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Mitigation - Tools, Techniques and Challenges (4)

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SPACE DEBRIS MITIGATION MEASURES FOR LOW-ORBIT LAUNCH VEHIVLE

Abstract

As the launch density of launch vehicles of various countries continues to increase, as one of the main sources of space debris, its orbital stage needs to be disposed in a timely and effective manner to prevent the disintegration of the remaining propellant explosion and to deorbit it as far as possible. At the same time, during the powered-flight phase, the pyrotechnic products will also generate operational debris when stage separation & LV/SC separation. It is necessary to minimize the generation of such debris. The number of launch missions in China recent years is among the highest in the world, and the requirements for the mitigation of space debris during the launch process are very urgent. Currently, the launch vehicles used for low-orbit missions are LM-2D, LM-4B/C, LM-6 and YZ-3 upper stage, this paper expounds the practice of space debris mitigation for launch vehicles from aspects of product optimization, flight procedure design, and post-mission disposal. The reverse thrust rocket and the explosion bolt are the main pyrotechnic devices for launch vehicles to perform separation action. The fairing on the top of the reverse thrust rocket needs to pop up during ignition. In order to prevent it from becoming a small space debris, it should be captured. In LV/SC separation devices, strapped mooring brackets and explosive bolt collection boxes are also designed for different products. As the number of multi-satellite launch missions increases, a transponder should be installed on transition capsule to make it a space target that can be monitored on the ground, or add deorbit sails to achieve passively deorbit. After the orbital stage has completed its mission, the propellant discharge passivation operation is performed. The discharge procedure takes into account deorbit operation, and the remaining gas in the pressurized cylinder is introduced into storage tank than emission through the propellant discharge pipe. Or rebuild it to keep it on track and make it an on-orbit experimental platform to use. For the upper stage which the main engine with multiple starting capabilities, a method using continuousforwardthrustwithpitchandyawattitudecontrolengineandresidual propellant dischargingtoprovidethe energy of deorbit is presented.