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AN ELECTROMAGNETIC SEPARATION SYSTEM FOR A SPHERICAL SATELLITE

Abstract

Separation from the rocket is a key step of a satellite mission. Compared with common shape satellites, spherical satellites are rare and very difficult to attach to the separation mechanism because a curved surface is hard to fix. Tsinghua University develops a small spherical satellite called Q-Sat, used for atmospheric detection, gravity recovery and panoramic imaging in space. The satellite will be launched in Sep, 2020. To suit the ball shape of Q-Sat, a "point to point" attachment separation system is proposed. The system contains the baring structure, a series of graphene batteries and two symmetrical release actuators. Pyro-based release actuators have been widely used in lots of satellites, but the shortcomings are obvious, such as contaminations, large shock, expensive for small satellites, one-time use so as to be tested only once. To solve the problem, an electromagnetic release actuator using ball-lock mechanism is developed. The electromagnetic actuator has low cost, almost no shock at the moment of releasing and it is easy to store. It can be tested for many times on ground to verify the reliability and measure the separation velocity. The analysis of the force balance is given. The electromagnetic needs high current in a short moment in uncertain environment temperature, so a new kind of graphene batteries are used. Validation tests, including repeated function tests, disturb tests, vibration tests, shock tests, and low temperature tests were conducted. The separation velocity was measured. The ground tests show that the function and reliability of the separation system meet the requirements. The results can provide beneficial reference and technical support in this field.