

Design and Assembly of an integrated Metabolic heat regenerated Temperature Swing Adsorption (MTSA) Subassembly Engineering Development Unit

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Metabolic heat regenerated Temperature Swing Adsorption (MTSA) technology is being developed for thermal and carbon dioxide (CO₂) control for a Portable Life Support System (PLSS), as well as water recycling. The core of the MTSA technology is a sorbent bed that removes CO₂ from the PLSS ventilation loop gas via a temperature swing. A Condensing Ice Heat eXchanger (CIHX) is used to warm the sorbent while also removing water from the ventilation loop gas. A Sublimation Heat eXchanger (SHX) is used to cool the sorbent. Research was performed to explore an MTSA designed for both lunar and Martian operations. Previously each the sorbent bed, CIHX, and SHX had been built and tested individually on a scale relevant to PLSS operations, but they had not been done so as an integrated subassembly. Design and analysis of an integrated subassembly was performed based on this prior experience and an updated transient system model. Focus was on optimizing the design for Martian operations, but the design can also be used in lunar operations. An Engineering Development Unit (EDU) of an integrated MTSA subassembly was assembled based on the design. Its fabrication is discussed. Some details on the differences between the as-assembled EDU to the future flight unit are considered.