

Study for Continuity of Cooling Operation of SPICA Cryogenic System by Adding Refrigerant Circulation System

K. Narasaki, Sumitomo Heavy Industries, Ltd., Niihama, Ehime, Japan

SPICA (Space Infrared Telescope for Cosmology and Astrophysics) is a pre-project mission of JAXA to launch a large infrared observatory to the second Sun-Earth Lagrangian liberation point (L2) in the 2020s. A unique feature of SPICA cryogenic system is a warm launch system using radiative cooling and a large number of mechanical coolers in orbit to cool 2.5m telescope below 8K and its detectors in sub kelvin. SPICA uses two sets of 1K Joule-Thomson (1K-JT) coolers and two sets of 4K Joule-Thomson (4K-JT) coolers with three sets of double-stage Stirling (2ST) coolers used as pre-coolers respectively for redundancy and reliability. Additionally, two 2ST coolers are used to cool the telescope shield. The pre-coolers for 1K-JT cooler should be separated from 4K-JT cooler because of the influence of the pre-cooler's failure as well as a required pre-cooling temperature for 1K-JT cooler lower than that for 4K-JT cooler.