Paper ID: 8454
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MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures I - Development and Verification (Space Vehicles and Components) (1)

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LOW SHOCK NON-PYRO SEPARATION SYSTEM FOR SMALL SATELLITE FROM LAUNCH VEHICLE

Abstract

The trend for the small satellite development is growing all over the world. Currently, a small satellite QSAT-EOS is being developed at the Kyushu University. Usually, V-band with pyrotechnic devices is used to release a satellite from a launcher. The method has been used in most of the launches until now and has developed high reliability. However, this system has some problems on small satellite component. One of the obstacles for small satellites is the separation shock to the pyrotechnic methods. Pyrotechnic causes a severe shock environment on components of small satellites. There is a possibility that the shock produces improper operating signal in electric devices. In addition, pyrotechnic is quite expensive. Therefore, a low cost and low shock separation system for small satellites has been studied in Kyushu University. The present system uses electric motor as an actuator s to initiate separation. This separation system will be used for the QSAT-EOS launch in the near future. Reliability of our separation mechanism is first discussed in this paper. Reliability of the entire separation system is conducted by analyzing mechanical and electrical performances of all components of the separation mechanism. Thermal and vacuum test is conducted to check the performance of the electric actuator in space environment. Separation tests are conducted to confirm the shock level on a satellite structure and components. The separation velocity and the angular rate after the separation can be also confirmed through the tests. The result of shock response spectrum analysis is reported and compared with that of a pyrotechnic system is shown. In these tests, satellite structure model is used, and the model is held upward with constant force springs in order to cancel acceleration of gravity force. This satellite structure model possesses the same mass and the structural characteristics as QSAT-EOS. In addition, we conduct vibration tests under the required mechanical condition of the H-IIA rocket piggy-back launch. Finally, the results of the tests are used to establish the reliability and the adaptability of the proposed separation mechanism compare to the one with pyrotechnic.