Paper ID: 50689
student

26th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Satellite Missions Global Technical Session (9-GTS.5)

Author: Ms. Nadja Wolf
ArianeGroup, Germany

CONCEPTUAL DESIGN OF AN ELECTRICAL POWER SUPPLY SUB-SYSTEM SUPPORTING EARTH OBSERVATION MISSIONS ON SMALL SATELLITES BY INTRODUCING SYNERGIES WITH THE PROPULSION SUB-SYSTEM

Abstract

During the last years, small satellites have gained increasing popularity due to their low-cost, minimized volume and reduced design and development time yet fulfilling a wide range of objectives of a space mission. However, driven mainly by weight and size limitations, the need for appropriate and adequate performance of space technology persists in the trend towards smaller satellite components. By benefiting from the miniaturization trend in the commercial electronics market and higher efficiencies of photovoltaic and battery technology, power and energy management is still the system driver for remote sensing applications to operate complex payloads in orbit over the mission lifetime. For propulsion, miniaturization has been more challenging, but recently, more effort has been spent on developing new and efficient electric propulsion for small satellites. The industry has come up with several small satellite components; however, synergies between sub-systems concerning lifetime, mass savings or power consumption are still to be improved. This paper focuses on the optimization approach of sub-systems by proposing a conceptual design of two main functions of a small satellite with 500kg of weight in Low Earth Orbit for remote sensing applications. The potential to reduce total spacecraft weight, size and cost is analyzed by identifying synergies between both power and propulsion sub-systems. The design approach follows the systems engineering process starting with the analysis of the high-level and system requirements, followed by selecting the best approach based on various designs and trade-offs. The mission requirements are dedicated to remote sensing missions at a circular, sun-synchronous orbit with an altitude of around 500-700km and an inclination of about 96-99. These parameters are selected to apply to a family of remote sensing missions.