Tuesday, September 13, 2022 | 8:00 a.m.

Pre-launch Testing and Post-launch Performance

Assessment of pre- and post-launch calibration and performance characterization for operational remote sensing systems

FPA Characterization and Spectrograph Calibration for the GeoCarb Mission

Eric Burgh, Mate Adamkovics – Lockheed Martin Advanced Technology Center (ATC); Timothy Miller, Sean Crowell – University of Oklahoma/GeoCarb

ABSTRACT: The Geostationary Carbon Cycle Observatory (GeoCarb) was selected as a NASA Earth Venture Mission in 2016 to measure greenhouse gas concentrations from geostationary orbit with a view of North and South America. The GeoCarb instrument incorporates a four-band, high-resolution, grating spectrograph operating at 0.765 µm, 1.606 µm, 2.065 µm, and 2.323 µm. From these bands, oxygen (O2), carbon dioxide (CO2), carbon monoxide (CO), methane (CH4), and solar induced fluorescence (SIF) are measured. The four bands are recorded through a single slit, with a roughly 6 x 2700 km field of view, which can be steered using scan mirrors. GeoCarb is being built at the Lockheed Martin (LM) Advanced Technology Center (ATC) for launch in approximately 2024. Here we present methods and recent results from the characterization of the four focal plane arrays (FPAs) as well as the spectrograph calibration test. We describe the calibration and characterization procedures, algorithms used for analysis, and results on the spectral and polarization performance.

Examining Water Transport Through Sneak Paths

De-Ling Liu, Aileen Hui, Andrew Robbins, Rocky Morales, Hagop Barsamian – The Aerospace Corporation

ABSTRACT: Water outgassed from spacecraft materials plays a key role in degrading cryogenic sensors, therefore characterizing “sneak paths” where water molecules can potentially migrate from sources external to payload to cryogenic surfaces becomes an important task to ensure proper sensor performance. Via modeling and laboratory testing, we examine water molecular transport mechanisms, and will show that sneak path testing at ambient pressure environment can be effective and expedient to help gain insights into molecular transport phenomenon under vacuum scenarios.

Filter Design for Precise Spectral Performance in Wide-Field-of-View Optical Systems

Chelsea Appleget, Frank Pan, Travis Thorne, Peter Fuqua, James Barrie – The Aerospace Corporation

ABSTRACT: Wide field of view (WFOV) imaging systems can suffer from significant variations in performance from the center of the focal plane array (FPA) to the periphery of the detector. Some of these undesirable spatial variations include angle of incidence (AOI) of the marginal rays, illumination, and resolution non-uniformities. Optical designers are often required to go to great lengths to achieve adequate performance across the entire field of view, but these designs commonly possess high angles of incidence on optical surfaces and filters.

For optical coatings and bandpass filters, large AOIs have crucial implications for system performance, as the physics of optical interference bandpass filters requires that the band edges shift to shorter wavelengths as the optical AOI grows, and these spectral shifts with angle can be dramatic. A typical optical bandpass filter on a flat optical window will result in mission performance varying from the center to the extremes of the field of view in WFOV systems. These challenges are exacerbated in short-wave IR (SWIR) and mid-wave IR (MWIR) applications where typical requirements call for narrow, sharp-edged performance. In summary, the physics of the filters will define and inform the telescope designs.

Depending on the telescope design and bandpass coatings employed, the spectral response can range considerably across the FOV unless deliberately addressed. In this paper we will: 1) discuss bandpass spectral performance and optimization for variable AOI, 2) show how these coatings inform the optical design constraints for uniform FOV performance, 3) demonstrate how careful telescope design can limit the burden of high AOIs on filter surfaces in an optical system. These combined efforts inform the technical community of the trade space between compact telescope design and bandpass filter capabilities in WFOV systems.

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