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INFRARED REMOTE SENSING USING LOW NOISE AVALANCHE PHOTODIODE DETECTOR

Abstract

For a remote sensing optical payload to achieve a Ground Sampling Distance of ¡ 10-30 m, a critical problem is platform-induced motion blur. While forward motion compensation can reduce this transit speed, it comes at the expense of a more challenging satellite attitude control system and induces a variable observation/illumination angle. This relative motion can be frozen out by simply reading the sensor system at a frame rate that matches the ground resolution element's pixel crossing time. To achieve high resolution using this Time-Delay Integration (TDI)-like approach requires high speed and hence near "zero" readout noise detector arrays to avoid swamping the observed signal. This requires associated control electronics for fast frame readout and direct interface with smart- Artificial Intelligence (AI) onboard processing. The large data volume challenge can be overcome using AI-based data processing and value-added data product generation. With this technique, the platform freezes out its movement with respect to the ground, reducing the demands placed on the attitude control systems, which can otherwise be difficult to implement on a small satellite platform.

Here we report the Australian National University's OzFuel mission which applies this technical solution to deliver high ground resolution via high frame rate imaging. OzFuel is built around the Leonardo SAPHIRA Mercury Cadmium Telluride linear mode electron avalanche photodiode (LMeAPD) detector and the in-house developed Rosella electronics control system. The mission will deliver an integrated sensor system in a suite of Short-Wave Infrared (SWIR) passbands dedicated to monitoring fuel moisture content and fuel load of Eucalypt trees. The OzFuel mission concept focuses on the application of SWIR remote sensing data to deliver a strategic evaluation of fuel loads and moisture content in the bushfire-prone Australian environment.

We will present an overview of the OzFuel mission, technical challenges, and instrument concept.