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DESIGN, INTEGRATION AND TESTING OF A NEW-CONCEPT LI-ION MODULAR BATTERY

Abstract

In recent years, starting from the success story of Agile mission, Carlo Gavazzi Space S.p.A. (CGS) in cooperation with Saft has started the development of a modular Li-ion battery for space applications. Battery modularity lies in the capability of integrating one or more basic elements named “modules” (composed of MPS176065 cells) according to the capacity required by a specific mission. CGS-Saft modular battery can satisfy different energy requests for different satellite configurations by simply adding or removing modules, i.e. it does not need to be re-designed for each mission, minimizing development times and costs. It is worth noting that the battery modularity is both electrical and structural. CGS-Saft modular battery has been selected as energy storage unit for different ASI/ESA missions, such as LARES, MIOSAT, PRISMA, and ESEO.

The first flight opportunity for the modular battery is represented by the qualification flight of VEGA launcher carrying LARES system as main payload. LARES system is supplied by two independent CGS-Saft battery packs. The first one, named Avionic and Harness Battery Unit (ABU) is composed of two basic modules. The second one, named Separation Battery Unit (SBU), includes one basic module. Even if, from a functional point of view, the two battery packs (ABU and SBU) are completely independent, they are mounted the one next to the other composing a higher level assembly named LARES Battery. Such a solution is better from a thermal point of view and limits the waste of space on launcher mounting plate.

LARES battery feeds LARES system, in order to grant:

- the deployment of the LARES satellite, i.e. a scientific satellite for laser ranging, and of other additional micro-satellites
- the support of the VEGA qualification flight by monitoring the environmental conditions in the payload area of the launcher and by telemetering acquired data to the ground.

The proto-flight model of LARES modular battery has successfully completed the manufacturing, the integration phase, and the acceptance tests including vibration, thermal, electrical, and performance tests.

This paper is focused on the following topics:

- glance at CGS-Saft modular battery characteristics
- description of LARES battery design focused on the adaptation of the general CGS-Saft modular concept to the requirements of a specific mission
- overview of LARES battery integration activities

- description of the acceptance tests carried out on the proto-flight model of LARES battery, including a critical analysis of test results.