The Compact SIM (CSIM), Compact TIM (CTIM), and Future Compact Earth Radiation Budget Instruments

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The Compact Spectral Irradiance Monitor (CSIM) and the Compact Total Irradiance Monitor (CTIM) are CubeSat instruments to demonstrate next-generation technology for monitoring spectral and total solar irradiance. Both instruments include novel silicon-substrate room temperature vertically aligned carbon nanotube (VACNT) bolometers. CSIM, a two-channel 6U CubeSat instrument similar in design to the SORCE and TSIS SIM instruments, was launched in December 2018 and has been operating on-orbit since. The first-light CSIM spectra, taken in April 2019, provided an independent validation of the TSIS SIM solar spectral measurements. Additionally, the CSIM spectral measurements extend to 2.8 μm, providing the first solar-spectral measurements beyond 2.4 μm with <1% radiometric accuracy. The continued observations since first-light are currently being analyzed to investigate on-orbit stability of CSIM.

The CTIM instrument, an eight-channel 6U CubeSat instrument, is currently begin built for a flight in 2021. Like CSIM, the basic design is similar to the SORCE, TCTE and TSIS TIM instruments. It will measure the total irradiance of the sun with an accuracy of <0.01%. An engineering model of the CTIM instrument has been built and tested under flight conditions, and the flight instrument build is in process.

The VACNT bolometer development initiated on the CSIM and CTIM program continues with Black Array of Broadband Absolute Radiometers (BABAR) project. The goal of BABAR is to develop a linear array of miniature bolometers for integration into a future broadband Earth radiation imager. Each element of the BABAR array is operated, like the CTIM and CSIM detectors, as closed-loop electrical substitution radiometers providing high accuracy, stability, and fast response.