

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

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THE DESIGN, IMPLEMENTATION AND TEST FLIGHT RESULT OF THE FIRST CHINESE
COMMERCIAL LAUNCH VEHICLE SYSTEM, ZQ-1

Abstract

This paper gives the general description of the first Chinese commercial launch vehicle system, ZQ-1, which includes the brief introduction to the design, engineering implementation of all ZQ-1 subsystems and the test data resulted from the test flight and launch attempt on Oct 27th, 2018. ZQ-1, which is independently developed by Beijing LandSpace Space Technology Co., Ltd, with the core IP sets, is a three-stage solid launch vehicle system, and the carrying capacity at 500km Sun-Synchronous Orbit (SSO) can reach 100kg. The characteristics of ZQ-1 aerodynamics are obtained by wind tunnel experiments, and the computational fluid dynamics simulation. When it comes to the end of the second stage flight, the maximum heat flux at the position of fairing stagnation point is reaching 160kW/m². The design of the stability control system is based on gain-scheduling method and classical control theory. Perturbation guidance method and closed-loop guidance method is applied to the design of its guidance control law. Iterative guidance method is adopted during the terminal correction of third stage flight to improve the orbit precision. Static and modal experiments are carried out to verify the reliability of the main structure and the accuracy of numerical analysis. Launch vehicle ground support system ensures the system safety of ZQ-1 during transportation, erection and launching. The examination test experiments of electrical system based on 1553B bus is conducted and works normally throughout the test flight. The separation system of the launch vehicle based on explosive bolts carried out the stage separation and fairing separation. At 1600hrs on October 27, 2018, the test flight of ZQ-1 launched at Jiuquan Satellite Launch Center of China. The first stage and the second stage worked normally, however, unfortunately the third stage was subject to an anomaly due to the propellant leakage and the micro-satellite on board ZQ-1 as the payload failed to enter the orbit. Despite the failure of the flight test, the launch of ZQ-1 is still a remarkable milestone in the history of China's space industry development, especially the private commercial launcher development.