IAF SPACE POWER SYMPOSIUM (C3)
Interactive Presentations - IAF SPACE POWER SYMPOSIUM (IP)

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DEVELOPMENT OF A MODULAR LI-ION BATTERY FOR LEO SATELLITES

Abstract

Technology evolution allows to design always smaller and lighter payloads for LEO satellites, whereas energy demand and power peaks of newest instrumentations are very high. Therefore, it is necessary to adapt satellites buses in terms of stored energy density and power peaks management, in order to ensure correct operation during overall lifetime. In this context, it is extremely important to develop energy storage hardware more and more performing, small and versatile. SAB Aerospace acquired a sturdy flight heritage through the development of a modular battery for LARES (Laser Relativity Satellite) mission launched within the maiden flight of VEGA Launcher. Module mechanical assembly has been developed with the aim of minimizing size of the battery, in order to gather a weight of the structure within 20% of the whole battery pack. Furthermore, the modular battery has been equipped with its own thermal control system, consisting of a couple of thermostats, up to eight thermistors and a string of heaters located under the base plate of each module. The elementary module is made up of eight Li-Ion cells connected in series, which are based on a Lithium-Cobalt (LiCoO2) electrochemical system. Cells not specifically designed for space applications are adopted in order to limit costs and lead time. Based on this heritage SAB is improving design of the modular battery, in order to make it suitable for longer missions. The modularity permits to satisfy a large amount of energy demands for a lot of LEO satellites configurations, depending on the number of integrated modules. Thus, modularity translates in an increase of versatility and in a decrease of development times and costs. A synthetic and effective model philosophy has been defined to demonstrate the compliance with mission requirements. Given its many advantages, SAB battery has been selected for a LEO satellite project (carried out by the Italian National Agency), in order to store and provide electrical energy for a mini-satellite, which shall be operative for 3 years and requires about 1100 Wh, with discharge power peak up to 2 KW. Adoption of innovative Li-Ion cells is being studied with the purpose of being used on this battery in the near future, in order to increase even more performances and life time. A comparison between actual and future battery capabilities is presented and will soon be demonstrated by a test campaign, which foresees the performance of accelerated life cycle test.