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IRIS (MANITOBASAT-1) – A CUBESAT MISSION TO STUDY SPACE WEATHERING OF PLANETARY SURFACES: PAYLOAD SELECTION AND TESTING

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ABSTRACT

Iris (formerly ManitobaSat-1) is a 3-U CubeSat being built in Manitoba via a collaboration between the University of Manitoba and the University of Winnipeg, with additional inputs from the Interlake School Division and York University. The scientific goal of the mission is to investigate the changes to geological materials relevant to a number of planetary bodies, when exposed to the low-Earth orbit space environment. These exposure effects, generally referred to as space weathering, are of interest to the planetary remote sensing community because they can impede our ability to determine the geology of planetary surfaces. Space weathering is expected to most strongly affect the visible spectral region; as a result, we will monitor changes in the "colours" of a variety of relevant geological materials using a three-colour camera.

The payload will consist of a suite of ~24 geological samples and a few calibration standards. The geological samples considered for inclusion on the mission are a mix of minerals relevant to multiple planetary bodies.

Sample preparation: The geological samples selected for the payload were ground to a fine grain size (<45 µm grain size) to ensure homogeneity at the resolution of the cameras. The samples were vacuum sintered at CIRIMAT in France using the same procedure as for the NASA Perseverance rover's SuperCam calibration targets. The melting temperatures were provided to CIRIMAT to ensure the samples were not destroyed during the sintering process from overheating. For multi-component samples (i.e., rocks) we selected a melting temperature corresponding to the major mineral component. The sintered pellets were sanded by hand to remove a graphite coating that results from the sintering process.

Payload testing: The payload samples are required to survive launch conditions, ensure astronaut safety (as they will be deployed from the International Space Station), and the low-Earth environment. To ensure this, we conducted a qualification vibration test campaign at Magellan Aerospace. A prototype sample plate was assembled and subjected to twice the expected vibration profile of the launch vehicle. Following the test, samples were inspected for signs of fragmentation that could pose a debris hazard to the astronauts in the microgravity environment of the International Space Station.

This presentation will describe the sample selection, preparation, and qualification process in preparation for the Iris CubeSat mission.