutional Review Board and have submitted all documents to Novespace for the French Ethical Committee approval (Comité de Protection des Personnes). |
| <b>Bibliography Type:</b>                     | Description: (Last Updated: 04/15/2024)   |
| <b>Abstracts for Journals and Proceedings</b> | Marshall-Goebel K, Pardon L, Greenwald S, Laurie S, Lee SMC, Martin D, Mercaldo N, Macias B. "Characterization of Jugular Venous Blood Flow during Acute Fluid Shifts." Virtual poster presentation. 2021 NASA Human Research Program Investigators' Workshop, Virtual, February 1-4, 2021.<br>Abstracts. 2021 NASA Human Research Program Investigators' Workshop, Virtual, February 1-4, 2021. , Feb-2021   |