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Title: V-SUIT Model Validation Using PLSS 1.0 Test Results

Abstract (300 words):
The dynamic portable life support system (PLSS) simulation software Virtual Space Suit (V-SUIT) has been under development at the Technische Universität München since 2011 as a spin-off from the Virtual Habitat (V-HAB) project. The MATLAB®-based V-SUIT simulates space suit portable life support systems and their interaction with a detailed and also dynamic human model, as well as the dynamic external environment of a space suit moving on a planetary surface.

To demonstrate the feasibility of a large, system level simulation like V-SUIT, a model of NASA's PLSS 1.0 prototype was created. This prototype was run through an extensive series of tests in 2011. Since the test setup was heavily instrumented, it produced a wealth of data making it ideal for model validation. The implemented model includes all components of the PLSS in both the ventilation and thermal loops. The major components are modeled in greater detail, while smaller and ancillary components are low fidelity black box models. The major components include the Rapid Cycle Amine (RCA) CO_2 removal system, the Primary and Secondary Oxygen Assembly (POS/SOA), the Pressure Garment System Volume Simulator (PGSVS), the Human Metabolic Simulator (HMS), the heat exchanger between the ventilation and thermal loops, the Space Suit Water Membrane Evaporator (SWME) and finally the Liquid Cooling Garment Simulator (LCGS).

Using the created model, dynamic simulations were performed using same test points also used during PLSS 1.0 testing. The results of the simulation were then compared to the test data with special focus on absolute values during the steady state phases and dynamic behavior during the transition between test points.

Quantified simulation results are presented that demonstrate which areas of the V-SUIT model are in need of further refinement and those that are sufficiently close to the test results. Finally, lessons learned from the modelling and validation process are given in combination with implications for the future development of other PLSS models in V-SUIT.

316 Words