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INTEGRATION OF A uCAM-III OPTICAL CAMERA IN THE MOSAIC CUBESAT: PROGRESS AND NEXT STEPS

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ABSTRACT

MOSAIC is a CubeSat mission under development that includes an educational optical imaging demonstrator. The purpose of this payload is to gain practical experience with commanding a camera in a space-like environment, integrating it into flight software, and reliably delivering image data to the ground under realistic constraints. We selected the 4D Systems uCAM-III serial TTL camera module due to its compact interface, suitability for embedded control, and reported use in small-satellite applications. We report the current bring-up status, including bench validation of the camera connection, establishment of a repeatable initialization/capture sequence, and early software integration results. To support reproducibility and cross-checking of protocol assumptions, the Phase-1 implementation has been published as an open-source reference codebase.

A key focus of MOSAIC is learning how operational decisions shape payload performance. We therefore discuss how the communications downlink rate, pass/contact opportunities, and power/energy budgets (including transmitting on-time) influence the selection of image format and resolution. JPEG at the highest supported resolution is the baseline candidate for achieving the best-looking images, while a small RAW grayscale mode is considered for deterministic debugging and fault recovery. Next steps are organized into formal engineering milestones: adding non-volatile storage and an image queue with integrity checks, implementing chunked store-and-forward downlink with resume/retransmit capability, and executing a structured test campaign that includes fault injection (timeouts, packet loss), power-cycle

recovery, and power-aware scheduling to prevent brownouts. The presented work targets an end-to-end, repeatable imaging pipeline suitable for mission operations and team training.