

Study of Closed Life Support System for Manned Space Exploration

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To further advance manned space exploration, a critical issue that must be addressed is recycling of resources, especially air revitalization and water reclamation. Japan is already a leader in terrestrial environmental technologies, and aims to apply this know-how to develop air and water recycling technologies for space applications. To support proposed post-ISS missions such as manned lunar or asteroid exploration and an Earth-Moon Lagrange point (EML1) space station, JAXA is developing an air revitalization system for an on-orbit demonstration on the International Space Station (ISS) early in the extended ISS operation period (2015-2020). The requirements for this technical demonstrator have been investigated and its specifications established. Regenerative life support functions include oxygen recovery from carbon dioxide using a combination of CO₂ reduction by a Sabatier process and O₂ generation by electrolysis. Each air and water re-vitalization subsystem is planned to be transported to the ISS separately by H-II Transfer Vehicle (HTV) launches in the Water Electrolysis This paper presents the air re-vitalization system developed by JAXA, and gives details of water electrolysis in microgravity.

A technical issue with space electrolysis systems is that gas-liquid separation is fundamentally different in a microgravity environment to its behavior in a gravity field. It is supposed that the electrode surface will become covered with generated gas. In microgravity, the gas will have to be removed using forced convection. A water/gas separator will be used to separate gas and water.

Keywords: Life Support System, Manned Space Expolaration, Air Re-vitalization, Microgravity, Closed System, Water Electrolysis