Contribution ID: **9** Type: **Contributed Oral Presentation**

In-Flight Performance of the OCO-2 Cryocooler

Monday, 29 June 2015 16:15 (15 minutes)

The Orbiting Carbon Observatory-2 (OCO-2) will have completed its first year in space on July 2, 2015. The OCO-2 instrument incorporates three bore-sighted, high-resolution grating spectrometers, designed to measure the near-infrared absorption of reflected sunlight by carbon dioxide and molecular oxygen. OCO-2 currently flies in a sun-synchronous, near-polar orbit at an inclination of 98.1 degrees, mean altitude of 705 kilometers, 99 minute orbit period and 1:30 pm ascending node. The OCO-2 spacecraft forms part of a constellation of six Earth observing satellites known as the "A-Train" and leads this procession ahead of the JAXA GCOM-W1 spacecraft.

The cryocooler system design is coupled with the instrument's thermal control design to maximize the instrument's performance. A single-stage NGAS pulse tube cryocooler provides refrigeration to three focal plane arrays to 120 K via a high conductance flexible thermal strap. A variable conductance heat pipe (VCHP) based heat rejection system (HRS) transports waste heat from the instrument located inside the spacecraft to the space-viewing radiators. The HRS provides tight temperature control of the spectrometer to 267 K and maintains the cryocooler at 300 K.

Soon after entering the A-Train on August 3, 2014, the spectrometer and focal planes were cooled to their operating temperatures. Evidence of ice accumulation on the cryogenic surfaces was deduced from increased cryocooler loads and drove a need for two focal plane decontamination cycles on August 31, 2014 and October 23, 2014.

This paper provides a general overview of the cryogenic system design and reviews the in-flight cryogenic performance over the Observatory's first year.

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Session Classification: C1OrH - Aerospace Cryocoolers

Track Classification: CEC-04 - Cryocoolers (Aerospace)