

SPACE POWER SYMPOSIUM (C3)  
Small and Very Small Advanced Space Power Systems (4)

Author: Mr. Jesus Gonzalez  
Kyushu Institute of Technology, Japan

Prof. Kei-ichi Okuyama  
Japan

Mr. Aleksander Lidtke  
University of Southampton, United Kingdom

DESIGN CONSIDERATIONS FOR ELECTRICAL POWER SYSTEM OF SMALL SATELLITE BASED  
ON EFFICIENCY AND RELIABILITY

**Abstract**

The Electrical Power System (EPS) is responsible for harvesting, managing and controlling the satellite's necessary energy. This system is considered a critical component because it must not fail at any time. If this system fails, the spacecraft could not fulfil the mission for which it was designed. A major challenge is to determine what architecture is the best for a small satellite and how it increases redundancy to minimize possible failures during the mission. We have proposed a dual independent input electrical power system to improve mission reliability and, thus, ensure that the satellite works continuously, even when a failure in the primary system occurs. This paper describes the design of the dual EPS and behavior of the modules under different conditions of the space mission: power converters efficiency, battery charge/discharge regulator, the behavior of the protection circuit, and the performance of switching regulators at different load conditions. Additionally, this paper describes trade-off analysis for efficiency, reliability and the use of Commercial off-the-shelf (COTS) components. Therefore, the designed EPS provides a reliable solution to supply power and validates the performance of the subsystems in small satellites. The analysis presented will be helpful to increase the efficiency and reliability of the electrical power systems.