

Experimentally determined heat transfer coefficients for spacesuit liquid cooled garments

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Grant Bue, Carly Watts, Richard Rhodes, Ian Anchondo, David Westheimer, Colin Campbell
NASA Lyndon B. Johnson Space Center, Houston, TX

Walt Vonau, Matt Vogel and Bruce Conger
Jacob Engineering, Houston, TX

A Human-In-The-Loop (HITL) Portable Life Support System 2.0 (PLSS 2.0) test has been conducted at NASA Johnson Space Center in the PLSS Development Laboratory from October 27, 2014 to December 19, 2014. These closed-loop tests of the PLSS 2.0 system integrated with human subjects in the Mark III Suit at 3.7 psi to 4.3 psi above ambient pressure performing treadmill exercise at various metabolic rates from standing rest to 3000 BTU/hr (880 W). The bulk of the PLSS 2.0 was at ambient pressure but effluent water vapor from the Spacesuit Water Membrane Evaporator (SWME) and the Auxiliary Membrane Evaporator (Mini-ME), and effluent carbon dioxide from the Rapid Cycle Amine (RCA) were ported to vacuum to test performance of these components in flight-like conditions. One of the objectives of this test was to determine the heat transfer coefficient (UA) of the Liquid Cooling Garment (LCG). The UA, an important factor for modeling the heat rejection of an LCG, was determined in a variety of conditions by varying inlet water temperature, flowrate, and metabolic rate. Three LCG configurations were tested: the Extravehicular Mobility Unit (EMU) LCG, the Oceanering Space Systems (OSS) LCG, and the OSS auxiliary LCG. Other factors influencing accurate UA determination, such as overall heat balance, LCG fit, and the skin temperature measurement, will also be discussed.