The LunarSat Power System

Steffen Ruefer, Division of Astronautics, TUM, Germany

LunarSat, the Lunar Academic and Research Satellite, is a micro spacecraft that will be sent into an orbit around the Moon to perform scientific investigations concerning the lunar environment and its characteristics. However, the prime objective of the LunarSat mission is not the scientific return but to serve as an educational and outreach project.

LunarSat is designed by young engineers, scientists, and students from around Europe, with support from numerous institutions and space industry. It shall be launched as an auxiliary payload on an ARIANE 5 ASAP platform and will have a mass of 120 kg in GTO. The nominal mission lifetime will be 6 month in lunar orbit, plus the transfer time from GTO to the Moon (up to 150 days). LunarSat will orbit the Moon in a highly elliptical polar orbit with its perilune above the lunar south pole area. This orbital strategy yields the possibility to obtain images of the lunar South Pole region with a resolution never achieved before. Further measurements shall provide further evidence regarding the existence of water ice in the lunar polar craters.

This paper describes the design, as well as the planned test and manufacture of the LunarSat power system. This system will be able to provide a peak power level of 100 W to the spacecraft, within an allocated mass budget of on the order of 6 kg. The LunarSat power system will use a 28 V +/- 1% regulated Bus architecture, hot redundancy battery charge regulators (BCRs) and battery discharge regulators (BDRs), internal shunts, body mounted GaAs solar arrays and a secondary battery, comprised of Lithium-Ion-cells. LunarSat will be the first spacecraft, relying exclusively on Lithium-Ion-cell technology as secondary battery. The anticipated energy capacity will be on the order of 130 Wh, with a gravimetric energy capacity of 93Wh/kg.

To keep the associated cost as low as possible, the use of commercial-off-the-shelf (COTS) equipment is planned, thus avoiding expensive radiation hardened electronics to the maximum extent possible. Careful mission design and arrangement of the internal components shall limit the radiation dose to acceptable levels for the COTS electronics.