PREDICTIVE MEASURES OF LOCOMOTOR PERFORMANCE ON AN UNSTABLE WALKING SURFACE

J. J. Bloomberg[1], B.T. Peters[2], A.P. Mulavara[3], E.E. Caldwell[2], C.D. Batson[4], Y.E. De Dios[2], N.E. Gadd[2], R. Goel[5], S.J. Wood[6], H.S. Cohen[7], L.I. Oddsson[8], and R.D. Seidler[9]

[1]NASA-Johnson Space Center, Mail Code: SK272. Houston, TX, (jacob.j.bloomberg@nasa.gov), [2]Wyle Science, Technology, & Engineering Group, Houston, TX, [3]Universities Space Research Association, Houston, TX, [4]MEI Technologies, Inc., Houston, TX, [5]Department of Health and Human Performance, University of Houston, Houston, TX, [6]Azusa Pacific University, Azusa, CA, [7]Baylor College of Medicine, Houston, TX, **[8]**University of Minnesota, Minneapolis, MN, [9]University of Michigan, Dept. of Psychology & School of Kinesiology, Ann Arbor, MI

INTRODUCTION: Locomotion requires integration of visual, vestibular, and somatosensory information to produce the appropriate motor output to control movement. The degree to which these sensory inputs are weighted and reorganized in discordant sensory environments varies by individual and may be predictive of the ability to adapt to novel environments. The goals of this project are to: 1) develop a set of predictive measures capable of identifying individual differences in sensorimotor adaptability, and 2) use this information to inform the design of training countermeasures designed to enhance the ability of astronauts to adapt to gravitational transitions improving balance and locomotor performance after a Mars landing and enhancing egress capability after a landing on Earth.

METHODS: As part of a larger set of measures, subjects performed tests that delineated individual sensory bias in tests of visual and proprioceptive function. Subjects were also tested in their ability to negotiate a complex obstacle course while wearing up-down vision displacing goggles to assess individual ability to engage strategic (immediate) adaptive responses. These results were then compared to individual locomotor performance during the initial exposure to a locomotor challenge consisting of walking on a treadmill-motion base system that provided destabilizing support surface movement. To assess postural stability the change in stride frequency during support surface movement was compared to unperturbed treadmill walking.

RESULTS: Tests of both visual dependency and proprioceptive sensitivity along with the rate of visuomotor adaptation on the obstacle course correlated with individual ability to maintain postural stability during support surface motion on the treadmill-motion based system.

DISCUSSION: These data indicate that how the CNS processes visual and proprioceptive information and ability to rapidly produce visuomotor adaptation can be predictive of individual responses to novel locomotor challenges. Future analysis will focus on cognitive, brain structural and functional metrics using neuroimaging and genetic makers as potential predictors of sensorimotor adaptability.