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Author: Mr. Arturo Pulido Balderas
Universidad Nacional Autónoma de México (UNAM), Mexico, arturopulidobalderascchsur@gmail.com

WATER IN-SITU RESOURCE UTILIZATION FOR SUSTAINABLE MANNED EXPLORATION OF MARS

Abstract

Water (H2O) is an indispensable natural resource required to sustain life, societies, and the exploration of space. The discovery of permafrost and liquid water deposits close to the surface on the red planet completely changed both technologies and strategies required for successful long-term manned exploration missions to Mars. The objective of this research project was to identify the development of sustainable technologies for in-situ resource utilization of water on the red planet proposed by public-private sectors, space agencies, and academia.

The present study utilized data from remote sensing maps of water ice distribution; technological development of mining technologies, current studies on organic and inorganic oxygen (O2) production, and green propulsion technologies proposed from hydrogen (H2) and oxygen (O2) from water electrolysis (bipropellants).

Ice and liquid water deposits studies are strategic to identify concentrations of salts and sediments in water close to the surface. For instance, magnesium perchlorate Mg (ClO4)2 deposits are ideal for the development of water electrolysis systems. While less saturated deposits are best for plant growth and human consumption after being filtered and de-iced.

Development of sustainable technologies derived from responsible and efficient water utilization on Mars can save costs and mass for interplanetary transportation by producing a variety of irreplaceable resources manned missions to the red planet require for successful completion.

Keywords: Manned missions to Mars, Water (H2O), In-situ resource utilization, Electrolysis, Oxygen (O2), Bipropellant production.