SMALL SATELLITE MISSIONS SYMPOSIUM (B4)
Access to Space for Small Satellite Missions (5)

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DEVELOPMENT OF GAS-LIQUID EQUILIBRIUM PROPULSION SYSTEM FOR IKAROS RCS

Abstract

IKAROS (Inter-planetary Kite-craft Accelerated by Radiation Of the Sun) is a small demonstration spacecraft of Solar-Sail which deploys the sail-membrane in the space to be accelerated by radiation of the sun. IKAROS has a reaction control system (RCS) to spin up itself before the deployment of sail-membrane and control its attitude. Because of very short manufacture schedule and relatively low manoeuvre (delta V) requirement of IKAROS, IKAROS RCS has adopted the gas-liquid equilibrium propulsion system which stores chlorofluorocarbon alternative HFC-134a as liquid-phase in the tank, extract the vapor of HFC-134a from the tank, and eject the vapor from the thruster nozzle. Cold gas through the nozzle realizes simplified thruster system, therefore can shorten manufacture schedule, but resultant Isp is lower than that of hot gas system (ex.: Hydrazine system). However this system can achieve higher manoeuvre than cold gas system (ex.: GN2 system) because of higher density in the tank. These are why it is suitable for small satellite propulsion system. There are two major technical problems during its development. One is how to extract the vapor of propellant. The other is how to avoid the thrust degradation due to the condensation of the equilibrium gas flow in the nozzle and the line between the tank and the thruster. This paper shows the design method to solve these problems, the verification results of the vapor extracting device, and the confirmation test results of the condensation in the nozzle and the line. IKAROS will be launched on 2010 by H-IIA rocket, and flight results may be included on the congress.