Rapid Cycle Amine (RCA) 3.0 System Development

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The Rapid Cycle Amine (RCA) 3.0 system is currently under development by NASA, the Lyndon B. Johnson Space Center (JSC) in conjunction with United Technologies Corporation Aerospace Systems (UTAS). The RCA technology is a new carbon dioxide (CO_2) and humidity removal system that has been baselined for the Advanced Extravehicular Mobility Unit (AEMU) Portable Life Support System. The evolution of the RCA development has progressed through several iterations of technology readiness levels including RCA 1.0, RCA 2.0, and RCA 3.0 test articles. The RCA is an advancement over currently technologies due to its unique regeneration capability. The RCA is capable of simultaneously removing CO_2 and humidity from an influent air steam and subsequent regeneration when exposed to a vacuum source. The RCA technology uses two solid amine sorbent beds in an alternating fashion to adsorb CO_2 and water (uptake mode) and desorb CO_2 and water (regeneration mode) at the same time. The two beds operate in an efficient manner so that while one bed is in the uptake mode, the other is in the regeneration mode, thus continuously providing an on-service sorbent bed by which CO_2 and humidity may be removed. The RCA 2.0 and 3.0 test articles were designed with a novel valve assembly which allows for switching between uptake and regeneration modes with only one moving part while minimizing gas volume losses to the vacuum source by means of an internal pressure equalization step during actuation. The RCA technology also is low power, small, and has performed extremely well in all development testing thus far. A final design was selected for the RCA 3.0, fabricated, assembled, and performance tested in 2014 with delivery to NASA-JSC in January 2015. This paper will provide an overview on the RCA 3.0 system design and results of pre-delivery testing with references to the development of RCA 1.0 and RCA 2.0.

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