

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Small Launchers: Concepts and Operations (7)

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SMALL LOW-COST LAUNCH VEHICLE CONCEPT DESIGN BASED ON EXISTING SOLID
ROCKET MOTORS

Abstract

Development of electronic and other related technique has made the satellite become smaller in size and lighter in weight. Small satellites have almost same functions compared with those in the last century and they will play more important role in fields of communication, earth observation, space experiment and education. Reducing size and weight also make the cost of satellites being reduced accordingly. Low-cost satellites will present requirement of same low cost to launch vehicle. This paper describe the method of a small low-cost launch vehicle concept design based on existing solid rocket motors. The existing solid rocket motor come from retired solid-propellant ballistic missile. As known solid launch vehicle Minotaur was derived from intercontinental ballistic missiles. Solid Rocket Motors (SRM) from Retired solid ballistic missiles of China and Russia were supposed could be acquired by China space industry. The design of launch vehicle is capable of delivering the payload of 100kg to a circular low earth orbit of 400, 500, and 600 km altitude. The overall launch vehicle configuration and the trajectory profile were optimized simultaneously, thus the exiting SRM parameters for first, second and three stages, vertical flight time, launch maneuver variable, maximum angle of attack, coasting time between first and second stage and the second coasting time between second and third stages were optimized. A genetic algorithm global optimization method has been implemented to perform the analysis, the algorithm consider mixed integer continuous variables. The result showed that the proposed optimization approach was able to find the optimal solution for all three variants with very acceptable values, the approach proved to be reliable for conceptual design level. And the result also proved the small low-cost launch vehicle from existing solid rocket motors are feasible in the aspect of technology.