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RESEARCH AND IN-ORBIT VERIFICATION ON THE HAN PROPULSION SYSTEM OF DALIAN-1 LIANLI SATELLITE

Abstract

Dalian-1 Lianli Satellite is a 12U high-resolution Earth observation CubeSat with a mass of 17kg. The satellite was launched on May 10, 2023, carried by Tianzhou-6 cargo spacecraft, and stored in-orbit for 253 days. The satellite was successfully released into orbit from the Tianzhou-6 cargo spacecraft on January 18, 2024. The main functions of the satellite are to verify the series of innovative technologies including the high-resolution remote sensing imaging, the highly reliable OpenHarmony operating system, and the module propulsion system.Different from the traditional hydrazine-based toxic propellants used in satellite propulsion systems, this satellite uses an innovative Hydroxylammonium Nitrate (HAN) monopropellant system. The HAN propulsion system has the characteristics of being environmentally friendly, non-toxic, high-energy, and low power consumption.Although the traditional propulsion needs on-site refueling, the propulsion module used this time is a pre-packaged system that has already been refueled before entering the launch plant.This paper first elaborates on the design and main performance specification of the HAN module propulsion system. The rated output thrust of the propulsion system is 0.5N, and the total impulse is 500Ns, which can complete the orbit control of the satellite in both steady-state and pulse modes.At the same time, the paper has carried out the research, design, and test on the in-orbit test scheme and orbit raising strategy of the propulsion system of the Dalian-1 Lianli Satellite.The telemetry data in-orbit shows that the propulsion system is working normally.As of February 28, 2023, several orbit raising operations have been initiated, and the satellite orbit was boosted from 330km to 350km. A series of orbit raising and maintenance will be carried out in the future.It is the first successful application of the HAN propulsion system in the orbit control of the CubeSat internationally. Currently, the next-generation high total impulse HAN module has been used for the orbital maneuver control of several CubeSat missions.