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A nK stable platform for 8kg space borne cryogenic instruments*

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We describe the design and test of a modular “Probe” structure to allow nK control of <8kg space borne instruments operated at liquid helium temperatures for the Low Temperature Microgravity Physics Program. The Probe consists of a 9.875” diameter cold plate on which is mounted a 9.75” high 3 stage truss. It has a bare mass of 7kg. Instrument wires and plumbing route through the cold plate. A germanium resistance thermometer with standard voltage readout and PI servo is used to control stage 1, the closest to the cold plate, to microKelvin stability. Paramagnetic thermometers with a DC SQUID readouts are used to control stages 2 and 3 to 500nK and 1nK respectively. A room temperature random vibration test at 7.7g_{rms} verified that the Probe supports a 6.2kg mock instrument mounted on stage 3 under launch load on the Japanese HII-A rocket or the shuttle. The measured lateral stiffness is 2 MegaN/m. Thermal tests at temperatures 1.5 – 7K show that the probe can compensate for helium bath temperature drifts higher than 0.1K, with stage 3 with 1nK from a set point for several weeks. The structure was modified to support 8kg instruments mass with improved the thermal performance.

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