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

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ENERGY EXTRACTION THROUGH SHOCK WAVES DURING RE-ENTRY TO PROVIDE BACKUP FOR SPACECRAFT BATTERIES

Abstract

The space travel is highly crucial and calculated period to plan. Weight optimization is one of the most vital parameter under consideration. Therefore it is prime engineering objective to eliminate the non-essential payload. In spacecraft batteries are important to power up various on board instruments. Charged batteries sent from the earth have some specific endurance limit depending upon the on-board devices it is powering. They cannot be used for multiple re-entries and deep space travel. Backup power supply carried on-board comes with a price of extra weight which can be eliminated by providing a source to charge the batteries. The paper describes the idea of generation of power by extracting the energy from the shock waves during re-entry to charge the batteries. The basic idea is to use the energy which is generated in the form of heat to provide the backup for on-board instruments. While the atmospheric re-entry, a large temperature difference is created across the detached bow shock. These rise in temperature is a forms of energy which is wasted throughout the re-entry. The heat energy can be reused to produce electricity. The stagnation region experiences the maximum amount of temperature rise. The temperature is high enough to destroy the spacecraft if proper shielding measures are not taken. The idea is to introduce a structural change at nosecone region i.e. introducing a composite structure comprising of thermoelectric transducer material layer. This much high temperature is capable of producing good amount of electricity. This method is even applicable in places where the intensity of sunlight is relatively low. This idea is only applicable in the celestial bodies which have thick atmosphere. The paper is fundamentally comprised of two major aspects namely structural optimization and thermoelectric power generation. The major challenge would be to implement this idea in places with relatively thin atmosphere with same effectiveness.