Paper ID: 66026
oral

IAF SPACE POWER SYMPOSIUM (C3)
Space Power System for Ambitious Missions (4)

Author: Mr. Valerio Giuliani
S.A.B. Aerospace Srl, Italy

Mr. Manuele Scipioni
S.A.B. Aerospace Srl, Italy
Mr. Roy Sueda
United States

FUNCTIONAL CHARACTERIZATION AND TESTING OF A HYBRID ENERGY STORAGE SYSTEM APPLIED TO SPACE RESOURCES UTILIZATION

Abstract

In the last few years, the global interest in deep space missions has grown exponentially. Technological developments and studies, carried out through increasingly performing spacecrafts, have given humanity the realistic perception of being able to establish a human outpost on the surface of celestial bodies other than Earth. For this reason, several -current and future- space missions are focused on the development of key technologies to make sustainable human life on another planet possible. Therefore, the production of water and oxygen, starting from the resources available in space environments, is of fundamental importance. Many terrestrial technologies could be applied to this scope, but they shall be optimized both in terms of efficiency and performance customized, as well as in terms of design to withstand specific atmospheric and environmental conditions. Several mission concepts foresee the extraction of water and oxygen starting from elements present within the soil. Hence, excavation and manipulation devices, which require lot of instantaneous electrical power, shall be implemented into complex extraction plants. This means that conventional Electrical Power Subsystems (EPS) shall be improved, in order to provide the extraction systems with very high levels of electrical power and energy, by having mass and volumes as reduced as possible. In this context, SAB Aerospace is developing a hybrid energy storage system composed of a battery pack, characterized by high energy density; and a Lithium-Ion Capacitors (LiCs) bank, characterized by very high-power density. LiCs are a new technology for space applications, but they have higher performance compared to conventional super capacitors used in several space systems. Therefore, SAB is approaching the space qualification process for these components. In this paper, the functional characterization and the performance verification process of the hybrid system will be described. Furthermore, this innovative energy storage system will be studied for lunar Lander applications. In particular, the performance increasing of a regolith excavation system will be assessed and analyzed.