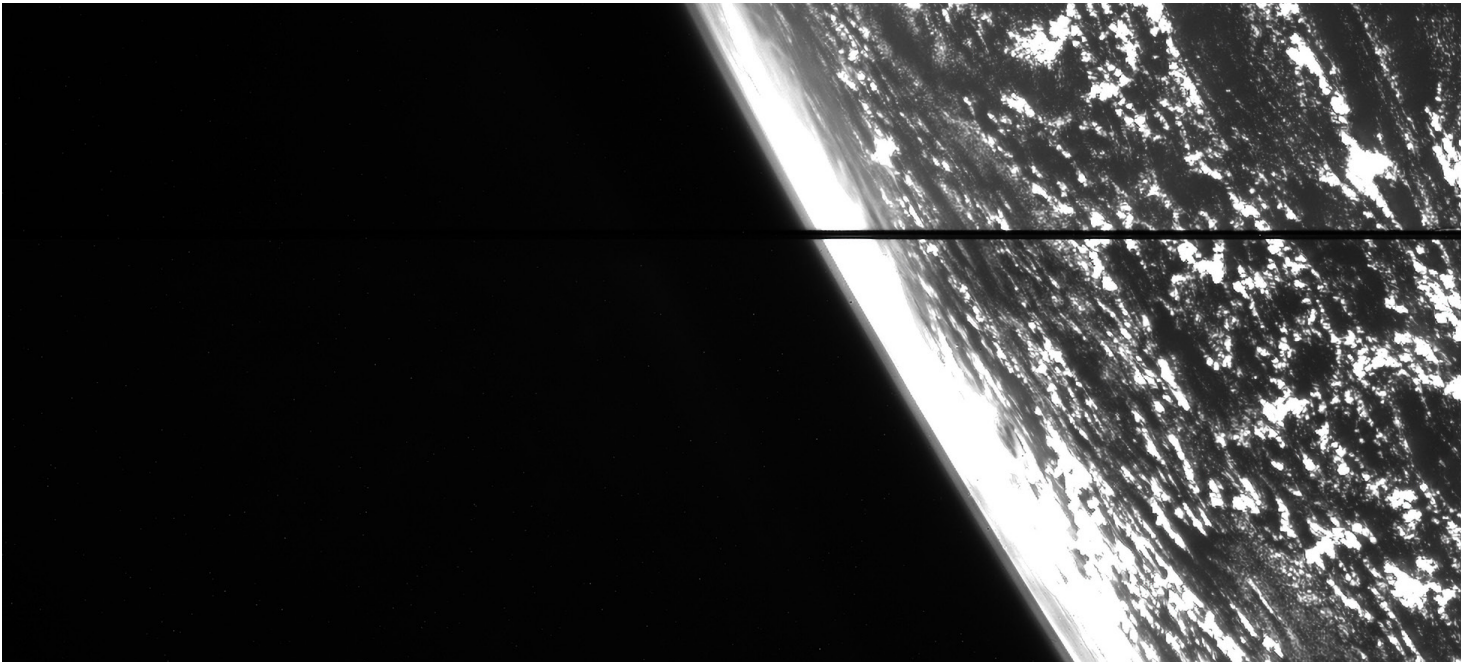


SPECTRE



Next-gen multi-spectral EO/IR imaging solution



CLOUD CHARACTERIZATION

Visible wave image captured by the SPECTRE payload, showcasing detailed cloud structures for advanced cloud characterization and weather analysis.

As global security dynamics evolve, maintaining an observational edge in the space domain has become critical for the U.S. to effectively defend against rapidly advancing adversarial abilities. Advances in sensor technologies have enabled smallsat and other SWaP-limited platforms to achieve capabilities that were once limited to larger, more power-intensive systems. These innovations are driving a shift toward more agile, cost-effective solutions that provide real-time data a variety of defense and civilian applications.

