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THE EFFECT OF AERODYNAMIC HEATING TO CRYOGENIC PROPELLANT DISCHARGE

Abstract

As the high-speed launch vehicle passes through the atmosphere, the air at the nose is compressed. The heated air acts as a heat source at the rear of the launch vehicle. The launch vehicle utilizes a cryogenic propellant, and the temperature of the cryogenic propellant is affected during the flight due to the aerodynamic heating generated earlier. Cryogenic propellants have a lower specific heat than room temperature liquids; therefore, the temperature rises relatively sensitively by external heat inflow. A test device for simulating external heat inflow into a small tank was manufactured to confirm the discharge temperature of cryogenic propellant due to external heat inflow. A cryogenic small propellant tank was installed in the vacuum chamber. Halogen lamps were installed around the small tank for external heat input. Cryogenic propellant discharge temperature characteristics were measured while changing the amount of external heat input by controlling the power of the halogen lamp. The gas and the liquid temperature were measured simultaneously to confirm the external heat inflow path. Additionally, liquid oxygen discharge temperature from the flight tests will be compared to the ground test results.