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CONCEPTUAL STUDY OF AN AIR-LAUNCHED ROCKET WITH LIFTING-BODY CONFIGURATION

Abstract

The air-launched rocket is carried by an aircraft and released at a high altitude. Compared with the ground-launched rocket, the air-launched rocket can obtain the velocity and the altitude of the carrier aircraft. At high altitude the density of the air is much lower as at sea level. The nozzle of the rocket can also be better optimized. Moreover, the air-launched rocket is more flexible for a launch mission. The air-launched rocket can usually be hanged beneath the wings or body of the aircraft or carried internally by a cargo aircraft. The objective of this work is to study the air-launched rocket carried beneath the body of an aircraft. The air-launched rocket should send much more load into space than the ground-launched rocket with the same amount of propellant. However, as the weight cost of the structure of large wings and the long flight with high angle-of-attack during the launching, the air-launched rocket in service, such as the PEGASUS rocket which is with regular aerodynamic configuration, has not proven predominant advantages of sending more payload into space. In this work, a concept of lifting-body rocket is proposed to increase the payload without increase the total weight of the rocket. The rocket is three-staged, the first stage is with a wing-body configuration and the second and third stage are with regular cylinder shape. The first stage is equipped with a main engine and two attitude motors. The motors are integrated with the wing-body configuration. The design of the lifting-body configuration are discussed in this paper. The propulsion system, the trajectory and the GNC system are also preliminary planned when designing the configuration of the rocket. The performance of the preliminary design is finally evaluated.