Payload system information for IARU

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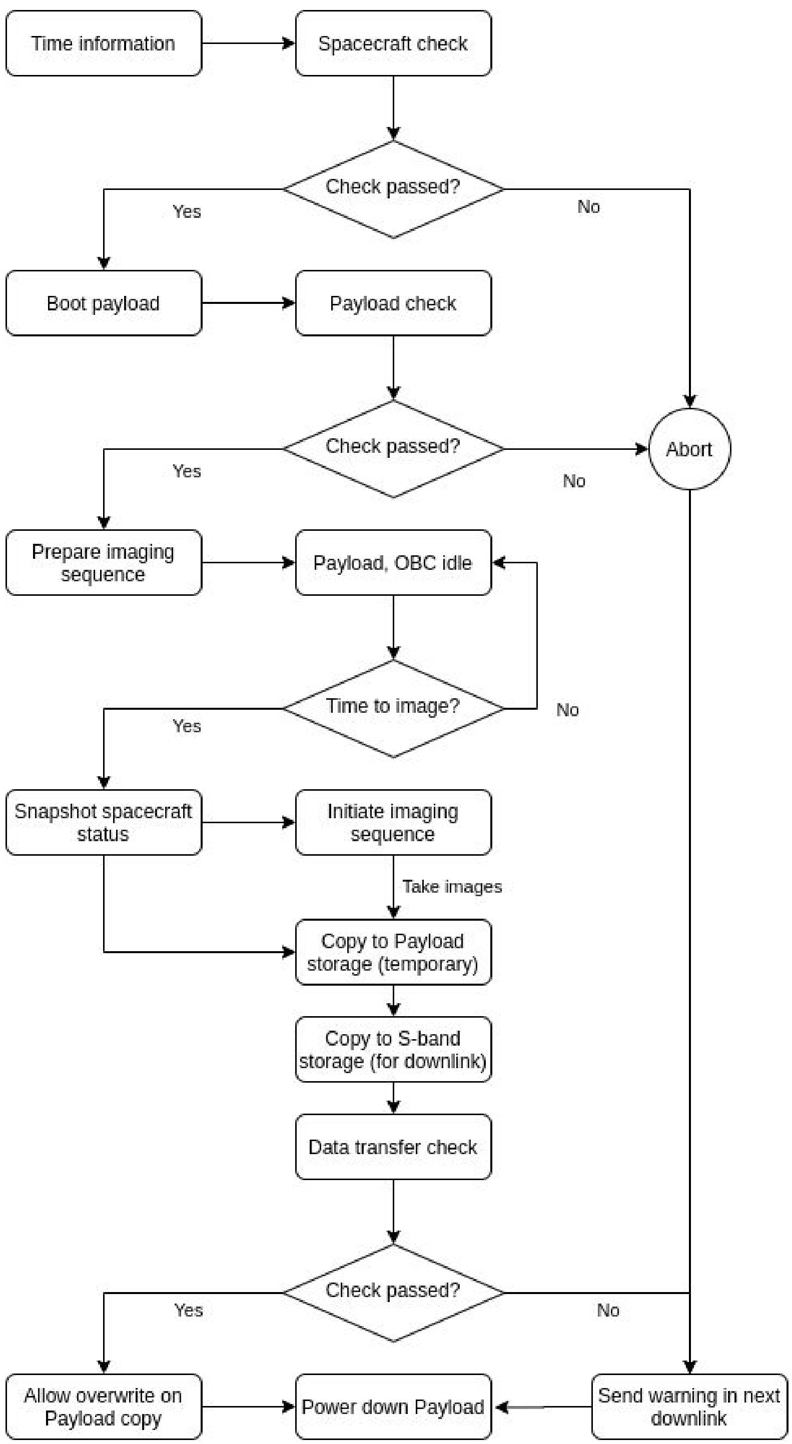
The SC-ODIN mission will capture RGB imaging data over Canada, Lake Colhué Huapí in Argentina, and Namibian coastal regions to characterize the aerosol particles that are present in the dust storms which frequent these locations. The images will be transmitted back to Earth for processing with the goal of extracting aerosol optical depth (AOD) measurements from the dust storm particles. AOD measurements from the dust storms over these regions of interest will be used by climate scientists at the University of Montreal to update their climate models.

The scientific objectives of the mission play an important role in the development of community awareness and appreciation for student projects. Perhaps more importantly, the process of defining mission objectives, researching relevant concepts, and integrating a payload into a spacecraft gives the students involved a unique opportunity to solve problems far beyond the scope of traditional education. In this way, it lays the foundation for a group of young highly qualified personnel in the field of remote sensing and payload integration. The experience students will gain by being involved in this project will directly benefit both the Canadian Space Sector and the Canadian economy at large by developing the next generation of highly qualified personnel in the field of space science and exploration.

Imaging mode



Time information: Imaging times will be selected based on terrestrial calculations using the predicted orbital trajectory from simulations and TLE information.

Spacecraft check: 5 minutes before the calculated imaging opportunity (nadir pointing over the ROI) a general spacecraft health check will be performed to ensure power levels and platform stability are sufficient for the imaging pass.

Payload check: After booting the payload an initial system check will be performed. This is mainly to determine payload storage availability such that critical data that has yet to be transferred to the S-band storage is not overwritten.

Snapshot spacecraft status: Once the calculated imaging time has been passed a spacecraft snapshot will be taken. This will provide crucial metadata information about the targeted location, time of acquisition, platform stability and angle during acquisition, as well as payload parameters.

Initiate imaging sequence (image acquisition): Under nominal conditions 25-50 sequential images will be acquired in .RAW format at a resolution of 1280x720 pixels with rate 5-30 fps. The exact numbers may vary depending on initial in-flight tests and the determined necessity of sequential images for geometric calibration and quality enhancement (to be conducted terrestrially).

Copy to Payload storage (temporary): Level 0 image products will immediately be saved to the dedicated Payload storage (2 GB) along with their associated metadata files.

Copy to S-band storage (for downlink): Level 0 image products will be saved to the S-band antenna storage (32 GB) along with their associated metadata files.

Data transfer check: Once the data has been saved to both the Payload and S-band antenna basic data quality checks will be conducted. In the case that the S-band copies match the Payload copies and pass the check, overwrite permissions will be allowed on the Payload data such that future imaging passes can utilize this intermediary storage.

Additional notes on the imaging mode:

Data levels and downlinking: Only raw, uncalibrated, unprocessed images (Level 0) will be saved onboard the spacecraft. Level 1A data will be obtained by coupling these images with auxiliary information. This information includes: a time-stamp and frame rate, radiometric and geometric calibration coefficients, angle from nadir, and trajectory predictions (if available). Although these parameters will be calculated on the satellite, they will not be applied until the data products have been received at our ground station. For more information on processing levels see (https://earthdata.nasa.gov/collaborate/open-data-services-and-software/data-information-policy/data-levels)

Calibration methods: Both pre-flight and in-flight calibration will be conducted to assess the flat-frame calibration of the image sensor. In-flight calibration methods currently under consideration use (i) deep convective clouds, (ii) particularly dark spots on the ocean surface, and (iii) deep-space as calibration targets. The final calibration target depends on the state of our ADCS at the time of launch.