

Habitat Water Wall for Water, Solids, and Atmosphere Recycle and Reuse

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Abstract

Over the last 20 years NASA human planetary/lunar exploration programs have come and gone. However, one fact remains constant across all of them. They are too expensive. Several different Administrations and Congresses have again and again turned down NASA human planetary exploration programs due to costs. What is needed is a radical departure from the status quo which would allow the cost of human spaceflight to be reduced by an order of magnitude. To do this will require a new approach to supporting humans in space.

Current space system architecture is severely limited by launch costs associated with the mass of building and radiation protection materials, and limits to the size (volume) of habitat elements. The membrane water wall concept proposes a system for membrane based structural, thermal, radiation, water, solids and air treatment functions that are embedded into the walls of inflatable or ridged habitat structures to provide novel and potentially game changing mass reuse and structural advantages over current mechanical life support hardware .

This study provides the first evaluation of this concept. It focuses primarily on water and solids treatment. Sizing calculation and functional concepts are developed for this application. Experimental work is provided that focuses on evaluating the performance of passive membrane based forward osmosis treatment of wastewater and dewatering of solid and brine wastes. Air treatment is address from a theoretical perspective and thermal, radiation and structural analysis is left for definition in future studies.