

# **EFFECT OF CARBON DIOXIDE EXPOSURE ON PHYSICAL AND COGNITIVE PERFORMANCE IN A SIMULATED SPACEFLIGHT CONTINGENCY SCENARIO**

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## **INTRODUCTION:**

Carbon dioxide (CO<sub>2</sub>) produced by astronauts inside space suits can accumulate to levels that may affect health and performance. The human health and performance risks associated with different levels of CO<sub>2</sub> exposure in the flight environment remain an area of debate. The purpose of this study is to characterize the limit of acceptable performance (cognitive and physical) decrements and symptom severity for mission operations when subjected to elevated inspired CO<sub>2</sub> levels in simulated contingency lunar extravehicular activity (EVA) scenarios.

## **METHODS:**

This study will create a simulation of a 1-hour, ~2km contingency EVA walk back to a habitat, incorporating a passive treadmill and a fully immersive virtual reality (VR) simulation of a lunar EVA environment. Subjects will be asked to walk on a treadmill while breathing partial pressures of CO<sub>2</sub> of 0, 5, 10, 15, 20, 25, 30mmHg for 1 hour at a time. Cognitive performance will be quantified using validated cognitive tests and measures of functional task performance embedded within the VR environment. Test subject symptoms and self-assessment of performance will be evaluated via survey.

## **RESULTS:**

This study currently has approval from NASA's Institutional Review Board and has completed the Test Readiness Review process. Next steps for this research study include test subject recruitment, data collection, and analysis. Data collection is planned for calendar year 2023 and 2024.

## **DISCUSSION:**

This study will provide valuable information regarding how various partial pressures of CO<sub>2</sub> exposure impact acute health, as well as cognitive and physical performance during simulated contingency lunar EVA. This information will enable assessment of health and performance risk associated with spacesuit systems and operations concepts for future exploration missions as well as informing definition of future standards and requirements.