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DESIGN AND TRL5 TEST OF THE REGENERATIVE FUEL CELL SYSTEM (RFCS) FOR LUNAR NIGHT SURVIVAL

Abstract

During the lunar night, landers, rovers, and modules on the Moon's surface require heat and electrical power to prevent their units from freezing. Fuel cells present a promising candidate for this application because of their high energy density and the possibility to exploit the excess heat they generate.

This paper presents the results of ESA's study carried out by Thales Alenia Space Italy, the Centre for Research and Technology-Hellas (CERTH) and the Foundation for Research and Technology-Hellas (FORTH) to design and bring to TRL 5 the Regenerative Fuel Cell System (RFCS).

The RFCS is designed to support the lunar night survival of the future ESA's lunar missions that will land with the new ESA's Argonaut LDE lander. It consists of a fuel cell activated during the lunar night to generate power from gaseous hydrogen and oxygen, and an electrolyser activated during the lunar day to reconvert water in to gaseous H2 and O2. It includes the gas and water tanks, the water separators, the electronics, the valves, the pumps, the structure, and the thermal control.

Test are carried out at unit level and system level. The RFCS breadboard is finally tested in the thermal vacuum chamber to demonstrate function in the relevant environment.