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CONCEPTUAL TECHNOLOGY FOR WATER RECOVERY, WASTE MANAGEMENT AND RADIATION SHIELDING IN MANNED SPACELIGHT

Abstract

After a first step out of this world in the late 1960's, Mankind sets new objectives for the 21st century in terms of space exploration. Its "next giant leap" will likely happen when an astronaut successfully sets foot on Mars or on an asteroid. However, achieving such a historic milestone will require tackling several major technical issues beforehand, especially those linked to carrying humans in an interplanetary mission. Amongst these showstoppers, the need to manage the waste produced during the long duration journey and the urge to establish closed-loop water recovery architectures are at the forefront of the challenges that must be faced. More importantly, space radiation has always been considered as the major hurdle for long duration manned missions. It is therefore necessary to develop effective shielding systems and techniques to limit its harming effects on the human body to achieve a long, safe and sustained human presence in space. This paper sought to design a conceptual technology that would bring a solution to these issues simultaneously. Entirely inspired from nature, this multifunctional life support system mimics peristalsis inside a mammal intestine so as to carefully move and store the solid waste produced by a crew while efficiently extracting water from both liquid and solid waste using osmosis, ubiquitous in nature as well. The system, containing waste and water, could also use the outstanding properties of melanin nanoshells to increase the shielding against hazardous radiation. This reliable, modular and highly redundant "artificial intestine" for spacecraft is anchored in advanced concepts under recent investigation which could lead the way towards long-duration manned-spaceflight in the near future."