INTRODUCING SPECTRE

Spectre is a next-generation multi-spectral optical payload engineered for exceptional weather monitoring and intelligence gathering in a compact, small-SWaP design. Optimized for versatility and efficiency, it delivers high-resolution imaging for Earth observation, climate and

environmental monitoring, and defense missions where size, weight and power are at a premium. Built on Orion's expertise in sensor miniaturization and advanced multi-spectral imaging, Spectre sets a new standard for performance in the EO/IR domain, providing unmatched data quality in the most demanding operational environments.

DEMONSTRATED PERFORMANCE

Spectre was successfully demonstrated on the Rapid Revisit Optical Cloud Imager (RROCI) mission, launched as part of the U.S. Space Force's EO/IR Weather System (EWS) program. Integrated into the RROCI 12U CubeSat, SPECTRE provided near real-time cloud scanning and terrestrial weather data with remarkable precision, offering critical insights for weather forecasting and climate monitoring. This successful demonstration validated

SPECTRE's ability to deliver high-quality data from a compact and efficient form factor, setting a new benchmark in space-based weather sensing. The performance of Spectre on the mission showcased its potential to revolutionize both defense and civilian weather prediction capabilities, providing critical data that enhances decision-making and operational effectiveness.

KEY ADVANTAGES

The SPECTRE payload provides enhanced observations compared to other earth-observing instrument, with advantages such as:

- Higher spatial resolution: Spectre provides superior ground spatial resolution compared to traditional Earth-observing weather instruments like ABI, enabling more detailed imagery and improved cloud typing.
- Flexibility: designed for rapid iteration, Spectre can accommodate new wavelengths in the range of 0.4 μm to 14 μm, which can be added or removed without requiring a full payload redesign.
- Rapid deployment: the Spectre instrument can be quickly assembled and calibrated, going from signed contract to delivery to the launch site in under 11 months.
- Multi-domain applicability: Spectre 's flexible payload architecture supports operation across various environments, from LEO to MEO, without requiring substantial design modifications.
- Cost efficiency: utilizing low-cost commercial off-the-shelf (COTS)

cameras, primarily COTS lens assemblies, and affordable custom filters, Spectre offers a breakthrough in price-to-performance ratio for space-based weather sensing.

WIDESPREAD APPLICATIONS

- Cloud characterization: capture detailed cloud structures across multiple wavelengths, enabling precise cloud classification and weather forecasting.
- Fires: Monitor active fires by detecting thermal signatures and providing real-time data for rapid response and management.
- Burn area: Assess burn severity and extent by analyzing post-fire areas, aiding in damage assessment and recovery efforts.
- Vegetation index (NDVI): Evaluate vegetation health and density using the Normalized Difference Vegetation Index (NDVI), critical for environmental monitoring and agriculture.
- Snow cover: Accurately measure snow cover extent, supporting climate studies and resource management in cold regions.
- Aerosols and night ights: Track aerosol concentrations for air quality monitoring and detect artificial light emissions for environmental studies.
- MW/MT: Utilize mid-wave and thermal infrared imaging for enhanced detection of heat sources, useful in both defense and environmental monitoring.

SPECIFICATIONS	PERFORMANCE
ORIENTATION	NADIR FACING
POWER	46W OAP
VOLUME	12U
MASS	11KG
PAYLOAD OPERABILITY	> 90%
REQUIRED GNC: (1 SIG)	
POINTING ACCURACY	30 ARCSEC
POINTING KNOWLEDGE	10 ARCSEC
DATA RATE	~30 GBITS/ORBIT
THERMAL CONTROL	FULLY INTEGRATED
THERMAL CONTROL PRECISION	MICROKELVIN

MULTI-SPECTRAL IMAGING

Five distinct images captured by the SPECTRE payload, showcasing cloud and environmental features across five different wavelengths: Visible (VIS), Near-Infrared (NIR), Short-Wave Infrared (SWIR), Mid-Wave Infrared (MWIR), and Long-Wave Infrared (LWIR). Each image provides unique insights into atmospheric and surface characteristics, enabling comprehensive weather and environmental analysis.

