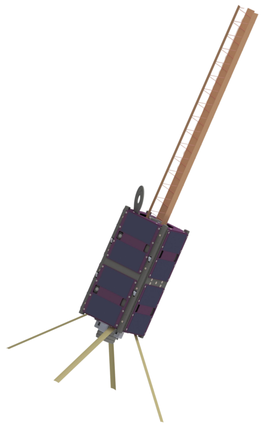
Design and Test of the OreSat Cirrus Flux Camera

Catie Spivey, Umair Khan, Davis Zarfas, Steve Hynes, Tiffani Shilts

OreSat

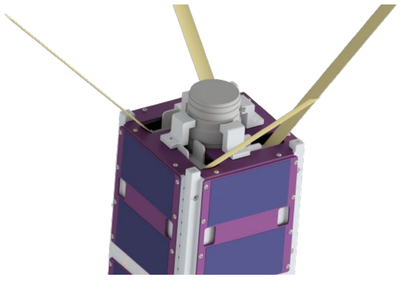
OreSat is an artisanally handcrafted 2U CubeSat being developed by the Portland State Aerospace Society. It was selected in 2017 as part of the NASA CubeSat Launch Initiative (CSLI), with handoff and launch scheduled for 2022. Its missions include the OreSat Live (DxWifi) STEM outreach mission, open source space technology demonstration, and the Cirrus Flux Camera science mission.



A render of OreSat.

Cirrus Flux Camera (CFC)

The CFC is a shortwave infrared (SWIR) cirrus cloud imager that will enhance understanding of global cirrus coverage and frequency, potentially informing climate models. Cirrus clouds are known to contribute significantly to atmospheric warming, but coverage has been underestimated due to detection difficulties. Through the CFC, we hope to pioneer a low-cost, open-source approach to scientific instrumentation.

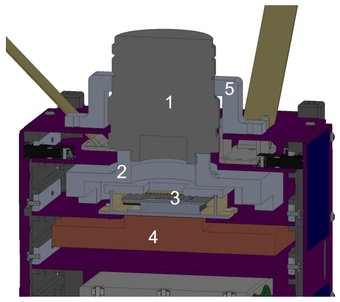


Left: The current design of the CFC, as situated on the -Z side of OreSat.

Right: Cirrus clouds as seen in visible, 870nm, 1.38μm, and 1.6μm bands.

Mechanical Design

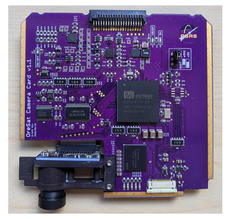
The mechanical design is limited by the locations of existing printed circuit board cards and turnstile antennas as well as the dimensions of the “tuna can” extension (maximum extrusion of 36 mm from the end of the rails and a maximum diameter of 64 mm). The assembly includes a NAVITAR SWIR-25 lens **(1)**, an aluminum lens mount **(2)**, detector and sensor housing **(3)**, a copper heat sink **(4)**, and aluminum thermal straps **(5)**.



Cutaway view of the CFC.

Electrical and Computational Design

On-board computing will be handled by a custom Linux board powered by the Octavo OSD335x, based heavily on OreSat’s already-functional star tracker board. An additional FPGA will be used to process and buffer data from the sensor before being read by the Octavo chip.



The star tracker board.

Concept of Operations

1. Find potential cirrus observation site using real-time satellite data.
2. Send command to OreSat.
3. Capture multispectral/multiangle images.
4. Compress and store on-board.
5. Downlink over SatNOGS or DxWifi.

Future Work

With the design largely complete, the next step is to build the CFC. The SWIR sensor is being procured, and initial 3D prints are on order. After extensive testing and characterization, the system will be ready to fly in 2022.

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Contact

Websites: oresat.org, pdxaerospace.org
Emails: oresat@pdx.edu, cspivey@pdx.edu, ukhan@pdx.edu