

Performance of the AIRS Pulse Tube Coolers and Instrument—a First Year in Space

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Launched on NASA's Earth Observing System Aqua platform on May 4, 2002, JPL's Atmospheric Infrared Sounder (AIRS) instrument has completed a highly successful first year in space and captured a number of important lessons for future space-cooler applications. The AIRS instrument is designed to make precision measurements of atmospheric air temperature over the surface of the Earth and uses a redundant pair of TRW pulse tube cryocoolers operating at 55 K to cool its sensitive IR focal plane.

Soon after launch, contamination of low-emittance cryogenic surfaces led to increased cooler loads and the need for subsequent decontamination cycles. In addition, signal event transients (SETs) occurred while passing through the South Atlantic Anomaly (SAA) necessitating corrective actions. Midway through the year the fundamental operating strategy of the AIRS instrument was changed from the original strategy of running a single cooler and having the second cooler as a non-operating backup. Instead, based on a new system-level reliability analysis, both coolers began operation simultaneously in November 2002. This change resolved the contamination and SAA driven interruptions and has enabled unprecedented levels of continuous science measurements since the change was made.

This paper presents a review of the AIRS instrument cryogenic performance over the past year including its contamination buildup and interrupt history. The reliability analysis conducted to justify two-cooler operation is also reviewed and compared with the excellent operational results achieved.

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