(71-240416-C) **BABAR-ERI: An Innovative Instrument to Image Broadband Radiation at High Spatial Resolution**

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The Earth Science Technology Office (ESTO) is supporting the development of an innovative, small, and adaptable satellite instrument to image outgoing broadband radiation at 1-km spatial footprint and <1% uncertainty. Such advances will increase the information content of the Earth Radiation Budget (ERB) observations relative to current sensors and improve the process-level understanding of climate drivers, such as clouds and aerosols while also enabling flexible observing and implementation strategies.

In this presentation, we will give the instrument development status of the *Black Array of Broadband Absolute Radiometers* (BABAR) *Earth Radiation Imager* (ERI) and briefly outline its utility to process-level and Earth radiation budget missions. BABAR-ERI is a suite of 3 instruments in a 12U CubeSat form factor and the development is scheduled to complete in July, 2024. BABAR-ERI measures the total (0.3 to 100 *μm*) and shortwave (0.3 to 4 *μm*) broadband radiation at 32 x 1-km spatial resolution from two co-registered telescopes. The longwave broadband radiation will be derived from the subtraction of the shortwave radiation from the total channel. The primary technology development being advanced are the 32-element, ambient temperature, electrical substitution radiometer (ESR) array detectors with vertically aligned carbon nanotubes (VACNT) as the optical absorber. Closed-loop electrical substitution techniques at each detector pixel provide fast and precise radiometry and eliminate the need for on-orbit radiometric calibration. Absolute radiometry will be verified during ground calibrations using blackbody sources and an absolute detector standard being developed under the program. The absolute detector standard, the Planar Bolometric Radiometer for Radiance (PBR-R), has heritage from the Compact Total Irradiance Monitor (CTIM) In-Space Validation of Earth Science Technologies (InVEST) program. The BABAR-ERI instrument suite also incorporates two PBR-Rs as on-board calibrators designed to operate at different exposure duty-cycles for tracking on-orbit degradation of the science channels to maintain stability. Finally, BABAR-ERI has a single-channel camera for providing scene context, sub-pixel variability at 100-m resolution, and for ensuring pointing accuracy. The BABAR-ERI has been fabricated and final characterization studies and instrument-level vibration and thermal/vacuum testing are underway.

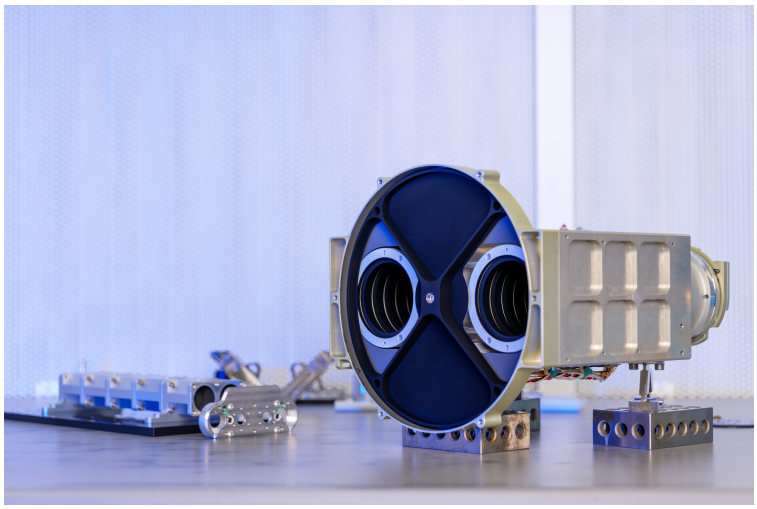

Figure 1. A photograph of the BABAR-ERI optical bench and prior to integration into the 12U CubeSat form factor. BABAR-ERI has two science telescopes with colocated footprints to measure the total (0.3 to 100+ micron) and shortwave (0.3-4.5 micron) broadband radiation. Longwave broadband radiation is derived from the subtraction of the shortwave from the total radiation measurements. Inset, at left, is the two-channel absolute reference detector instrument, the planar bolometric radiometer for radiance, to monitor and correct any degradation of the science channels.