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Performance of a Multifunctional Space Evaporator-Absorber-Radiator (SEAR)

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The Space Evaporator-Absorber-Radiator (SEAR) is a nonventing thermal control subsystem that combines a Space Water Membrane Evaporator (SWME) with a Lithium Chloride Absorber Radiator (LCAR). The LCAR is a heat pump radiator that absorbs water vapor produced in the SWME. Because of the very low water vapor pressure at equilibrium with lithium chloride solution, the LCAR can absorb water vapor at a temperature considerably higher than the SWME, enabling heat rejection by thermal radiation from a relatively small area radiator. Prior SEAR prototypes used a flexible LCAR that was designed to be installed on the outer surface of a portable life support system (PLSS) backpack. This paper describes a SEAR subsystem that incorporates a very compact LCAR. The compact, multifunctional LCAR is built in the form of thin panels that can also serve as the PLSS structural shell. We designed and assembled a 2 ft² prototype LCAR based on this design and measured its performance in thermal vacuum tests when supplied with water vapor by a SWME. These tests validated our models for SEAR performance and showed that there is enough area available on the PLSS backpack shell to enable heat rejection from the LCAR.