

# AIRS Optical Calibration Systems

The Atmospheric Infrared Sounder (AIRS) is one of six instruments on board the Aqua satellite (launched on May 4, 2002), part of the NASA Earth Observing System.

Together these instruments observe the global water and energy cycles, climate variation and trends, and the response of the climate system to increased greenhouse gases. AIRS is a high-resolution infrared sounder which main purpose being to acquire atmospheric temperature and humidity profiles from the surface upward to an altitude of 40 km. This instrument uses cutting-edge infrared technology to create 3-dimensional maps of air and surface temperature, water vapor, and cloud properties.

Lockheed Martin Infrared and Imaging Systems developed for the Jet Propulsion Laboratory (JPL) the Atmospheric Infrared Sounder (AIRS). The ABB Analytical Measurement engineering department produced two optical calibration systems for the AIRS test facility.

The Spatial Collimator System (SCS) is a sophisticated optical system with some cryogenic elements, all enclosed in a large vacuum chamber (See Figure 1). The main purpose of the SCS is to provide a collimated beam at varying angles over the AIRS field of view to test the spectrometer spatial performance.



Figure 1: The AIRS Spatial Collimator System

Figure 2: Large Aperture Blackbody

Figure 3: Space View Blackbody

### The SCS is composed of eight major subsystems:

- 1- An optical bench that includes a collimator, an illuminator, a pointing system, and a focal plane box. The focal plane box is cryogenic and comprises an aperture wheel, a shutter, a chopper, and a filter wheel.
- 2- A vacuum chamber on a movable cart.
- 3- A pumping system on a separate cart.
- 4- A set of optical sources.
- 5- A gas system.
- 6- A dolly to transfer the optical bench into the vacuum chamber.
- 7- A control rack.
- 8- A control software developed at ABB under LabVIEW™, that operates most elements of the SCS.

This software allows remote control by the AIRS Ground Support Station and local control via a graphical user interface.

The Large Area and Space View Blackbodies (LABB/SVBB) rely on a specular black coating and a light-trap geometry to achieve a high emissivity. The SVBB is a cold reference source operated at a temperature <85K (see Figure 3). The LABB is a separate source adjustable in temperature from 190K up to 360K (see Figure 2). The LABB/SVBB system has its own controller operated by a ABB developed LabVIEW™ software.

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