

SPACE POWER SYMPOSIUM (C3)
Architectures, concepts and systems for space power (3)

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ARCHITECTURES FOR SMALL SATELLITES: A MODULAR BATTERY SYSTEM

Abstract

The growing interest in the use of small satellites as a quick and inexpensive way to access space is increasing the request of new-concept, lower cost, re-usable, and flexible architectures. Modular approach in small satellite components design is a good answer to such a growing demand.

In the last years, Carlo Gavazzi Space S.p.A. (CGS) has developed modular components for space applications. Recently, CGS, in cooperation with Saft, has started the design and manufacturing of a modular Li-ion battery for small satellites.

Battery modularity is achieved thanks to the capability of integrating a large number of modules if required capacity increases. Thus, the modular battery can satisfy a large number of energy requests for different satellite configurations by simply adding or removing modules, i.e. it does not need to be re-designed and re-qualified for each mission, minimizing development times and costs. It is worth noting that the battery modularity is both electrical and structural. Module structure is designed to facilitate the module side-by-side integration without waste of space. Moreover, after cells modules integration, no further structural element is required to withstand launch mechanical loads.

Each cell module includes eight Saft MPS176065 Li-ion cells and is able to achieve different battery electrical configurations, such as xPyS (parallel in series) and xSyP (series in parallel), by means of an equipped module PCB. Battery module is compatible with two different cells voltage balancing philosophies, i.e. active and passive balancing. In case of active balancing, modular battery integrates n cell modules and a single balancing electronics module carrying out the balancing of cells state of charge and granting the power/housekeeping data connection to the satellite Power Control and Distribution Unit (PCDU). In case of passive balancing, the battery is composed of n cells modules and one connector support as interface with the satellite PDCU. Passive balancing is performed by passive components mounted on cells module PCB.

This paper is focused on the following topics:

- an overview of battery cells characteristics
- a description of modular battery mechanical design
- a description of modular battery electrical design
- an overview of modular battery performances
- a glance at near-future modular battery applications in the frame of different missions (Lares, Miosat, and Prisma)