Paper ID: 22286
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SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Launch Services, Missions, Operations, and Facilities (2)

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LAUNCH VEHICLE ENERGY PERFORMANCE DURING SINGLE INJECTION OF THE SATELLITES INTO INDIVIDUAL ORBITS

Abstract

The tendency to weight reduction of the near space satellites, variety of the target orbits often and often do not allow to ensure maximum weight load of the Launch Vehicles (LV) during each launch. As a consequence, LV usage efficiency declines and the prime cost for launching the satellites increases. A proposal (IAC13-D-2.4 at 64th International Astronautical Congress on.23-28.09.2013, Beijing) partially addresses the problems of LV maximum full load during each launch. The prime cost for injection of the satellites during its launch using a single LV into individual orbits reduces. This paper studies the issues of energy efficiency of the aforementioned proposal. It says that classical representation of LV capability does not reflect its real capabilities for launching the satellites using a single LV into individual orbits. LV capability analytical evaluation methodology is provided with its analytical and graphic representation. Its usage allows at the first stage of LV payload generation for confirmation of payload capability sufficiency to refuse volumetric and rather complex numerical calculations of injection trajectory and focus attention on analysis of various options of the payload arrangement and selection of the most acceptable one. LV maximum load during each launch (full propellant expenditure correspondingly) raise high demands to Guaranteed Propellant Reserves' calculation method (GPR). The paper provides the methods comparison for evaluating the amount of GPR for two options of the flight trajectory mapping based on implementation of the "rigid" pitch program and apparent speed during terminal injection. The results of numerical calculations confirm the need for reflecting the features of injection in GPR evaluation method.