30th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Interactive Presentations - 30th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (IP)

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EARTH OBSERVATION PAYLOADS ON-BOARD A 3U CUBESAT AND THEIR SCIENTIFIC PURPOSE FOR MONITORING AEROSOLS AND SURFACE TEMPERATURE HOTSPOTS

Abstract

The technical student society PolyOrbite from the university of Polytechnique Montreal in Canada is designing a nanosatellite mission with a homemade 3U CubeSat that will observe the Earth's surface with the help of long wave infrared (LWIR) and visible spectrum cameras. These payloads will give information on various surface temperature hotspots on earth. The CubeSat will be able to monitor temperature in cities, agricultural lands, wildfires, aerosols, glaciers, and more. The main goal would be to monitor Canadian grounds and work with scientists and students in various fields to help push knowledge about our planet. To achieve these goals, the project objectives split into two categories: scientific and engineering. The scientific part will consist in making the link between scientists and engineers. The team will need to know the studied targeted area and what information to get from it. The received data will have to be analysed, making it important to design an easy-to-use platform that will encompass needed information. The engineering part consists of integrating payloads into the CubeSat, the main challenges being:

- Designing an optical system: To design a good optical system, choosing a right configuration of lenses (reflective, refractive, catadioptric) will impact functionality of our payload; the field of view (FOV) and the modulation transfer function (MTF) will be determined from the chosen configuration. For the thermal camera, the optical train will have a temperature gradient the more complex it is, resulting in a biased measurement that will have to be taken in consideration.
- Payload calibration: Having a thermal payload, temperature calibration will be done on bodies with known surface temperature such as the moon, the Atlantic or glaciers. A good calibration will minimize biases on temperature measurement and increase the scientific value of the data.

- Gathering data, filtering data and sending it to the ground station network: The data gathered from both payloads cam be huge to downlink with a CubeSat antenna system, thus it is necessary to filter the information we get before sending it to the pre-established ground station network. For instance, using on-board processing methods, cropping images to focalise them on studied hotspots or removing unnecessary clouds.
- Combining data: Having two imagers on the CubeSat allows us to use band combinations with both visible and infrared gathered data to make pansharpened and multispectral images that can reveal or enhance studied features.