Results from Carbon Dioxide Washout Testing Using a Suited Manikin Test Apparatus with a Space Suit Ventilation Test Loop

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NASA is developing an advanced portable life support system (PLSS) to meet the needs of a new NASA advanced space suit. The PLSS is one of the most critical aspects of the space suit providing the necessary oxygen, ventilation, and thermal protection for an astronaut performing a spacewalk. The ventilation subsystem in the PLSS must provide sufficient carbon dioxide (CO₂) removal and ensure that the CO₂ is washed away from the oronasal region of the astronaut. CO₂ washout is a term used to describe the mechanism by which CO₂ levels are controlled within the helmet to limit the concentration of CO₂ inhaled by the astronaut. Accumulation of CO₂ in the helmet or throughout the ventilation loop could cause the suited astronaut to experience hypercapnia (excessive carbon dioxide in the blood). A suited manikin test apparatus (SMTA) integrated with a space suit ventilation test loop was designed, developed, and assembled at NASA in order to experimentally validate adequate CO₂ removal throughout the PLSS ventilation subsystem and to quantify CO₂ washout performance under various conditions. The test results from this integrated system will be used to validate analytical models and augment human testing. This paper presents the system integration of the PLSS ventilation test loop with the SMTA including the newly developed regenerative Rapid Cycle Amine component used for CO₂ removal and tidal breathing capability to emulate the human. The testing and analytical results of the integrated system are presented along with future work.

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