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

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ROBISAT MISSION: DOUBLE UNIT CUBESAT POWER ESTIMATION IN CONTEXT OF QB50 MISSION

Abstract

The paper presents the power budget simulations performed on the satellites RO 01 and RO 01 in context of QB50 CubeSat mission. Satellites RO 01 and RO 02 forming RoBiSAT space mission are part of QB50 - the most challenging and ambitious international small satellites collaboration. In addition to the QB50 mission objectives, RoBisat's goal is to test bidirectional intersatellite communication as a prerequisite for developing future formation flying missions. We present the concept of the two identical satellites that are going to be built and operated in order to achieve these goals. To speed up the development, the flight bus consists of two identical 2U CubeSats built using both existing commercial and in house developed subsystems. The payload includes the QB50 Science unit and the inter-satellite communications unit. The paper elaborates on the available onboard electric power starting from the orbit parameters and required satellite attitude. A detailed simulation has been performed using STK software platform. For a more realistic estimation, the satellite 3D model has been used considering solar cells area, efficiency and position. Using the Solar Panel tool of STK, the orbit available power has been computed. Moreover, the Sun Glint vector has been used for the estimation of the Earth albedo. The QB50 mission requirements for attitude control impose that the satellite long axis shall be aligned with the satellite velocity vector. In case of RoBiSAT satellites, this is done by the use of Y-Thomson maneuver. It was found that this specific attitude requirement for the satellite has a major impact on the power generated. The exact orbit parameters for the QB50 mission are not yet totally defined. However, the initial obit altitude between 350 Km and 400 Km and the orbit inclination of 96.8 deg. are imposed by the mission requirements and are targeted. For the required attitude control it was found that the orbit LTAN dramatically affects the average orbit power. Starting from approximately 2W average orbit power for a 2U CubeSat at LTAN of 12:00 AM, the average orbit power increase to 5.5 W for a LTAN of 6:00 AM for the same satellite. Worst case and respectively best case scenarios has been computed in respect to those assumptions. The simulations have been also performed for the case when the satellite is spinning in order to assess the available power. The satellite operation phases have been computed in accord with the simulated results.