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| **Fiscal Year:** | FY 2011 | **Task Last Updated:** | FY 05/04/2011 |
| **PI Name:** | Moore, Steven T. Ph.D. | | |
| **Project Title:** | Galvanic Vestibular Stimulation (GVS) as an analogue of post-flight sensorimotor dysfunction | | |
| **Division Name:** | Human Research | | |
| **Program/Discipline:** | NSBRI | | |
| **Program/Discipline--Element/Subdiscipline:** | NSBRI--Sensorimotor Adaptation Team | | |
| **Joint Agency Name:** | | **TechPort:** | Yes |
| **Human Research Program Elements:** | (1) **HHC**:Human Health Countermeasures | | |
| **Human Research Program Risks:** | (1) **Sensorimotor**:Risk of Altered Sensorimotor/Vestibular Function Impacting Critical Mission Tasks | | |
| **Space Biology Element:** | None | | |
| **Space Biology Cross-Element Discipline:** | None | | |
| **Space Biology Special Category:** | None | | |
| **PI Email:** | s.moore@cqu.edu.au | **Fax:** | FY |
| **PI Organization Type:** | UNIVERSITY | **Phone:** | 212-241-1943 |
| **Organization Name:** | Mount Sinai School of Medicine | | |
| **PI Address 1:** | Human Aerospace Laboratory | | |
| **PI Address 2:** | Department of Neurology | | |
| **PI Web Page:** | | | |
| **City:** | New York | **State:** | NY |
| **Zip Code:** | 10029 | **Congressional District:** | 14 |
| **Comments:** | NOTE: PI moved to Central Queensland University, Australia, July 2016. | | |
| **Project Type:** | GROUND | **Solicitation / Funding Source:** | 2007 Crew Health NNJ07ZSA002N |
| **Start Date:** | 05/01/2008 | **End Date:** | 04/30/2012 |
| **No. of Post Docs:** | 2 | **No. of PhD Degrees:** | 0 |
| **No. of PhD Candidates:** | 0 | **No. of Master' Degrees:** | 0 |
| **No. of Master's Candidates:** | 0 | **No. of Bachelor's Degrees:** | 0 |
| **No. of Bachelor's Candidates:** | 0 | **Monitoring Center:** | NSBRI |
| **Contact Monitor:** | | **Contact Phone:** | |
| **Contact Email:** | | | |
| **Flight Program:** | | | |
| **Flight Assignment:** | | | |
| **Key Personnel Changes/Previous PI:** | | | |
| **COI Name (Institution):** | Bloomberg, Jacob ( NASA JSC )<br>Curthoys, Ian ( University of Sydney ) | | |
| **Grant/Contract No.:** | NCC 9-58-SA01603 | | |
| **Performance Goal No.:** | | | |
| **Performance Goal Text:** | | | |
| **Task Description:** | The recent NASA Small Assessment Team (SAT) and the draft NASA Human Research Program (HRP) Integrated Research Plan evaluated sensorimotor risks for future exploration class missions. A high priority was placed on the development and validation of ground-based operational tests to determine the effects of long-term microgravity exposure on sensorimotor performance, particularly manned control or supervision of spacecraft during docking and landing maneuvers. Head down bed rest (HDBR) was suggested as the ground-based analogue with which to conduct these tests. However, our recent artificial gravity study has demonstrated that HDBR does not reproduce sensorimotor deficits observed following spaceflight. There is currently no operational analogue of post-flight sensorimotor effects, and the primary aim of this proposal is to deliver such a system to facilitate the sensorimotor risk assessments mandated by the NASA SAT and HRP, as well as for crew training and countermeasure development. To this end we have developed a prototype ambulatory system that generates a reversible sensorimotor deficit. The system uses Galvanic | | |

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| | vestibular stimulation (GVS), which modulates afferent vestibular input with a pseudorandom current delivered via surface electrodes placed on the skin behind each ear. The GVS analogue has been designed such that the sensorimotor perturbation delivered accurately reproduces postural, locomotor, gaze and perceptual deficits observed in astronauts following short and long duration missions, without inducing significant motion sickness symptoms. In this proposal we aim to bring the GVS sensorimotor analogue to operational readiness by answering the following critical questions: (i) What are the optimal parameters for a single exposure to the GVS analogue? (ii) What is the long-term response to GVS? (iii) How well does the GVS analogue reproduce post-flight deficits in shuttle landing performance? |
| **Rationale for HRP Directed Research:** | |
| **Research Impact/Earth Benefits:** | Our GVS paradigm disrupts normal functioning of the human vestibular system, essentially adding noise to veridical afferent information from the peripheral vestibular apparatus. In our studies we have shown that GVS replicates the sensorimotor dysfunction observed in astronauts post-flight (gait, gaze, balance, manual control). The GVS approach may be useful for modeling spatial disorientation in commercial aviation. Another potential application is modeling of vestibular pathology. |
| **Task Progress:** | Specific Aim 1. Optimal parameters for GVS exposure Data collection, analysis and writing of publications has been completed for this aim.<br>Dilda, V, MacDougall HG, Moore ST. Tolerance to extended Galvanic vestibular stimulation: optimal exposure for astronaut training Aviat Space Environ Med 2011; In Press.<br>Dilda, V, MacDougall HG, Curthoys IS, Moore ST. Effects of Galvanic vestibular stimulation on cognitive function . J Appl Physiol 2011 - in review .<br>Specific Aim 2. Long-term response to the GVS analogue<br>We have recruited 20 subjects for this experiment and will begin data collection the first week of April 2011.<br>Specific Aim 3. GVS as an analogue of spatial disorientation during orbiter landings<br>Data collection, analysis and writing of publications has been completed for this aim.<br>Moore ST, Dilda, V, MacDougall HG. Galvanic vestibular stimulation as an analogue of spatial disorientation after spaceflight. Aviat Space Environ Med 2011; In Press. |
| **Bibliography Type:** | Description: (Last Updated: 09/07/2020) |
| **Articles in Other Journals or Periodicals** | Dilda V, MacDougall HG, Curthoys IS, Moore ST. "Effects of Galvanic vestibular stimulation on cognitive function." J Appl Physiol. In review, as of March 2011. , Mar-2011 |
| **Articles in Other Journals or Periodicals** | Dilda V, MacDougall HG, Moore ST. "Tolerance to extended Galvanic vestibular stimulation: optimal exposure for astronaut training." Aviat Space Environ Med. In press, as of March 2011. , Mar-2011 |
| **Articles in Other Journals or Periodicals** | Moore ST, Dilda V, MacDougall HG. "Galvanic vestibular stimulation as an analogue of spatial disorientation after spaceflight." Aviat Space Environ Med. In press, as of March 2011. , Mar-2011 |
| **Awards** | Moore ST, MacDougall HG, Ondo WG. "Journal of NeuroScience Methods, Top cited paper 2008-2010. 'Ambulatory monitoring of freezing of gait in Parkinson's disease.' J Neurosci Methods. 2008 Jan 30;167(2):340-8. " Nov-2010 |
| **Awards** | Dilda V. "Valentina Dilda: ESA Young Researchers Award, June 2010." Jun-2010 |