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THE APPLICATION OF LASER COMMUNICATION IN FUTURE LAUNCH VEHICLE

Abstract

In order to explore the deep-space, many countries in the world are competing to promote the future large launch vehicle research. China also needs a more capable launch vehicle to enter deep-space. Although the Long March 5 (LM-5) launched for the first time in 2016 successfully, has a maximum capacity of 14 tons in geostationary transfer orbit (GTO), China's manned lunar-landing project requires a launch vehicle with more capacity. The future large launch vehicle, which can fully meet the needs of various deep-space exploration missions such as manned lunar exploration, Mars sampling return, and solar system planetary exploration, is now being planning. As a new generation of launch vehicle in China, laser communication is one of the new technologies adopted by the rocket to improve its carrying capacity. The use of laser communications can reduce the weight of the cable network. At present, the launch vehicles usually use cable network for signal transmission and information interaction, which not only brings additional communication cable weight, but also is vulnerable to electromagnetic interference, affecting the efficiency and quality of information transmission. The future large launch vehicle plans to use the laser communication technology to replace the traditional wired communication. From the moment the rocket is fixed to the launch platform until the satellite is sent into the predetermined orbit in outer space, the communication links between various stages will experience drastic changes in atmospheric environment, temperature and other conditions. In order to ensure the reliability of the communication links in the launch and flight environment, this paper optimized the design of the communication system according to the actual application requirements and the restrictions of various external constraint environments. The design includes following original features: 1) Analyzing the feasibility of the inter-stage communication system of the rocket. The paper focuses on the changes of laser communication link from the launching to the separation of the rocket-satellite and the key factors affecting the link; 2) Realizing the light and miniaturization design of laser communication system; 3) Solving the engineering design problem of laser communication system in complex application environment, and realizing the optical end machine design with wide temperature adaptability. The experimental results show that the proposed laser communication in future large launch vehicle is feasible.